Fifth Grade Math Lesson Materials

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G5 Unit 1:

Place Value with Decimals

G5 U1 Lesson 1

Explain the relationships between the place values

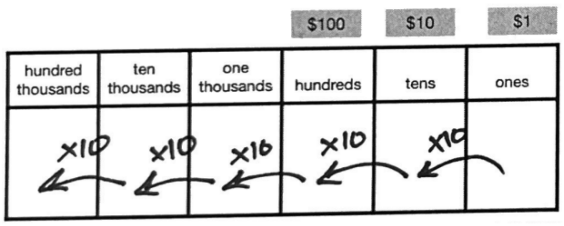
G1 U1 Lesson 1 - Today we will explain the relationships between the place values.

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): Today we will explain the relationships between place values. This is the foundation of working with decimals. So it might not seem like we are going to learn something you need in real life. But you do need it in order to add, subtract, multiply and divide decimals.

Let's Review (Slide 3): Let's review what we already know about whole number place value by discussing this question: What do we see when we build each place value to the left? Don't answer the question yet. Let's first imagine counting it out with dollar bills. This is the ones place. *Point to the ones place.* We can take 10 one dollar bills and trade it for a ten dollar bill. Then this is the tens place. *Point.* We can take 10 ten dollar bills and trade it for a hundred dollar bill. Then this is the hundreds place. *Point.* And we can keep going. So, now I'll take your answers. What do we see when we build each place value to the left? Possible Student Answers, Key Points:

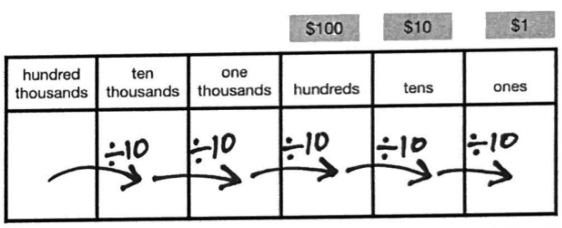
- The numbers get bigger.
- It always takes ten of the place value to make the next place value.
- The place on the left is always ten times the place to the left.



We will show that idea with arrows like this. This same relationship is going to be true for decimal place values.

Let's Talk (Slide 4): So, how do we describe that same pattern as we move to the right. Here's a hint: We are going the opposite direction! So it would be the opposite of x10. Possible Student Answers, Key Points:

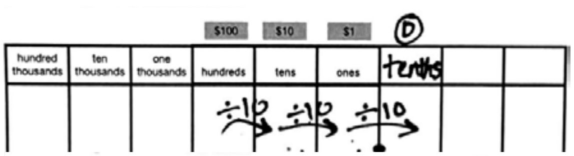
- The numbers get smaller.
- It always made up of ten of the place over.
- The place on the right is always a tenth of the place to the left.
- The place of the left divide by ten makes the place to the right.



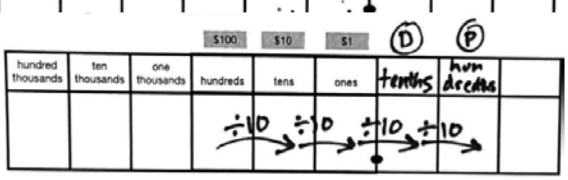
We will show that idea with arrows like this. This same relationship is going to be true for decimal place values.

Let's Think (Slide 5): Let's explore what happens when we continue the pattern. We will need the decimal point to show when we go from whole numbers to pieces just like we go from dollars to coins.

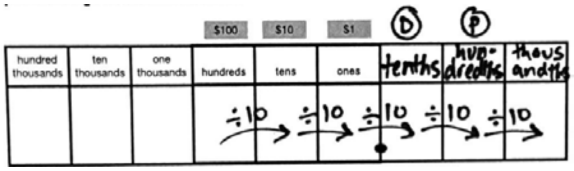
We can start at the hundreds then divide by ten to get to the tens. We can take the tens and divide by ten to get to the ones.



Now, here's the key understanding of today. We can keep dividing by ten. The ones divided by ten means one whole cut into ten pieces. We call those tenths. It is like taking a dollar and splitting it into dimes.

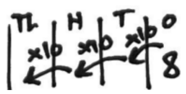


The tenths can also get divided by ten. That makes a hundred pieces called hundredths. That is like taking a dime and splitting it into pennies. Just like there's 100 pennies in a dollar, these are 100 pieces in one whole.



And if we wanted to get really really small, we would keep dividing by ten. That makes a thousand pieces called thousandths. That is like pieces of a penny. They are that tiny.

Let's Think (Slide 6): These relationships can be shown with an equation. Let's use a place value chart to see the operation and factors that would show the relationship between two numbers. Then we will rewrite them as one factor. Watch me.

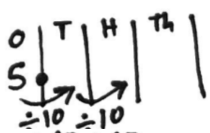


8 $\times 10 \times 10 \times 10$ = 8,000

8 $\times 1000$ = 8,000

First, I am going to draw a place value chart. I can just put the first letter of the place value names. Second, I am going to put the first number on the chart. Third, I am going to draw arrows that would get us to the second number. I want to label them with x10 or ÷10. Since we're getting bigger, it's x10.

We can write the equation with all those factors written out. Or we can put them together to show it as one factor.



5 $\div 10 \div 10$ = 0.05

5 $\div 100$ = 0.05

Let's do it for the next number. We follow the same steps. First, I am going to draw a place value chart. I can just put the first letter of the place value names. Second, I am going to put the first number on the chart. Third, I am going to draw arrows that would get us to the second number. I want to label them with x10 or ÷10. This time, we're going the opposite way so it's ÷10.

We can write the equation with all those factors written out. Or we can put them together to show it as one factor.

Let's Try it (Slides 7): Let's work on writing these kinds of equations together. The most important thing is to always show your work on a place value chart.

WARM WELCOME

Today we will explain the relationships between the place values.

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Let's Review: What pattern do we see when we build each place value to the LEFT?

Let's imagine counting it out with dollar bills.

			$100	$10	$1
hundred thousands	ten thousands	one thousands	hundreds	tens	ones

Let's Talk: How do we describe that same pattern as we move to the RIGHT?

Hint: We are going the opposite direction! So it would be the opposite of x10!

			$100	$10	$1
hundred thousands	ten thousands	one thousands	hundreds	tens	ones

Let's Think: Let's explore what happens when we continue the pattern.

We will need the decimal point to show when we go from whole numbers to pieces just like we go from dollars to coins.

			$100	$10	$1			
hundred thousands	ten thousands	one thousands	hundreds	tens	ones			

Let's Think: These relationships can be shown with an equation.

Let's use a place value chart to see the operation and factors that would show the relationship between two numbers. Then we will rewrite them as one factor.

8 ________________ = 8,000

8 ________________ = 8,000

5 ________________ = 0.05

5 ________________ = 0.05

Let's Try It:

Let's practice writing equations to show these place value relationships.

Name: ______________________ G5 U1 Lesson 1 - Let's Try It

What is the relationship between 500 and 50,000?

1. First, we can think about which number is smaller and which is bigger. Choose the true statement.

(a) 500 can be multiplied to make 50,000.
OR
(b) 500 can be divided to make 50,000.

2. This can also be written in a different order. Choose the statement that is true.

(a) 50,000 can be multiplied to make 500.
OR
(b) 50,000 can be divided to make 500.

3. Let's get more specific by drawing a place value chart with the first number on it.

4. Let's draw arrows from place to place to create the second number, labeling the arrows with x10 or ÷10 based on the direction of the arrows.

5. Now we can make an equation to show the relationship between the numbers.

On your Own:

Now it's time for you to write equations to show the place value relationships.

Name: ______________________ G5 U1 Lesson 1 – Independent Work

Remember: Each place value is ten times the place to the right.

Show your work on a place value chart.

1. Fill in the operation and factors that would make a true equation. Then rewrite them as one factor. **60** ______________ **= 6,000** **60** ______________ **= 6,000**	2. Fill in the operation and factors that would make a true equation. Then rewrite them as one factor. **500** ______________ **= 50,000** **500** ______________ **= 50,000**
3. Fill in the operation and factors that would make a true equation. Then rewrite them as one factor	4. Fill in the operation and factors that would make a true equation. Then rewrite them as one factor

What is the relationship between 500 and 50,000?

1. First, we can think about which number is smaller and which is bigger. Choose the true statement.

(a) 500 can be multiplied to make 50,000.
OR
(b) 500 can be divided to make 50,000.

2. This can also be written in a different order. Choose the statement that is true.

(a) 50,000 can be multiplied to make 500.
OR
(b) 50,000 can be divided to make 500.

3. Let's get more specific by drawing a place value chart with the first number on it.

4. Let's draw arrows from place to place to create the second number, labeling the arrows with x10 or ÷10 based on the direction of the arrows.

5. Now we can make an equation to show the relationship between the numbers.

500 _______________________________________ = 50,000

6. We can rewrite our factors as a single factor by also thinking about the place value chart.

500 _______________________________________ = 50,000

7. We can also write the equations in a different order.

50,000 _______________________________________ = 500

50,000 _______________________________________ = 500

8. Let's put this relationship into words.

____

____

What is the relationship between 400 and 0.04?

9. First, we can think about which number is smaller and which is bigger. Choose the true statement.

(c) 400 can be multiplied to make 0.04.

OR

(d) 400 can be divided to make 0.04.

10. This can also be written in a different order. Choose the statement that is true.

(c) 0.04 can be multiplied to make 400.

OR

(d) 0.04 can be divided to make 400.

11. Let's get more specific by drawing a place value chart with the first number on it.

12. Let's draw arrows from place to place to create the second number, labeling the arrows with x10 or ÷10 based on the direction of the arrows.

13. Now we can make an equation to show the relationship between the numbers.

400 ____ = 0.04

14. We can rewrite our factors as a single factor by also thinking about the place value chart.

400 ____ = 0.04

15. We can also write the equations in a different order.

0.04 ____ = 400

0.04 ____ = 400

16. Let's put this relationship into words.

____

____

Name: ______________________________

Remember: Each place value is ten times the place to the right.

Show your work on a place value chart.

1. Fill in the operation and factors that would make a true equation. Then rewrite them as one factor. 60 ______________________ = 6,000 60 ______________________ = 6,000	2. Fill in the operation and factors that would make a true equation. Then rewrite them as one factor. 500 ______________________ = 50,000 500 ______________________ = 50,000
3. Fill in the operation and factors that would make a true equation. Then rewrite them as one factor. 900 ______________________ = 0.09 900 ______________________ = 0.09	4. Fill in the operation and factors that would make a true equation. Then rewrite them as one factor. 4 ______________________ = 0.004 4 ______________________ = 0.004

Show your work on a place value chart.

5. Fill in the operation and factors that would make a true equation. Then rewrite them as one factor. 300 ________________________________ = 3,000 300 ________________________________ = 3,000	6. Fill in the operation and factors that would make a true equation. Then rewrite them as one factor. 20 ________________________________ = 0.02 20 ________________________________ = 0.02
7. Fill in the operation and factors that would make a true equation. Then rewrite them as one factor. 0.4 ________________________________ = 0.004 0.4 ________________________________ = 0.004	8. Fill in the operation and factors that would make a true equation. Then rewrite them as one factor. 700 ________________________________ = 700,000 700 ________________________________ = 700,000

Name: ANSWER KEY

What is the relationship between 500 and 50,000?

1. First, we can think about which number is smaller and which is bigger. Choose the true statement.

    (a) 500 can be multiplied to make 50,000.

    OR

    (b) 500 can be divided to make 50,000.

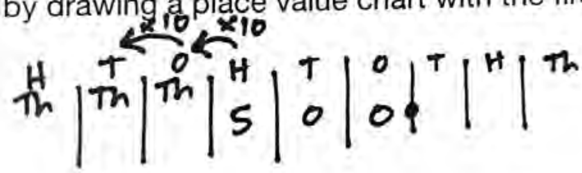
2. This can also be written in a different order. Choose the statement that is true.

    (a) 50,000 can be multiplied to make 500.

    OR

    (b) 50,000 can be divided to make 500.

3. Let's get more specific by drawing a place value chart with the first number on it.



4. Let's draw arrows from place to place to create the second number, labeling the arrows with x10 or ÷10 based on the direction of the arrows.

5. Now we can make an equation to show the relationship between the numbers.

    500 ×10 ×10 = 50,000

6. We can rewrite our factors as a single factor by also thinking about the place value chart.

    500 × 100 = 50,000

7. We can also write the equations in a different order.

    50,000 ÷10 ÷10 = 500

    50,000 ÷ 100 = 500

8. Let's put this relationship into words.

50,000 is a hundred times as much as 500.

500 is a hundredth of 50,000.

What is the relationship between 400 and 0.04?

9. First, we can think about which number is smaller and which is bigger. Choose the true statement.

(c) 400 can be multiplied to make 0.04.

OR

(d) 400 can be divided to make 0.04.

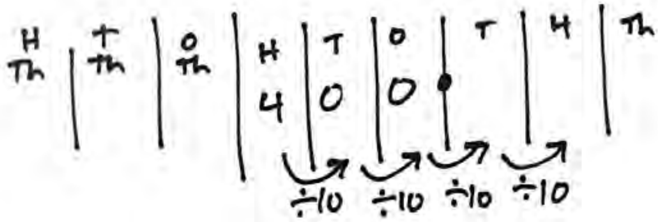
10. This can also be written in a different order. Choose the statement that is true.

(c) 0.04 can be multiplied to make 400.

OR

(d) 0.04 can be divided to make 400.

11. Let's get more specific by drawing a place value chart with the first number on it.



12. Let's draw arrows from place to place to create the second number, labeling the arrows with x10 or ÷10 based on the direction of the arrows.

13. Now we can make an equation to show the relationship between the numbers.

400 ÷10 ÷10 ÷10 ÷10 = 0.04

14. We can rewrite our factors as a single factor by also thinking about the place value chart.

400 ÷ 10,000 = 0.04

15. We can also write the equations in a different order.

0.04 ×10 ×10 ×10 ×10 = 400

0.04 × 10,000 = 400

16. Let's put this relationship into words.

400 is ten thousand times as much as 0.04

0.04 is a ten thousandth of 400.

Name: ANSWER KEY

G5 U1 Lesson 1 - Independent Work

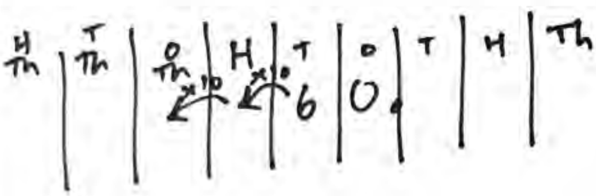
Remember: Each place value is ten times the place to the right.

Show your work on a place value chart.

1. Fill in the operation and factors that would make a true equation. Then rewrite them as one factor.

60 ×10 ×10 = 6,000

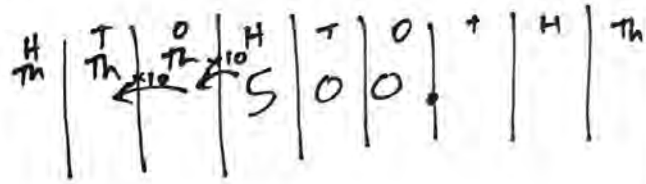
60 ×100 = 6,000



2. Fill in the operation and factors that would make a true equation. Then rewrite them as one factor.

500 ×10 × 10 = 50,000

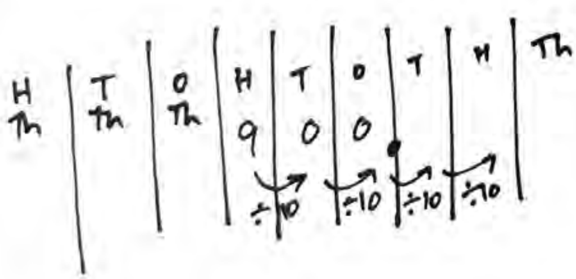
500 ×100 = 50,000



3. Fill in the operation and factors that would make a true equation. Then rewrite them as one factor.

900 ÷10 ÷10 ÷10 ÷10 = 0.09

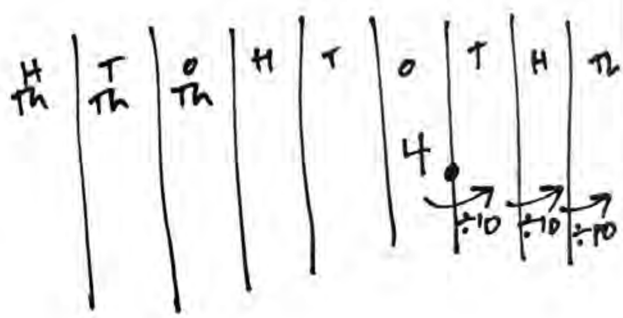
900 ÷10,000 = 0.09



4. Fill in the operation and factors that would make a true equation. Then rewrite them as one factor.

4 ÷10 ÷10 ÷10 = 0.004

4 ÷1,000 = 0.004

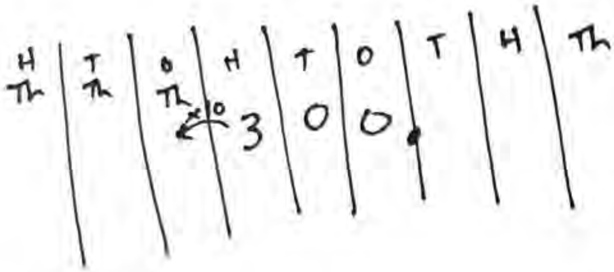


Show your work on a place value chart.

5. Fill in the operation and factors that would make a true equation. Then rewrite them as one factor.

300 $\times 10$ = 3,000

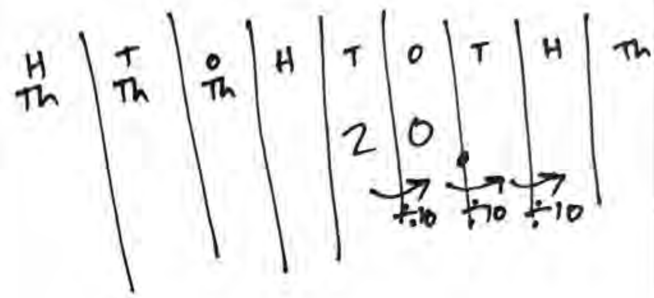
300 $\times 10$ = 3,000



6. Fill in the operation and factors that would make a true equation. Then rewrite them as one factor.

20 $\div 10 \div 10 \div 10$ = 0.02

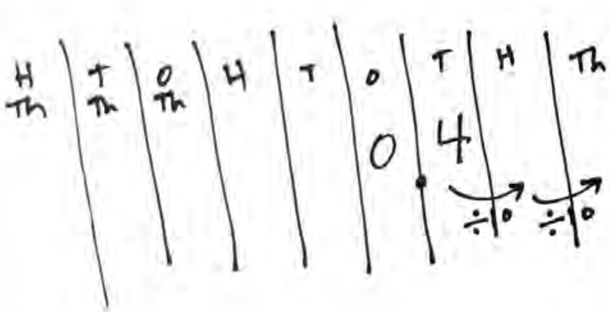
20 $\div 1{,}000$ = 0.02



7. Fill in the operation and factors that would make a true equation. Then rewrite them as one factor.

0.4 $\div 10 \div 10$ = 0.004

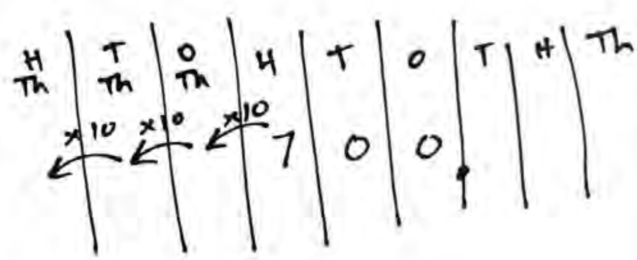
0.4 $\div 100$ = 0.004



8. Fill in the operation and factors that would make a true equation. Then rewrite them as one factor.

700 $\times 10 \times 10 \times 10$ = 700,000

700 $\times 1{,}000$ = 700,000



G5 U1 Lesson 2

Write numbers in scientific notation using place value

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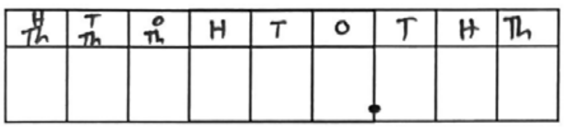
G1 U1 Lesson 2 - Today we will write numbers in scientific notation using place value.

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): Today we are going to write numbers in scientific notation using place value. This might seem like a new idea but really it is just showing the size of a number like we were working on in our last lesson. Scientists use scientific notation as a shortcut for writing numbers so they don't have to write all the zeros for really big numbers.

Let's Review (Slide 3): First, let's review what we already know. How do we fill in the place value chart? Possible Student Answers, Key Points:

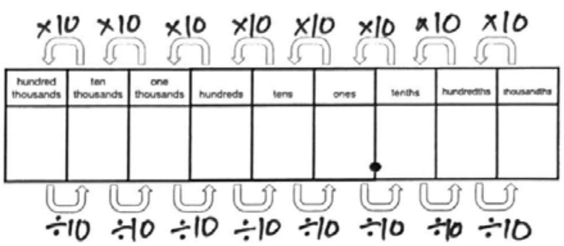
- Ones, Tens, Hundreds, One Thousands, Ten Thousands, Hundred Thousands then on the other side of the decimal: Tenths, Hundredths, Thousandths



I will write O for ones, T for tens, H for hundreds, OTh for one thousands, TTh for ten thousands, HTh for hundred thousands. Then on the other side of the decimal, we will have T for tenths, H for hundredths and Th for thousandths.

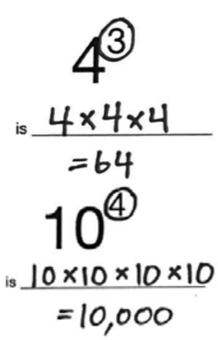
Let's Talk (Slide 4): What relationships did we see on our place value chart last time? How did we label the arrows. Possible Student Answers, Key Points:

- The arrows going left are x10 and the arrows going right are ÷10.
- The place on the left is always ten times the place to the left. The place on the right is always a tenth of the place to the left.



That's a lot of the same number getting multiplied over and over! Since that is so much to write, we are going to use a special math notation called an exponent.

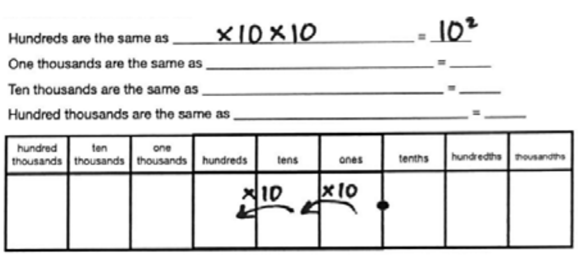
Let's Think (Slide 5): We will review what an exponent is so we can use it to show place values. You should have learned what an exponent is but just in case, I want to tell you again. *Circle the exponent.* The exponent is the small number that tells the big number how many times to multiply itself.



This is four to the third power. The three is the exponent and it is telling the four to multiply itself three times. That's 4 x 4 x 4. Then I do 4 x 4 is 16. I happen to know 16 x 4 is 64 but you might have to do some scratch work on the side. Notice that this is not the same as 4 x 3 which is 12. This is some big multiplication. Luckily the tens we're going to do later are way easier to multiply.

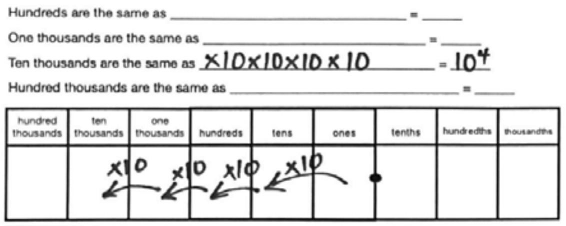
This is ten to the fourth power. The four is the exponent and it is telling the ten to multiply itself four times. That's 10 x 10 x 10 x 10. We can do 10 x 10 is 100. Then 100 x 10 is 1000. Notice that this is not the same as 10 x 4 which is 40. And I bet you heard those place value words. These exponents are going to be helpful for showing place values.

Let's Think (Slide 6): Now let's use exponents on the place value chart. Keep your eye out for a pattern!



First, we want to represent hundreds. If we start in the ones place, I can draw one x10 arrow and another x10 arrow. Let's fill in the sentence: Hundreds are the same as 10 x 10. We write this as 10^2 because the 2 will tell the ten to multiply itself two times.

Let's represent thousands. If we start in the ones place, I already have one x10 arrow and another x10 arrow. I need another x10 arrow. Let's fill in the sentence: Thousands are the same as 10 x 10 x 10 = 10^3.

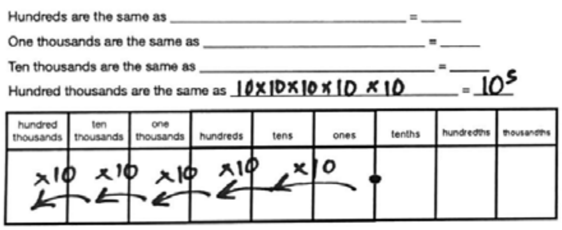

Hundreds are the same as ______ = ____
One thousands are the same as ______ = ____
Ten thousands are the same as x10x10x10x10 = 10^4
Hundred thousands are the same as ______ = ____

hundred thousands	ten thousands	one thousands	hundreds	tens	ones	tenths	hundredths	thousandths
	x10	x10	x10	x10	.			

Let's represent ten thousands. I already have one x10 arrow and another x10 arrow and another x10 arrow. I need another x10 arrow. Let's fill in the sentence: Ten thousands are the same as 10 x 10 x 10 x 10 = 10^4.

Do you see a pattern? Possible Student Answers, Key Points:

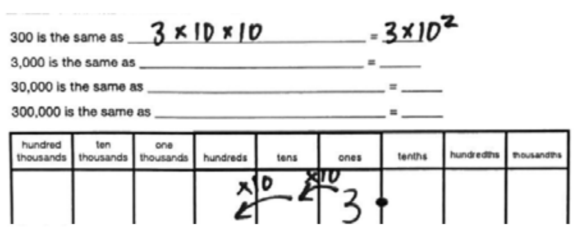
- Each place value is another x10.
- The exponent keeps going up.
- Because each place value is x10, the exponent keeps going up by 1 for each place value.
- The number of zeros is also the number of x10 arrows which is also the number of the exponent.


Hundreds are the same as ______ = ____
One thousands are the same as ______ = ____
Ten thousands are the same as ______ = ____
Hundred thousands are the same as 10x10x10x10 x10 = 10^5

hundred thousands	ten thousands	one thousands	hundreds	tens	ones	tenths	hundredths	thousandths
x10	x10	x10	x10	x10	.			

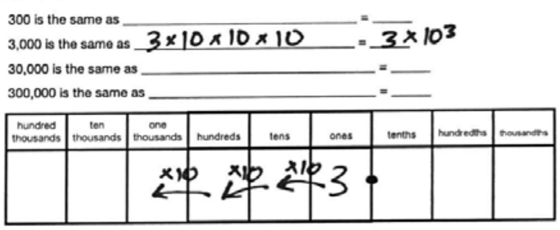
Let's represent hundred thousands. I already have one x10 arrow and another x10 arrow and another x10 arrow and another x10 arrow. I need another x10 arrow. Let's fill in the sentence: Hundred thousands are the same as 10 x 10 x 10 x 10 x 10 = 10^5.

Let's Think (Slide 7): Now we can use exponents to write numbers in scientific notation. We are going to have the same place value ideas we just did but now there is a digit to think about too. Watch me.


300 is the same as 3 x 10 x 10 = 3×10^2
3,000 is the same as ______ = ____
30,000 is the same as ______ = ____
300,000 is the same as ______ = ____

hundred thousands	ten thousands	one thousands	hundreds	tens	ones	tenths	hundredths	thousandths
			x10	x10	3 .			

300 starts with 3 so I am going to put a 3 on my place value chart. Just like we drew the arrows on the last slide, I am going to draw the arrows to 300. I see 3 x 10 x 10. That's the same as 3 x 10^2 because the 2 tells the 10 to multiply itself two times.

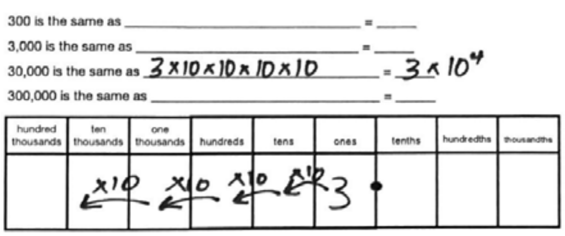

300 is the same as ______ = ____
3,000 is the same as 3x10 x 10 x 10 = 3×10^3
30,000 is the same as ______ = ____
300,000 is the same as ______ = ____

hundred thousands	ten thousands	one thousands	hundreds	tens	ones	tenths	hundredths	thousandths
		x10	x10	x10	3 .			

Let's keep going! 3000 starts with 3 so it begins the same way only now I need another arrow to get to 3000. I see 3 x 10 x 10 x 10. That's the same as 3 x 10^3 because the 3 tells the 10 to multiply itself three times.

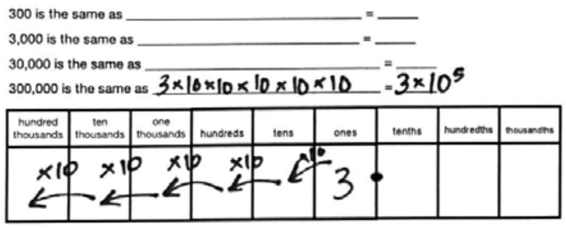
Do you see a pattern? Possible Student Answers, Key Points:

- It's the same as last time.
- Each number is another x10.
- The exponent keeps going up.
- The number of zeros is the same as the number in the exponent.
- The number of zeros is also the number of x10 arrows which is also the number of the exponent.


300 is the same as ______ = ____
3,000 is the same as ______ = ____
30,000 is the same as 3 x10x10x10x10 = 3×10^4
300,000 is the same as ______ = ____

hundred thousands	ten thousands	one thousands	hundreds	tens	ones	tenths	hundredths	thousandths
	x10	x10	x10	x10	3 .			

Let's keep going! 30,000 starts with 3 so it begins the same way only now I need another arrow to get to 3000. I see 3 x 10 x 10 x 10 x 10. That's the same as 3 x 10^4.



Let's keep going! 300,000 starts with 3 so it begins the same way only now I need another arrow to get to 3000. I see 3 x 10 x 10 x 10 x 10 x 10. That's the same as 3 x 10^5.

Let's Try it (Slides 7): Let's work on writing some more numbers in scientific notation. I will walk through the process with you step by step. Remember, we can't try to take a short cut and skip drawing our place value charts.

WARM WELCOME

Today we will write numbers in scientific notation using place value.

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Let's Review:

How do we fill in the place value chart?

Let's Talk:

What relationships did we see on our place value chart last time?

hundred thousands	ten thousands	one thousands	hundreds	tens	ones	tenths	hundredths	thousandths

Let's Think: **We will review what an exponent is so we can use it to show place values.**

The exponent is the small number that tells the big number how many times to multiply itself.

4^3 is ______________________

10^4 is ________________________

Let's Think: **Now let's use exponents on the place value chart. Look for a pattern!**

Hundreds are the same as ________________________________ = _____

One thousands are the same as ______________________________ = _____

Ten thousands are the same as ______________________________ = _____

Hundred thousands are the same as ____________________________ = _____

hundred thousands	ten thousands	one thousands	hundreds	tens	ones	tenths	hundredths	thousandths

Let's Think:

Now we can use exponents to write numbers in scientific notation.

300 is the same as ________________________________ = ______

3,000 is the same as ______________________________ = ______

30,000 is the same as _____________________________ = ______

300,000 is the same as ____________________________ = ______

hundred thousands	ten thousands	one thousands	hundreds	tens	ones	tenths	hundredths	thousandths

Let's Try It:

Let's practice writing numbers in scientific notation.

Name: ______________________________ G5 U1 Lesson 2 - Let's Try It

Write 70,000 in scientific notation.

1. What do you notice about the number?

____

____

2. Since we can see all those zeros, we will put the first digit in a place value chart and draw arrows to see how to make it.

3. Let's write an expression to represent our work. ______________________

4. Let's rewrite the expression with exponents. __________

Write 8 x 10^5 in standard form.

1. The exponent tells the _____ to multiply itself _____ time.

On your Own:

Now it’s time to for you to write numbers in scientific notation.

Name: ______________________________ G5 U1 Lesson 1 - Independent Work

Remember: Each place value is ten times the place to the right.

Show your work on a place value chart.

1. Fill in the operation and factors that would make a true equation. Then rewrite them as one factor. **60** ____________________ **= 6,000** **60** ____________________ **= 6,000**	2. Fill in the operation and factors that would make a true equation. Then rewrite them as one factor. **500** ____________________ **= 50,000** **500** ____________________ **= 50,000**
3. Fill in the operation and factors that would make a true equation. Then rewrite them as one factor.	4. Fill in the operation and factors that would make a true equation. Then rewrite them as one factor.

Write 70,000 in scientific notation.

1. What do you notice about the number?

____

____

2. Since we can see all those zeros, we will put the first digit in a place value chart and draw arrows to see how to make it.

3. Let's write an expression to represent our work. ____

4. Let's rewrite the expression with exponents. _____________

Write 8 x 10^5 in standard form.

1. The exponent tells the _____ to multiply itself _____ time.

2. Since we have x10 repeating, we will use a place value chart with arrows.

3. Let's write an expression to represent our work. ____

4. Let's rewrite the expression as just a normal number. ________________

Name: ______________________________ G5 U1 Lesson 2 - Independent Work

Remember: The exponent tells the base to multiply itself that many times.

Show your work on a place value chart.

1. Write 400,000 in scientific notation. ______________________________	2. Write 9×10^3 in standard form. ______________________________
3. Write 8×10^2 in standard form. ______________________________	4. Write 50,000 in scientific notation. ______________________________

Show your work on a place value chart.

5. Write 60,000 in scientific notation. ____________________________________	6. Write 8×10^5 in standard form. ____________________________________
7. Write 400 in scientific notation. ____________________________________	8. Write 2×10^4 in standard form. ____________________________________

Name: ANSWER KEY

Write 70,000 in scientific notation.

1. What do you notice about the number?

There is a digit followed by lots of zeroes.

2. Since we can see all those zeros, we will put the first digit in a place value chart and draw arrows to see how to make it.

H Th	T Th	O Th	H	T	O
	×10	×10	×10	×10	7
	7	0	0	0	0

3. Let's write an expression to represent our work. $7 \times 10 \times 10 \times 10 \times 10$

4. Let's rewrite the expression with exponents. 7×10^4

Write 8 x 10^5 in standard form.

1. The exponent tells the 10 to multiply itself 5 time.

2. Since we have x10 repeating, we will use a place value chart with arrows.

H Th	T Th	O Th	H	T	O
×10	×10	×10	×10	×10	8
8	0	0	0	0	0

3. Let's write an expression to represent our work. $8 \times 10 \times 10 \times 10 \times 10 \times 10$

4. Let's rewrite the expression as just a normal number. 800,000

Name: ANSWER KEY

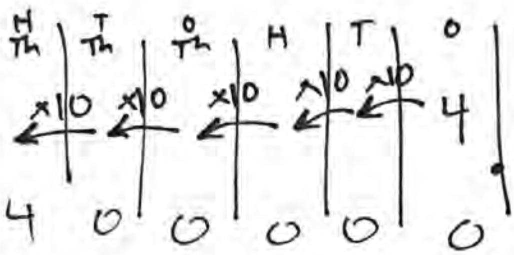
G5 U1 Lesson 2 - Independent Work

Remember: The exponent tells the base to multiply itself that many times.

Show your work on a place value chart.

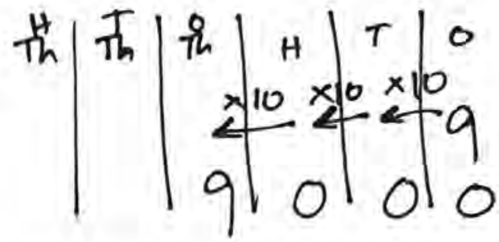
1. Write 400,000 in scientific notation.

4×10^5



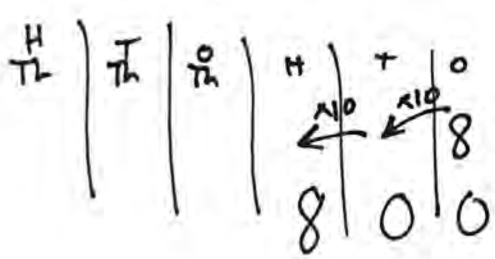
2. Write 9×10^3 in standard form.

9,000



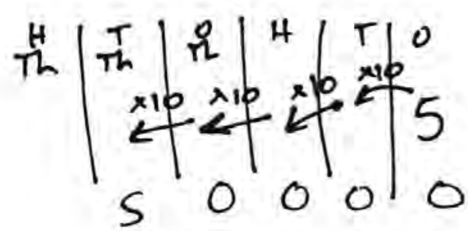
3. Write 8×10^2 in standard form.

800



4. Write 50,000 in scientific notation.

5



Show your work on a place value chart.

5. Write 60,000 in scientific notation.

6×10^4

HTh	TTh	OTh	H	T	O
					6
	6	0	0	0	0

6. Write 8×10^5 in standard form.

800,000

HTh	TTh	OTh	H	T	O
					8
8	0	0,	0	0	0

7. Write 400 in scientific notation.

4×10^2

HTh	TTh	OTh	H	T	O
					4
			4	0	0

8. Write 2×10^4 in standard form.

20,000

HTh	TTh	OTh	H	T	O
					2
	2	0	0	0	0

G5 U1 Lesson 3

Name decimal fractions in different forms

CITYTUTOR DC

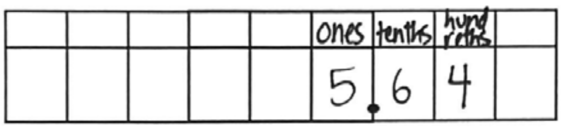
G1 U1 Lesson 3 - Today we will name decimals in different forms.

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): Today we are going to write decimals in different forms using place value. This is helpful because it will let us think of numbers in pieces, and that will help us add, subtract, multiply and divide them.

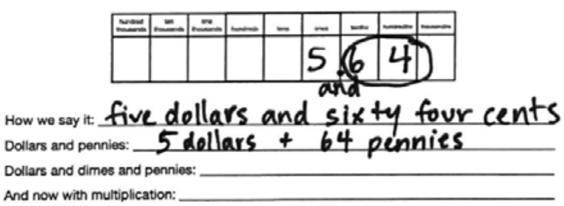
Let's Review (Slide 3): For the next few lessons, money is going to be a really helpful way to understand decimals. So let's imagine I had $5.64. What place are the digits in that amount of money? Possible Student Answers, Key Points:

- 5 is dollars. 6 is dimes. 4 is pennies.
- 5 is in the ones place. 6 is in the tenths place. 4 is in the hundredths place.



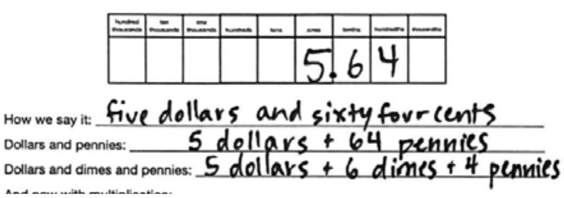
Let's fill in the names we already know on the place value chart. Now we can use the location of the decimal to write the number in the correct place on the chart. 5 is in the ones place. That's like one dollar bills. We have 5 one dollar bills. 6 is in the tenths place. That's the dimes. We have 6 dimes. 4 is in the hundredths place. That's the pennies. We have 4 pennies.

Let's Talk (Slide 4): Understanding how this amount of money is put together helps us write the amount is lots of different ways. How do we say this amount of money? *Take a few ideas.* The proper way to say it is five dollars and sixty four cents.

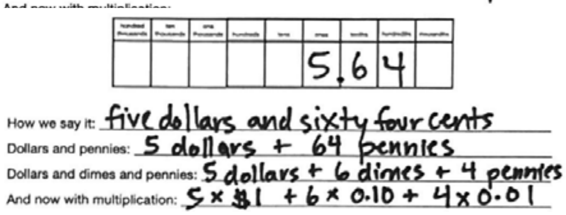


The place value chart helps me understand how we say the amount in words. I say everything before the decimal. Then I say "and" for the decimal. *Write the word "and" under the decimal point.* I say everything after the decimal and then I say cents. *Circle the 64 cents as one amount.* Anytime we have a number to read in words, the decimals is always the word "and."

If we were to write this amount as dollars and pennies, it would be very similar to how we say it, right? I'll use a plus sign though to help us see how to do the next part. I'll write 5 dollars plus 64 pennies.

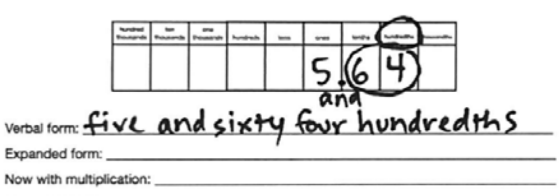


We can think of this same amount as dollars and dimes and pennies. Then I would write 5 dollars for the 5 in the ones place plus 6 dimes for the 6 in the tenths place plus 4 pennies for the 4 in the hundredths place. This is how we thought about it at the beginning of class. This is going to help us write expanded form in a minute.

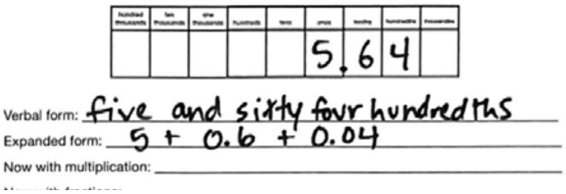


Now this is a super duper challenge! To write this with multiplication, we have to think about the value of each part. 5 dollars is really one dollar five times so we can write 5 x 1. Plus 6 dimes is one dime six times so we can write 6 x 0.1. That is the way a dime gets written in the tenths place. Plus 4 pennies is one penny four times so we can write 4 x 0.01. That is the way a penny gets written in the hundredths place.

Let's Think (Slide 5): I told you that money can help us do our decimals work. Now we are going to see how. Because just like there are lots of ways to make $5.64, there are lots of ways to represent 5.64 as a decimal. And we are going to use our place value chart to help us like always.



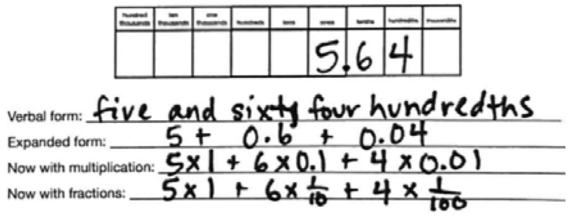
Just like we said everything before the decimal and then everything after the decimals, that is how we write a number in verbal form. The decimal says "and." *Write "and" under the decimal.* I write five and… Now I say the whole amount after the decimal. *Circle the whole 64 in one circle.* I write sixty four. But this time instead of cents, I say the place name, "hundredths." This is five and sixty four hundredths. You say it.



					5.	6	4	

Verbal form: five and sixty four hundredths
Expanded form: 5 + 0.6 + 0.04
Now with multiplication:

For expanded form, we write out each part with plus signs. Just like we did for dollars and dimes and pennies! I write 5 plus 0.6 because the 6 is in the tenths place. Plus 0.04 because the 4 is in the hundredths place. I hope you notice that every time I write a digit, I check that it has stayed in the same place as when we started.



					5.	6	4	

Verbal form: five and sixty four hundredths
Expanded form: 5 + 0.6 + 0.04
Now with multiplication: 5 x 1 + 6 x 0.1 + 4 x 0.01
Now with fractions: $5 \times 1 + 6 \times \frac{1}{10} + 4 \times \frac{1}{100}$

Now multiplication is the super duper challenge. We think of each place repeating lots of times. Like we had dollars many times and dimes many times and pennies many times. So 5 is 5 x 1. Plus 0.6 is 6 x 0.1. This amount still means six tenths. Plus 0.04 is 4 x 0.01. This amount still means four hundredths.

If you get that super duper challenge then the last part is easy because we just write the decimal how it sounds as a fraction. 0.1 is one tenth so we can write one over ten. 0.01 is one hundredth so we can write one over one hundred.

Let's Try it (Slides 6): Let's work on writing all these forms altogether. This page is going to take us through step by step.

WARM WELCOME

Today we will name decimals in different forms.

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Let's Review:

Imagine I had $5.64. What place are the digits in my number?

Let's Talk:

What are the different ways we can make $5.64?

hundred thousands	ten thousands	one thousands	hundreds	tens	ones	tenths	hundredths	thousandths

How we say it: ______________________________

Dollars and pennies: ______________________________

Dollars and dimes and pennies: ______________________________

And now with multiplication: ______________________________

Let's Think:

Just like there are lots of ways to make $5.64, there are lots of ways to represent 5.64 as a decimal.

hundred thousands	ten thousands	one thousands	hundreds	tens	ones	tenths	hundredths	thousandths

Verbal form: ____

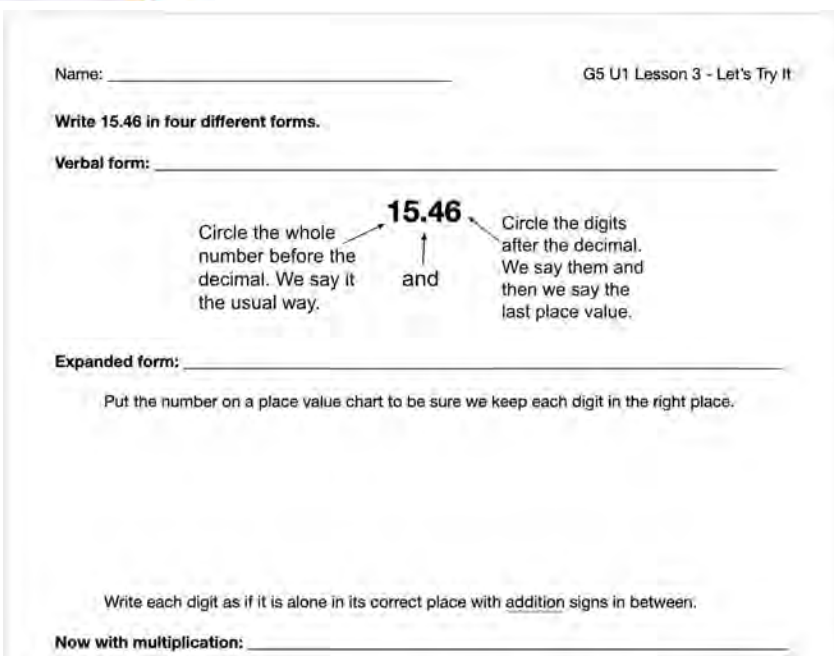
Expanded form: ____

Now with multiplication: ______________________________________

Now with fractions: ____

Let's Try It:

Let's practice naming decimals in different forms using the place value chart.



Name: ______________________ G5 U1 Lesson 3 - Let's Try It

Write 15.46 in four different forms.

Verbal form: ______________________________

15.46

Circle the whole number before the decimal. We say it the usual way.

and

Circle the digits after the decimal. We say them and then we say the last place value.

Expanded form: ______________________________

Put the number on a place value chart to be sure we keep each digit in the right place.

Write each digit as if it is alone in its correct place with addition signs in between.

Now with multiplication: ______________________________

On your Own:

Now it's time for you to write the numbers in different forms independently.

Name: ______________________ G5 U1 Lesson 3 - Independent Work

Remember: The value of each digit depends on its place based on the location of the decimal.

Show your work on a place value chart.

1. Write 5.46 in three different forms.

Verbal form: ______________________

Expanded form: ______________________

Now with multiplication: ______________________

2. Write 920.7 in three different forms.

Verbal form: ______________________

Expanded form:

Name: ____

Write 15.46 in four different forms.

Verbal form: ____

15.46

Circle the whole number before the decimal. We say it the usual way.

and

Circle the digits after the decimal. We say them and then we say the last place value.

Expanded form: ____

Put the number on a place value chart to be sure we keep each digit in the right place.

Write each digit as if it is alone in its correct place with addition signs in between.

Now with multiplication: ____

Use your expanded form. Write each digit as if it is alone without a place.

Multiply it by the correct value with just a 1 in that place.

Now with fractions: ____

Use the form you just wrote. Rewrite each decimal as a fraction.

Write 3.027 in four different forms.

Verbal form: ____

Circle the digits

3.027

Circle the whole number before the decimal. We say it the usual way.

and

Expanded form: ____

Put the number on a place value chart to be sure we keep each digit in the right place.

Write each digit as if it is alone in its correct place with addition signs in between.

Now with multiplication: ____

Use your expanded form. Write each digit as if it is alone without a place.

Multiply it by the correct value with just a 1 in that place.

Now with fractions: ____

Use the form you just wrote. Rewrite each decimal as a fraction.

Name: ______________________________

Remember: The value of each digit depends on its place based on the location of the decimal.

Show your work on a place value chart.

1. Write 5.46 in three different forms.

Verbal form:

____

Expanded form:

____

Now with multiplication: ______________________________

2. Write 920.7 in three different forms.

Verbal form:

____

Expanded form:

____

Now with multiplication: ______________________________

3. Write 0.853 in three different forms.

Verbal form:

____

Expanded form:

____

Now with multiplication: ____

4. Write 23.8 in four different forms.

Verbal form:
____

Expanded form:
____

Now with multiplication: ____

Now with fractions: ____

5. Write 9.067 in four different forms.

Verbal form:
____

Expanded form:
____

Now with multiplication: ____

Now with fractions: ____

6. Write 51.403 in four different forms.

Verbal form:
____

Expanded form:

____

Now with multiplication: ____

Now with fractions: ____

Name: ANSWER KEY

Write 15.46 in four different forms.

Verbal form: fifteen and forty six hundredths

T O T H
15.46

Circle the whole number before the decimal. We say it the usual way.

and

Circle the digits after the decimal. We say them and then we say the last place value.

Expanded form: $10 + 5 + 0.4 + 0.06$

Put the number on a place value chart to be sure we keep each digit in the right place.

H	T	O	T	H
	1	5.	4	6

Write each digit as if it is alone in its correct place with addition signs in between.

Now with multiplication: $1 \times 10 + 5 \times 1 + 4 \times 0.1 + 6 \times 0.01$

Use your expanded form. Write each digit as if it is alone without a place.

Multiply it by the correct value with just a 1 in that place.

Now with fractions: $1 \times 10 + 5 \times 1 + 4 \times \frac{1}{10} + 6 \times \frac{1}{100}$

Use the form you just wrote. Rewrite each decimal as a fraction.

Write 3.027 in four different forms.

Verbal form: three and twenty seven thousandths

Th H Th

3.027

Circle the whole number before the decimal. We say it the usual way.

and

Circle the digits after the decimal. We say them and then we say the last place value.

Expanded form: $3 + 0.02 + 0.007$

Put the number on a place value chart to be sure we keep each digit in the right place.

O	T	H	Th
3	0	2	7

Write each digit as if it is alone in its correct place with addition signs in between.

Now with multiplication: $3 \times 1 + 2 \times 0.01 + 7 \times 0.001$

Use your expanded form. Write each digit as if it is alone without a place.

Multiply it by the correct value with just a 1 in that place.

Now with fractions: $3 \times 1 + 2 \times \frac{1}{100} + 7 \times \frac{1}{1000}$

Use the form you just wrote. Rewrite each decimal as a fraction.

Name: ANSWER KEY

G5 U1 Lesson 3 - Independent Work

Remember: The value of each digit depends on its place based on the location of the decimal.

Show your work on a place value chart.

1. Write 5.46 in three different forms.

O	T	H
5.	4	6

Verbal form: five and forty six hundredths

Expanded form: $5 + 0.4 + 0.06$

Now with multiplication: $5 \times 1 + 4 \times 0.1 + 6 \times 0.01$

2. Write 920.7 in three different forms.

H	T	O	T
9	2	0.	7

Verbal form: nine hundred twenty and seven tenths

Expanded form: $900 + 20 + 0.7$

Now with multiplication: $9 \times 100 + 2 \times 10 + 7 \times 0.1$

3. Write 0.853 in three different forms.

O	T	H	Th
0.	8	5	3

Verbal form: eight hundred fifty three thousandths

Expanded form: $0.8 + 0.05 + 0.003$

Now with multiplication: $8 \times 0.1 + 5 \times 0.01 + 3 \times 0.001$

4. Write 23.8 in three different forms.

T	O	T
2	3 .	8

Verbal form: twenty three and eight tenths

Expanded form: $20 + 3 + 0.8$

Now with multiplication: $2 \times 10 + 3 \times 1 + 8 \times 0.1$

Now with fractions: $2 \times 10 + 3 \times 1 + 8 \times \frac{1}{10}$

5. Write 9.067 in three different forms.

O	T	H	Th
9 .	0	6	7

Verbal form: nine and sixty seven thousandths

Expanded form: $9 + 0.06 + 0.007$

Now with multiplication: $9 \times 1 + 6 \times 0.01 + 7 \times 0.001$

Now with fractions: $9 \times 1 + 6 \times \frac{1}{100} + 7 \times \frac{1}{1000}$

6. Write 51.403 in three different forms.

T	O	T	H	Th
5	1 .	4	0	3

Verbal form: fiftyone and four hundred three thousandths

Expanded form: $50 + 1 + 0.4 + 0.003$

Now with multiplication: $5 \times 10 + 1 \times 1 + 4 \times 0.1 + 3 \times 0.001$

Now with fractions: $5 \times 10 + 1 \times 1 + 4 \times \frac{1}{10} + 3 \times \frac{1}{1000}$

G5 U1 Lesson 4

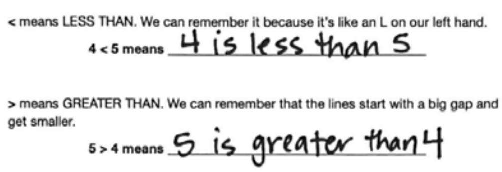
Compare decimals

G1 U1 Lesson 4 - Today we will compare decimals.

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): Today we are going to compare decimals. This is something that comes up a lot in real life. Medicine is often measured in decimals. Distances are often measured in decimals. Time is often measured in decimals. And there are so many instances in real life when you will want to know when something is more or less. You definitely want to get this lesson today.

Let's Review (Slide 3): The first thing we want to review is the meaning of the symbols. Some people might have learned a trick about the alligator mouth eating the bigger number. That is an okay trick but we really need to be able to read the comparison like a sentence from left to right. So we want to memorize what the symbol means and translate it into words. One trick that you can use to remember the less than symbol is that it looks like a scrunched-up L. Your left hand can reach out and make the shape. Then the right hand symbol must be greater than. So if you remember "left hand is less than" that can really help you.

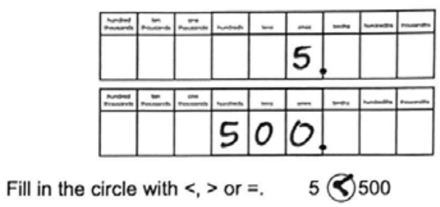


This symbol is like my left hand. *Put left hand along the symbol.* That means 4 is less than 5. This next symbol is like my right hand. *Put right hand along the symbol.* That means 5 is greater than 4.

Let's Review (Slide 4): Now we need to think about how we can tell when a number is bigger so we can choose the correct symbol. Think for ten seconds about this question and then I will call on someone. How does the place value chart help someone compare 5 and 500? Possible Student Answers, Key Points:

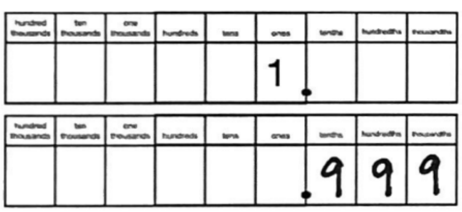
- 500 has hundreds but 5 only has ones.
- The zeros mean that the 5 is in a bigger place.

Note: "500 has more digits" is NOT a correct answer. When we start working with decimals, numbers with more digits won't necessarily be larger (such as 0.124 compared to 0.9). So, if someone says that 500 is bigger because it has more digits, you will need to say, it is true that 500 has more digits but that's not what makes it bigger. It is really about the place of the digits.



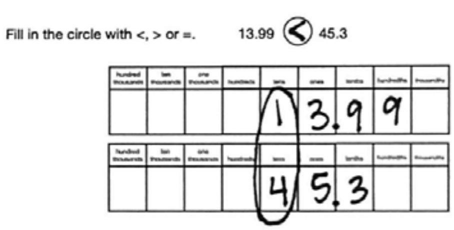
If I put both digits on the place value chart, their decimals are in line and all the place values are in line. Now it is clear that 500 has digits in the larger values. 5 is less than 500 so I put the less than symbol. I have a trick for remembering which way it goes by saying "Left Hand Less Than."

Let's Talk (Slide 5): Lining up the place values is super useful because we know that anything on the right - even if it's just a 1 - is going to be bigger than anything on the left.



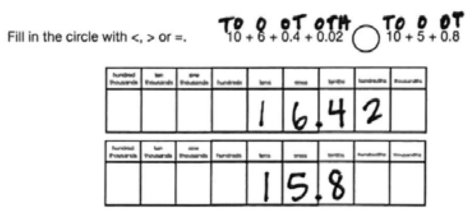
That's because the highest amount that can be in any place is a 9. And we know that each place on the right has 10 of the smaller place. So even 1 of a place to the right is bigger than 9 to the left.

Let's Think (Slides 6): So then anytime we compare, we want to line up the place values and look in the biggest place first.



Sometimes people call this "lining up the decimals" because when the decimals are in line then the place values are in line. I am going to write 13.99 and 45.3. If it helps, I can put place value letters above the numbers. The most important thing is that if 13 is before the decimal, it stays before the decimal. 99 is after the decimal so it has to stay after the decimal. The same with the next number. 45 is before the decimal. The 3 is after the decimal. Now I look in the tens place. 13.99 has 1 ten. 45.3 has 4 tens. *Circle the tens.* The rest of the numbers don't matter because they are smaller values. They are just pieces of the bigger place value. So, 13.99 is less than 45.3. Less than is my left hand so I draw the symbol like this.

Let's Think (Slides 7): If our numbers are written in different forms, we still use a place value chart, of course. We have to make sure that the place value of all these pieces doesn't change.



If I need to, I can write the place value above these numbers. The 1 is in the tens place so I have to keep it in the tens place. The 6 is in the ones place. The 4 is in the tenths place. The 2 is in the hundredths place. Now for our next number, the 1 is in the tens place. The 5 is in the ones place. The 8 is in the tenths place. Now I am going to look in the biggest place first, which is the tens place. The digits in the tens place are the same. So I am going to look in the next biggest place, which is the ones place. 6 ones is more than 5 ones. It doesn't matter what the smaller digits are. So 16.42 is greater than 15.8. I know left hand is less than. I need my right hand symbol.

Let's Try it (Slides 8): Now let's go through the steps of comparing decimals together. Remember we are always going to put the numbers on a place value chart and look at the biggest place that's not the same.

WARM WELCOME

Today we will compare decimals.

Let’s Review: Today we will need to use < and >.

< means LESS THAN. We can remember it because it’s like an L on our left hand.

4 < 5 means ________________________________

> means GREATER THAN. We can remember that the lines start with a big gap and get smaller.

5 > 4 means ________________________________

Let’s Review: How does the place value chart help someone compare 5 and 500?

hundred thousands	ten thousands	one thousands	hundreds	tens	ones	tenths	hundredths	thousandths

hundred thousands	ten thousands	one thousands	hundreds	tens	ones	tenths	hundredths	thousandths

Fill in the circle with <, > or =. 5 ◯ 500

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Let's Talk:

Because of regrouping, we know that a digit will always be bigger than any other digit in a place value to its left.

hundred thousands	ten thousands	one thousands	hundreds	tens	ones	tenths	hundredths	thousandths
					1			

hundred thousands	ten thousands	one thousands	hundreds	tens	ones	tenths	hundredths	thousandths

Let's Think:

I can compare any numbers by lining up the place values.

Fill in the circle with <, > or =. 13.99 ◯ 45.3

hundred thousands	ten thousands	one thousands	hundreds	tens	ones	tenths	hundredths	thousandths

hundred thousands	ten thousands	one thousands	hundreds	tens	ones	tenths	hundredths	thousandths

Let's Think: If our numbers are written in different forms, we still use a place value chart.

Fill in the circle with <, > or =.   10 + 6 + 0.4 + 0.02 ◯ 10 + 5 + 0.8

hundred thousands	ten thousands	one thousands	hundreds	tens	ones	tenths	hundredths	thousandths

hundred thousands	ten thousands	one thousands	hundreds	tens	ones	tenths	hundredths	thousandths

Let's Try It: Let's practice comparing decimals with place value charts.

Name: ____________________   G5 U1 Lesson 4 - Let's Try It

< means ________________   > means ________________

Jesse has 3 dollar bills, 6 dimes and 9 pennies. Lisa has 3 dollar bills and 8 dimes. Who has the most money?

Jesse's money is draw for us below. Let's draw Lisa's money to solve the story problem.

$1 $1 $1   D D D D D D   P P P P P P P P P

What do we notice about the number of coins?

____

What do we notice about the value of the coins?

____

This problem is the same as asking:

On your Own:

Now it's time to compare decimals on your own!

Name: ______________________________ G5 U1 Lesson 4 - Independent Work

Remember: We start by looking at the biggest place value to compare.

Show your work on a place value chart.

1. Fill in the comparison with words. Then fill in the circle with <, > or =. 3.45 is ____________ than 6.1 3.45 ◯ 6.1	2. Fill in the comparison with words. Then fill in the circle with <, > or =. 8.211 is ____________ than 3.999 8.211 ◯ 3.999
3. Fill in the comparison with words. Then fill in the circle with <, > or =.	4. Fill in the comparison with words. Then fill in the circle with <, > or =.

Name: ____________________________________

< means ______________________ > means ______________________

Jesse has 3 dollar bills, 6 dimes and 9 pennies. Lisa has 3 dollar bills and 8 dimes. Who has the most money?

Jesse's money is draw for us below. Let's draw Lisa's money to solve the story problem.

What do we notice about the number of coins?

____

What do we notice about the value of the coins?

____

This problem is the same as asking:

______________ ◯ ______________

Let's represent the problem with numbers on the place value chart.

Which place helped us determine which number was larger? Why?

____

____

Fill in the blank with <, > or =.

0.2 + 0. 03 + 0.004 ◯ 229 thousands

Step #1: Put each number on a place value chart.

Step #2: Look in the biggest place. If it is the same then look at the next biggest place.

What place did you look in to compare? ______________________________

Step #3: Write the words that would make the comparison true.

0.2 + 0. 03 + 0.004 is ____________________________ 229 thousands

Step #4: Fill in the matching symbol.

Fill in the blank with <, > or =.

Seventy eight hundredths ◯ x 0.1 + 2 x 0.01 + 3 x 0.001

Step #1: Put each number on a place value chart.

Step #2: Look in the biggest place. If it is the same then look at the next biggest place.

What place did you look in to compare? ______________________________

Step #3: Write the words that would make the comparison true.

Seventy eight hundredths is ____________________________ than 7 x 0.1 + 2 x 0.01 + 3 x 0.001

Step #4: Fill in the matching symbol.

Name: ____

Remember: We start by looking at the biggest place value to compare.

Show your work on a place value chart.

1. Fill in the comparison with words.
Then fill in the circle with <, > or =.

3.45 is ______________ than 6.1

3.45 $\bigcirc$ 6.1

2. Fill in the comparison with words.
Then fill in the circle with <, > or =.

8.211 is ______________ than 3.999

8.211 $\bigcirc$ 3.999

3. Fill in the comparison with words.
Then fill in the circle with <, > or =.

7.8 is ______________ than 7.80

7.8 $\bigcirc$ 7.80

4. Fill in the comparison with words.
Then fill in the circle with <, > or =.

16.5 is ______________ than 7.802

16.5 $\bigcirc$ 7.802

Show your work on a place value chart.

5. Fill in the comparison with words.
Then fill in the circle with <, > or =.

3 x 0.1 + 4 x 0.01 is ______________________ than 6 x 0.01 + 8 x 0.001

3 x 0.1 + 4 x 0.01 ◯ 6 x 0.01 + 8 x 0.001

6. Fill in the comparison with words.
Then fill in the circle with <, > or =.

9 + 0.3 + 0.007 is ______________________________ than 9 + 0.3 + 0.07

9 + 0.3 + 0.007 ◯ 9 + 0.3 + 0.07

7. Fill in the comparison with words.
Then fill in the circle with <, > or =.

8.9 is __________________________ than Sixteen

8.9 ◯ Sixteen

8. Fill in the comparison with words.
Then fill in the circle with <, > or =.

Fifty four hundredths is ______________________ than 0.6 + 0.01 + 0.002

Fifty four hundredths ◯ 6 + 0.01 + 0.002

Name: ANSWER KEY

< **means** less than

> **means** greater than

Jesse has 3 dollar bills, 6 dimes and 9 pennies. Lisa has 3 dollar bills and 8 dimes. Who has the most money?

Jesse's money is draw for us below. Let's draw Lisa's money to solve the story problem.

$1 $1 $1 D D D D D D P P P P P P P P P

$1 $1 $1 D D D D D D D D

What do we notice about the number of coins?

Jesse has more coins.

What do we notice about the value of the coins?

Jesse has $3.69. Lisa has $3.80. Lisa's value is higher.

This problem is the same as asking:

3.69 < 3.8

Let's represent the problem with numbers on the place value chart.

O	T	H
3.	6	9
3.	8	

Which place helped us determine which number was larger? Why?

The ones were the same so I looked in the tenths because those are bigger than hundredths.

Fill in the blank with <, > or =.

0.2 + 0. 03 + 0.004 > **229 thousands**

Step #1: Put each number on a place value chart.

H	T	O	T	H	Th
		.	2	3	4
		.	2	2	9

Step #2: Look in the biggest place. If it is the same then look at the next biggest place.

What place did you look in to compare? hundredths

Step #3: Write the words that would make the comparison true.

0.2 + 0. 03 + 0.004 is greater than 229 thousands

Step #4: Fill in the matching symbol.

Fill in the blank with <, > or =.

Seventy eight hundredths > **7 x 0.1 + 2 x 0.01 + 3 x 0.001**

Step #1: Put each number on a place value chart.

H	T	O	T	H	Th
		.	7	8	
		.	7	2	3

Step #2: Look in the biggest place. If it is the same then look at the next biggest place.

What place did you look in to compare? hundredths

Step #3: Write the words that would make the comparison true.

Seventy eight hundredths is greater than 7 x 0.1 + 2 x 0.01 + 3 x 0.001

Step #4: Fill in the matching symbol.

Name: ANSWER KEY

Remember: We start by looking at the biggest place value to compare.

Show your work on a place value chart.

1. Fill in the comparison with words.
Then fill in the circle with <, > or =.

3.45 is less than 6.1

$3.45 < 6.1$

O	T	H
3	4	5
6	1	

2. Fill in the comparison with words.
Then fill in the circle with <, > or =.

8.211 is greater than 3.999

$8.211 > 3.999$

O	T	H	Th
8	2	1	1
3	9	9	9

3. Fill in the comparison with words.
Then fill in the circle with <, > or =.

7.8 is equal to than 7.80

$7.8 = 7.80$

O	T	H
7	8	
7	8	0

4. Fill in the comparison with words.
Then fill in the circle with <, > or =.

16.5 is greater than 7.802

$16.5 > 7.802$

T	O	T	H	Th
1	6	5		
	7	8	0	2

Show your work on a place value chart.

5. Fill in the comparison with words.
Then fill in the circle with <, > or =.

3 x 0.1 + 4 x 0.01 is greater than 6 x 0.01 + 8 x 0.001

3 x 0.1 + 4 x 0.01 > 6 x 0.01 + 8 x 0.001

O	T	H	Th
	3	4	
	0	6	8

6. Fill in the comparison with words.
Then fill in the circle with <, > or =.

9 + 0.3 + 0.007 is less than 9 + 0.3 + 0.07

9 + 0.3 + 0.007 < 9 + 0.3 + 0.07

O	T	H	Th
9	3	0	7
9	3	7	

7. Fill in the comparison with words.
Then fill in the circle with <, > or =.

8.9 is less than Sixteen

8.9 < Sixteen

T	O	T
0	8	9
1	6	

8. Fill in the comparison with words.
Then fill in the circle with <, > or =.

Fifty four hundredths is less than 0.6 + 0.01 + 0.002

Fifty four hundredths < 0.6 + 0.01 + 0.002

O	T	H	Th
	5	4	
	6	1	2

G5 U1 Lesson 5

Round decimals

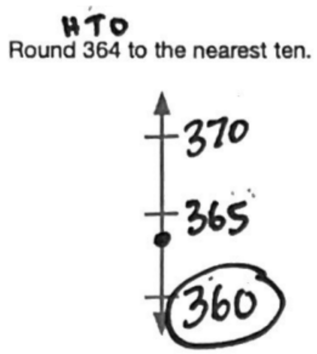
CITYTUTOR DC

G1 U1 Lesson 5 - Today we will round decimals.

Warm Welcome (Slide 1): Tutor choice

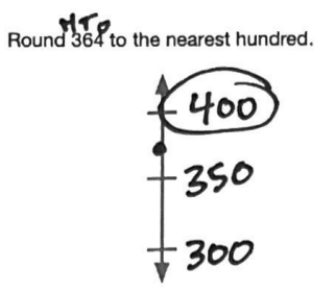
Frame the Learning/Connect to Prior Learning (Slide 2): Today we are going to round decimals. That will be really important to helping us estimate when we're adding, subtracting, multiplying and dividing.

Let's Review (Slide 3): What have you learned about rounding whole numbers? *You can accept any answer because you are just getting a sense of what students already know about rounding. If they say anything that is correct, you can refer to it when you do your explanation.* Rounding means finding out what a number is close to.



The first step is to find which benchmarks your number is between. I can label the place values about the number to know which place we are talking about. *Write O, T and H above the digits.* If we are rounding to the nearest ten then the ones place is too small to be part of my rounding. That place becomes a zero. That's the lower benchmark and then the next ten is the higher benchmark. 364 is between 360 and 370. *Write those numbers on the number line.*

Halfway between the numbers is 5 in the ones place, which is 365. *Write that number in.* Our number is less than the halfway mark. *Draw a point to represent it.* It is on this side of halfway, which means our number is closer to 360. *Circle 360.*

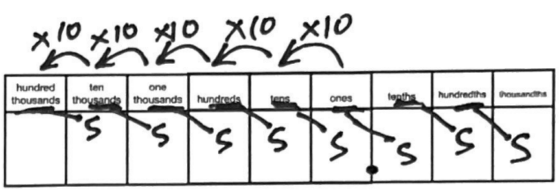


Now we have the same number but it is being rounded to a different place. We will follow the same steps for a different place. I can label the place values about the number to know which place we are talking about. *Write O, T and H above the digits.* The first step is to find which benchmarks your number is between. If we are rounding to the nearest hundred then the tens and ones are too small to be part of my rounding. Those places become zeros. That's the lower benchmark and then the next hundred is the higher benchmark. 364 is between 300 and 400. *Write those numbers on the number line.*

Halfway between the numbers is 5 in the tens place, which is 350. *Write that number in.* Our number is bigger than the halfway mark. *Draw a point to represent it.* It is on this side of the halfway mark, which means that our number is closer to 400. *Circle 400.*

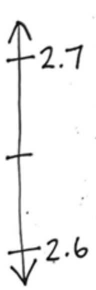
Let's Review (Slide 4): We always use a 5 to find the halfway mark. Why is that? I'll give you a hint. It has something to do with those x10 relationships we've been talking about in all the previous lessons. Possible Student Answers, Key Points:

- 5 is half of 10. 50 is half of 100. 500 is half of 1,000.
- The arrows we've been drawing are x10 and half of that is 5.
- Each place value is 10 of the place to the left so half would be 5.

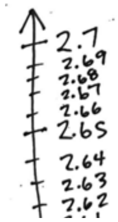


This means that if I am rounding between hundreds, my halfway mark is 50. If I am rounding between thousands, my halfway mark is 500. We can keep going with that pattern for any place. *Draw the corresponding arrows as you are talking.*

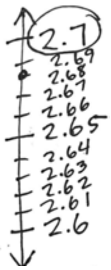
Let's Talk (Slide 5): We will follow the same steps for decimals that we do for whole numbers. Step 1- low and high benchmarks. Step 2 - halfway mark. Step 3 - see what your number is closest to. Watch me.



The first step is to find which benchmarks your number is between. I can label the place values above the number to know which place we are talking about. If we are rounding to the nearest tenth then the hundredths and thousandths place is too small to be part of my rounding. Those places become zeros. That's the lower benchmark and then the next tenth is the higher benchmark. 2.681 is between 2.6 and 2.7.

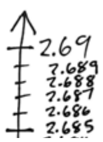


We already talked about how halfway between the numbers is 5 in the next smallest place, which is 2.65. But if you are having trouble you can count up from the bottom number. From 2.6, we say 2.61, 2.62, 2.63, 2.64, 2.65, 2.66, 2.67, 2.67, 2.68, 2.69. Now we really see the halfway mark is 2.65.

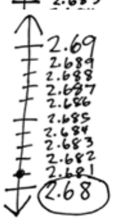


Our number is greater than the halfway mark. I am going to mark a point about where it goes. It is on this side of the halfway mark, which means that our number is closer to 2.7.

Now we have the same number but it is being rounded to a different place. We will follow the same steps for the different place. Again, I can label the place values about the number to know which place we are talking about.The first step is to find which benchmarks your number is between. If we are rounding to the nearest hundredth then the thousandths are too small to be part of my rounding. That place becomes a zero. That's the lower benchmark and then the next hundredth is the higher benchmark. 2.681 is between 2.68 and 2.69.



We already talked about how halfway between the numbers is 5 in the next smallest place. So halfway between the numbers is 5 in the thousandths place, which is 2.685. But if this is tricky, we can just count up from the low number. 2.68 then 2.681, 2.682, 2.683, 2.684, 2.685, 2.686, 2.687, 2.688, 2.689. There is the halfway mark.



Our number is less than the halfway mark. I am going to mark a point about where it goes. It is on this side of the halfway mark, which means that our number is closer to 2.69.

Let's Try It (Slides 6): Let's work together through the same steps now. Step 1- low and high benchmarks. Step 2 - halfway mark. Step 3 - see what your number is closest to.

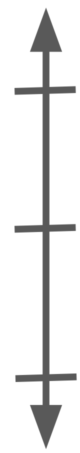
WARM WELCOME

Today we will round decimals.

Let's Review: What have you learned about rounding whole numbers?

Round 364 to the nearest ten.

Round 364 to the nearest hundred.

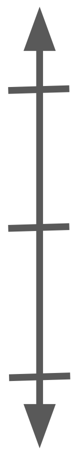


Let's Talk: We always use a 5 to find the halfway mark. Why is that?

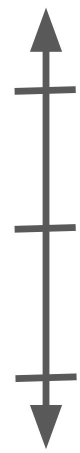
hundred thousands	ten thousands	one thousands	hundreds	tens	ones	tenths	hundredths	thousandths

Let's Think: Let's use that idea to round decimals.

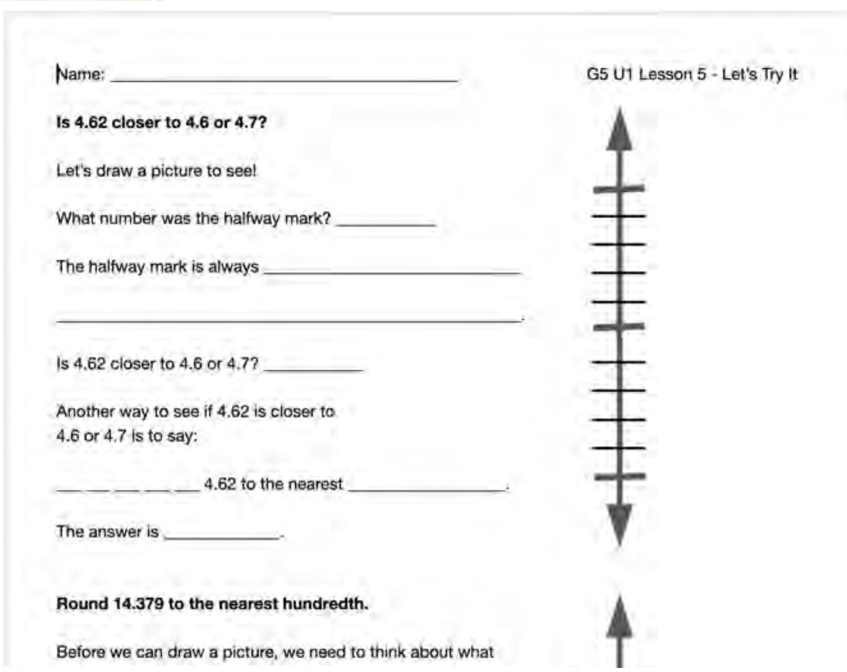
Round 2.681 to the nearest tenth.



Round 2.681 to the nearest hundredth.



Let's Try It: Let's practice rounding decimals together.



Name: ____________________ G5 U1 Lesson 5 - Let's Try It

Is 4.62 closer to 4.6 or 4.7?

Let's draw a picture to see!

What number was the halfway mark? ________

The halfway mark is always ____________________

____________________.

Is 4.62 closer to 4.6 or 4.7? ________

Another way to see if 4.62 is closer to 4.6 or 4.7 is to say:

___ ___ ___ ___ ___ 4.62 to the nearest ____________.

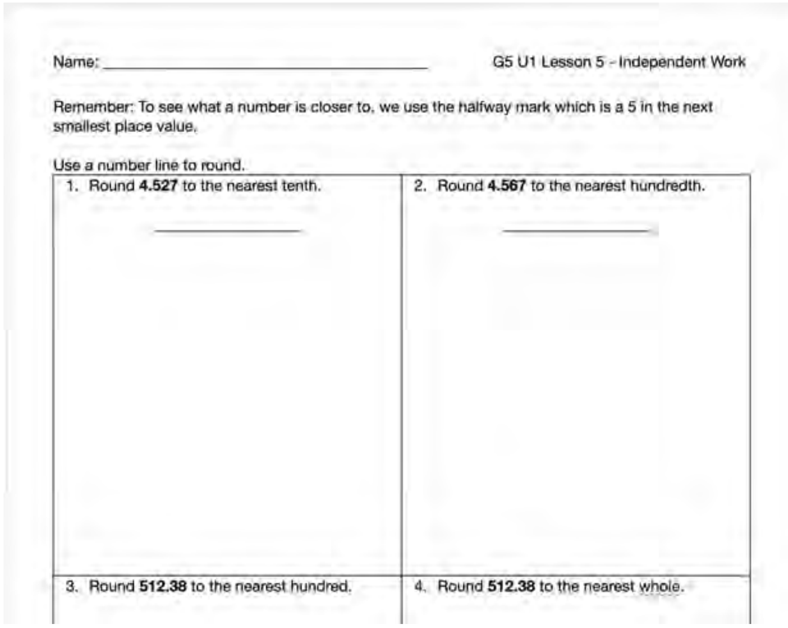
The answer is ________.

Round 14.379 to the nearest hundredth.

Before we can draw a picture, we need to think about what

On your Own:

Now it's time to for you to round decimals independently!



Name: ______________________ G5 U1 Lesson 5 - Independent Work

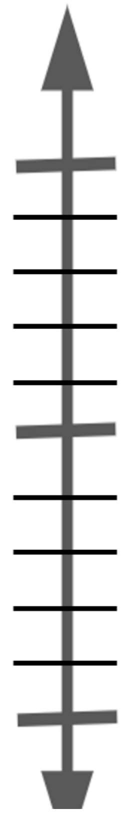
Remember: To see what a number is closer to, we use the halfway mark which is a 5 in the next smallest place value.

Use a number line to round.

1. Round **4.527** to the nearest tenth. ______________	2. Round **4.567** to the nearest hundredth. ______________
3. Round **512.38** to the nearest hundred.	4. Round **512.38** to the nearest whole.

Name: ____

Is 4.62 closer to 4.6 or 4.7?



Let's draw a picture to see!

What number was the halfway mark? ___________

The halfway mark is always ______________________________

____.

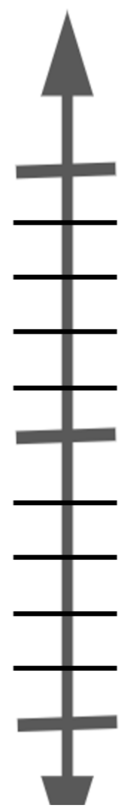
Is 4.62 closer to 4.6 or 4.7? ___________

Another way to see if 4.62 is closer to
4.6 or 4.7 is to say:

___ ___ ___ ___ ___ 4.62 to the nearest __________________.

The answer is _____________.

Round 14.379 to the nearest hundredth.



Before we can draw a picture, we need to think about what
hundredths our number is between.

_____________ and ______________

Now let's draw a picture to see!

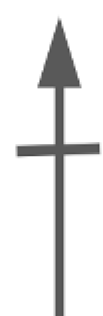
What number was the halfway mark? ___________

The halfway mark is always ______________________________

____.

The answer is _____________.

Round 8.34 to the nearest tenth.



Before we can draw a picture, we need to think about what
tenths our number is between.

_____________ and ______________

Now let's draw a picture to see! This time you don't need to fill in all the numbers.

The halfway mark is always ______________________________

____.

What number is the halfway mark? ___________

The answer is _____________.

Round 8.725 to the nearest whole.

Before we can draw a picture, we need to think about what whole numbers our number is between.

_____________ and ______________

Now let's draw a picture to see! This time you will need to do the whole picture on your own.

The halfway mark is always ______________________________

____.

What number is the halfway mark? ___________

The answer is _____________.

Name: ____ G5 U1 Lesson 5 - Independent Work

Remember: To see what a number is closer to, we use the halfway mark which is a 5 in the next smallest place value.

Use a number line to round.

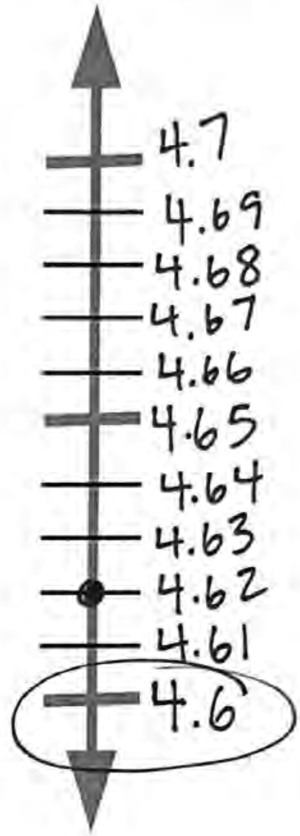
1. Round 4.527 to the nearest tenth. ____________________	2. Round 4.567 to the nearest hundredth. ____________________
3. Round 512.38 to the nearest hundred. ____________________	4. Round 512.38 to the nearest whole. ____________________

Use a number line to round.

5. Round 164.817 to the nearest ten. ____________________	6. Round 9.817 to the nearest tenth. ____________________
7. Round 6.734 to the nearest whole. ____________________	8. Round 6.734 to the nearest hundredth. ____________________

Name: ANSWER KEY

Is 4.62 closer to 4.6 or 4.7?



Let's draw a picture to see!

What number was the halfway mark? 4.65

The halfway mark is always 5 in the place to the left.

Is 4.62 closer to 4.6 or 4.7? 4.6

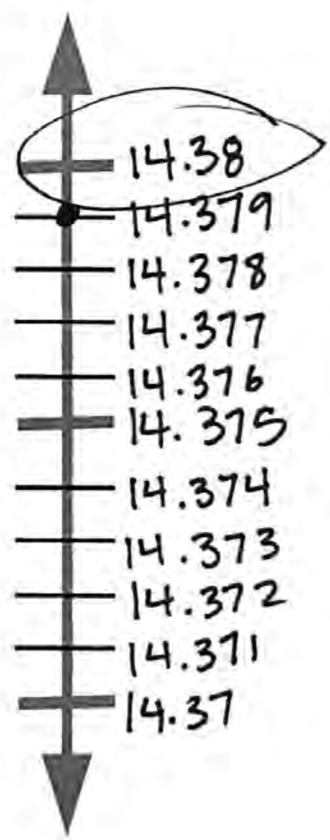
Another way to see if 4.62 is closer to 4.6 or 4.7 is to say:

Round 4.62 to the nearest tenth.

The answer is 4.6.

TO THTH

Round 14.379 to the nearest hundredth.



Before we can draw a picture, we need to think about what hundredths our number is between.

14.37 and 14.38

Now let's draw a picture to see!

What number was the halfway mark? 14.375

The halfway mark is always 5 in the place to the left.

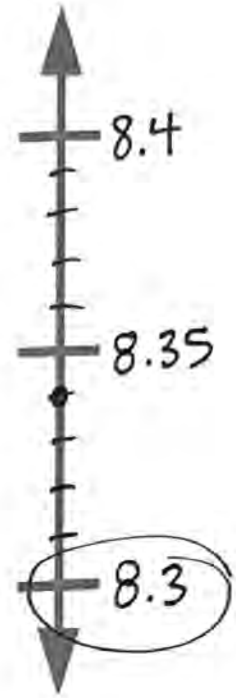
The answer is 14.38.

Round 8.34 to the nearest tenth.

Before we can draw a picture, we need to think about what tenths our number is between.

8.3 and 8.4

Now let's draw a picture to see! This time you don't need to fill in all the numbers.



The halfway mark is always 5 in the place to the left.

What number is the halfway mark? 8.35

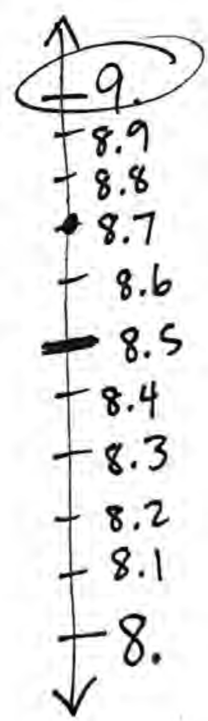
The answer is 8.3.

Round 8.725 to the nearest whole.

Before we can draw a picture, we need to think about what whole numbers our number is between.

8. and 9.

Now let's draw a picture to see! This time you will need to do the whole picture on your own.



The halfway mark is always 5 in the place to the left.

What number is the halfway mark? 8.5

The answer is 9.

Name: ANSWER KEY

G5 U1 Lesson 5 - Independent Work

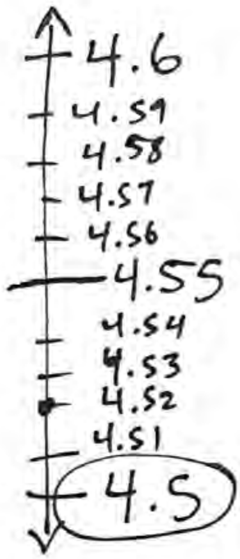
Remember: To see what a number is closer to, we use the halfway mark which is a 5 in the next smallest place value.

Use a number line to round.

O THTh

1. Round **4.527** to the nearest tenth.

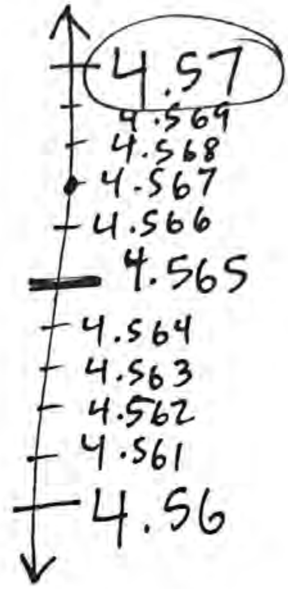
4.5



O THTh

2. Round **4.567** to the nearest hundredth.

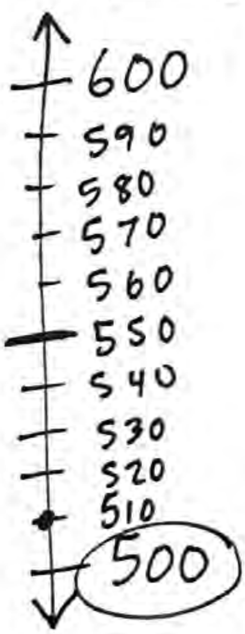
4.57



HTOTH

3. Round **512.38** to the nearest hundred.

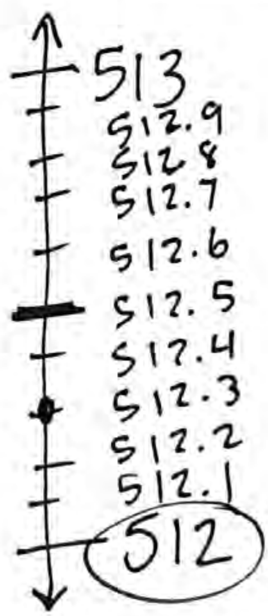
500



HTOTH

4. Round **512.38** to the nearest whole.

512



Use a number line to round.

H T O T H Th

5. Round **164.817** to the nearest ten.

160

170
169
168
167
166
165
164
163
162
161
160

O T H Th

6. Round **9.817** to the nearest tenth.

9.8

9.9
9.89
9.88
9.87
9.86
9.85
9.84
9.83
9.82
9.81
9.8

O T H Th

7. Round **6.734** to the nearest whole.

7

7.
6.9
6.8
6.7
6.6
6.5
6.4
6.3
6.2
6.1
6.

O T H Th

8. Round **6.734** to the nearest hundredth.

6.73

6.74
6.739
6.738
6.737
6.736
6.735
6.734
6.733
6.732
6.731
6.73

G5 U1 Lesson 6

Add decimals

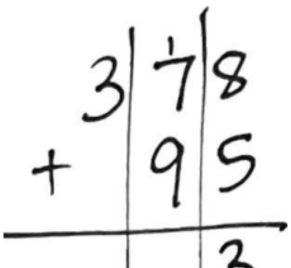
CITYTUTOR DC

G1 U1 Lesson 6 - Today we will add decimals.

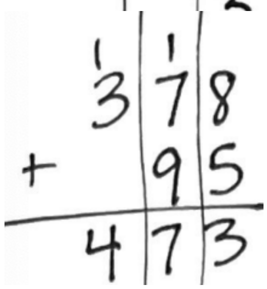
Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): Today we are going to add decimals. It is going to work exactly the same way as it does with whole numbers. So you are going to do great!

Let's Review (Slide 3): How do we add the numbers below? *You can accept any answer because you are just getting a sense of what students already know about adding. If they say anything that is correct, you can refer to it when you do your explanation.* I heard you say a lot of good things. Now it's time to watch me.

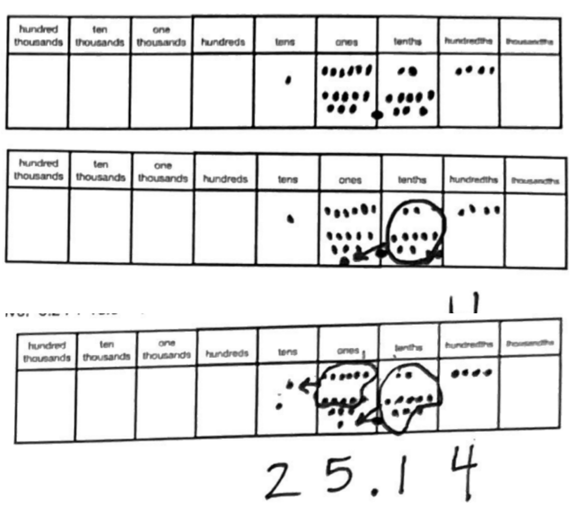


The first step is to line up the numbers. We do this like we are putting together money in a cash register drawer. We want the ones to go with the ones and the tens to go with the tens. Then we start on the right side because if we have too much in any place, we can regroup to the bigger places on the left. I add 8 + 5. *It is great for kids to count on their fingers no matter how old they are. Model counting on from 8.* 8, 9, 10, 11, 12, 13. 8 + 5 is 13. That's too much for that place. So I keep 3 ones but the rest go to the next place.



Now I add: 1+ 7 makes 8. 8 plus 9 is 8, 9, 10, 11, 12, 13, 14, 15, 16, 17. That's too much for that place. So I keep 7 but the rest go to the next place. Now I add 1 + 3 makes 4. My answer is 473. There are two keys steps. We always line up the same place values. We always have to regroup to the bigger place if we have too much.

Let's Talk (Slide 4): Let's use the picture to add decimals.



We have 6 ones, 2 tenths and 4 hundredths. When I draw the next number, you can see how the same places end up together. I have 1 ten, 8 ones and 9 tenths.

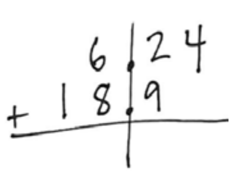
There's nothing to add in the hundredths. Let's count up the tenths. There are 11 tenths. I am going to circle ten of them to make the next place. That's like taking 10 dimes and making a dollar. 1 stays in the tenths place.

Now we can count up the ones place. There are 15 ones. I am going to circle ten of them to make the next place. That's like taking 10 one dollars and making a ten dollar bill. 5 stays in the ones place. And now we can count 2 ten dollar bills. Make sure you notice the two keys steps. We always line up the same place values. We always have to regroup to the bigger place if we have too much.

Let's Think (Slide 5): We will need to use the same ideas from the model when we use numbers. It is easy to put the first number on the place value chart. We've been doing that for many lessons. When we put the second number on the place value chart, we can't get distracted by lining up the numbers on the left or the right. The ones in 6.24 have to be with the ones in 18.9. The tenths in 6.24 have to be with the tenths in 18.9. What helps me see where the ones and the tens are?

Possible Student Answers, Key Points:

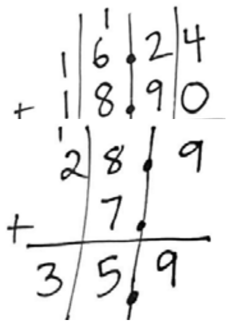
- The place value chart
- The decimal point.



To line up the place values, we have to line up the decimals points in both numbers. Watch me. In 6.24, the 6 is right before the decimal point so it has to stay right before the decimal point. 24 is after the decimal point so it has to stay right after the decimal point. The decimal point can't suddenly be between the 2 and the 4. For

18.9, the 18 has to be before the decimal point. The 9 has to be after the decimal point. Now my numbers are properly lined up and I can add.

If it makes it easier, you can add zeros in the empty spaces. I start in the hundredths place. 4 + 0 is 4. Now tenths. 2 + 9 is 11. Just like I circled ten and moved them to the bigger place, I will keep the 1 but the 1 in the tens place moves over. Now ones. 1 + 6 + 8 is 14. I will keep the 4 but the 1 moves over. 1 + 1 = 2



Let's Think (Slides 6): Lining up decimals was the key first step. That is a little bit harder if one number has a decimal and the other one doesn't. For whole numbers, we still need to line up matching place values.

I'm going to draw the decimal line and put that first number because that's like what we just did. 28 goes before the decimal. 9 goes after the decimal. Now we look at the number 7, what place is a plain old seven? Hint: It is like if I said plain old seven dollars. Possible Student Answers, Key Points:

- The seven is seven one dollar bills.
- The seven is in the ones place.

The 7 is 7 ones. So that would mean there is an imaginary decimal right here. *Put a decimal point after the 7 in the numerical expression.* The 7 goes before the decimal in the ones place like this. *Put the 7 on the place value chart you've drawn.* Then we can add like usual.

Let's Try It (Slides 7): Now we're ready to work through the steps together. I know you know how to add so we're going to focus on how we line things up on the place value chart. We'll think about it with money and then we'll practice with digits.

WARM WELCOME

Today we will add decimals.

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Let's Review: How do we add the numbers below?

Solve. $378 + $95 = ?

Let's Talk: Let's use the picture to add decimals.

Solve. 6.24 + 18.9 = ?

hundred thousands	ten thousands	one thousands	hundreds	tens	ones	tenths	hundredths	thousandths

Let's Think: **We will need to use the same ideas from the model when we use numbers.**

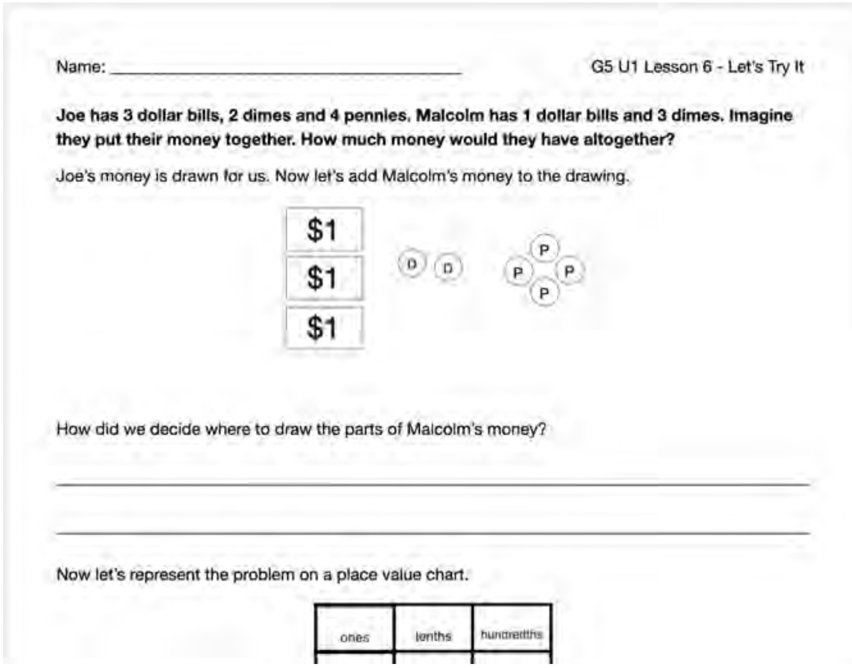
Solve. $6.24 + 18.9 = ?$

Let's Think: **For whole numbers, we still need to line up matching place values.**

Solve. $28.9 + 7 = ?$

Let's Try It:

Let's practice adding decimals together using a place value chart.



Name: ________________________________ G5 U1 Lesson 6 - Let's Try It

Joe has 3 dollar bills, 2 dimes and 4 pennies. Malcolm has 1 dollar bills and 3 dimes. Imagine they put their money together. How much money would they have altogether?

Joe's money is drawn for us. Now let's add Malcolm's money to the drawing.

How did we decide where to draw the parts of Malcolm's money?

____

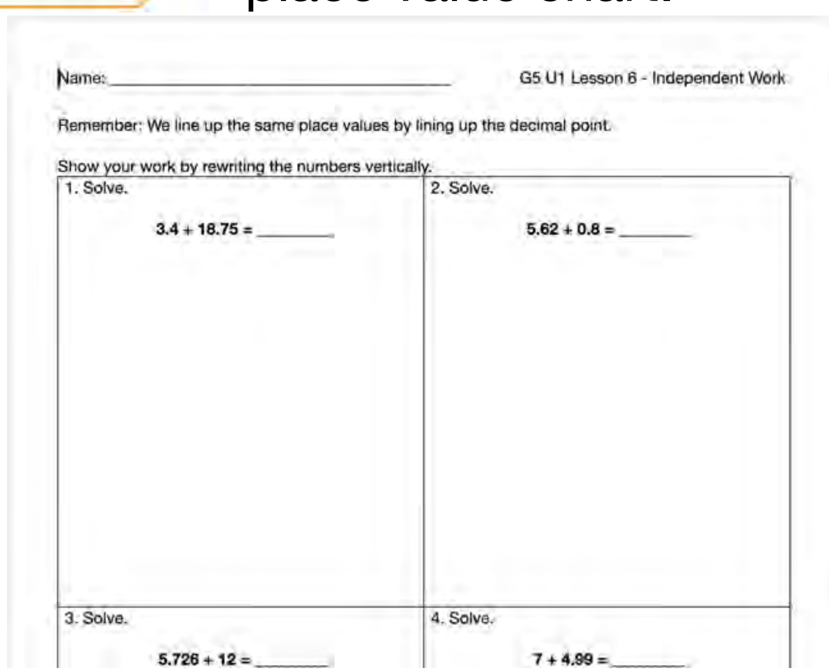
____

Now let's represent the problem on a place value chart.

ones	tenths	hundredths

On your Own:

Now it's time to add decimals on a place value chart.



Name: ________________________________ G5 U1 Lesson 6 - Independent Work

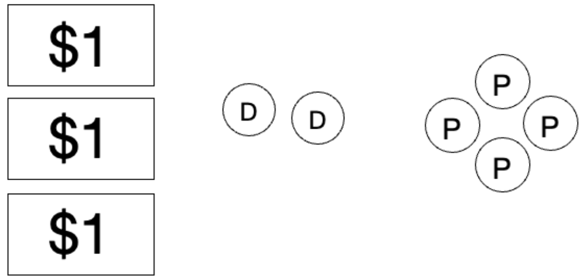
Remember: We line up the same place values by lining up the decimal point.

Show your work by rewriting the numbers vertically.

1. Solve. $3.4 + 18.75 =$ _______	2. Solve. $5.62 + 0.8 =$ _______
3. Solve. $5.726 + 12 =$ _______	4. Solve. $7 + 4.99 =$ _______

Joe has 3 dollar bills, 2 dimes and 4 pennies. Malcolm has 1 dollar bills and 3 dimes. Imagine they put their money together. How much money would they have altogether?

Joe's money is drawn for us. Now let's add Malcolm's money to the drawing.



How did we decide where to draw the parts of Malcolm's money?

____

____

Now let's represent the problem on a place value chart.

ones	tenths	hundredths

This same problem could be written as ______________ + ______________.

Let's practice writing the problem vertically without the chart drawn for us:

Solve. $56.4 + 2.987 = ?$

Let's represent the problem on a place value chart.

one thousands	hundreds	tens	ones	tenths	hundredths	thousandths

Let's practice writing the problem vertically without the chart drawn for us:

Solve. $42.78 + 9 = ?$

What place is the 9 in? ______________________________

What digit has the same place in the number 42.78? ________ It has to be lined up with the 9!

Now let's represent the problem on a place value chart.

one thousands	hundreds	tens	ones	tenths	hundredths	thousandths

Let's practice writing the problem vertically without the chart drawn for us:

Name: ____

Remember: We line up the same place values by lining up the decimal point.

Show your work by rewriting the numbers vertically.

1. Solve. $3.4 + 18.75 =$ __________	2. Solve. $5.62 + 0.8 =$ __________
3. Solve. $5.726 + 12 =$ __________	4. Solve. $7 + 4.99 =$ __________

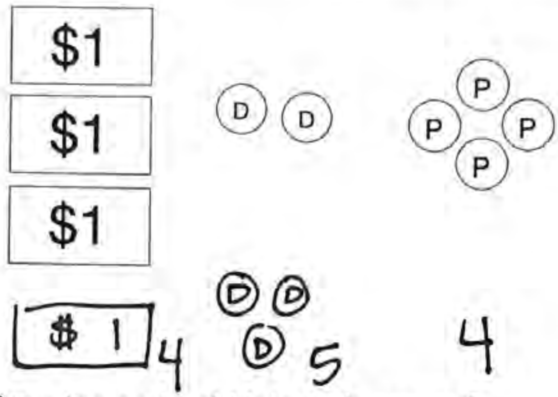
Show your work by rewriting the numbers vertically.

5. Solve. $1.9 + 13 =$ __________	6. Solve. $6.5 + 4.27 =$ __________
7. Solve. $876 + 42.3 =$ __________	8. Solve. $7.8 + 1.39 + 12 =$ __________

Name: ANSWER KEY

Joe has 3 dollar bills, 2 dimes and 4 pennies. Malcolm has 1 dollar bills and 3 dimes. Imagine they put their money together. How much money would they have altogether?

Joe's money is drawn for us. Now let's add Malcolm's money to the drawing.



$4.54

How did we decide where to draw the parts of Malcolm's money?

We put the dollars with the dollars and the dimes with the dimes

Now let's represent the problem on a place value chart.

ones	tenths	hundredths
3.	2	4
1.	3	

This same problem could be written as 3.24 + 1.3.

Let's practice writing the problem vertically without the chart drawn for us:

$$\begin{array}{r} 3.24 \\ +\ 1.3 \\ \hline 4.54 \end{array}$$

Solve. **56.4 + 2.987 = ?**

Let's represent the problem on a place value chart.

one thousands	hundreds	tens	ones	tenths	hundredths	thousandths
		5	6 .	4		
			2 .	9	8	7

Let's practice writing the problem vertically without the chart drawn for us:

$$\begin{array}{r} {}^{1}\\ 56.4 \\ +\ \ 2.987 \\ \hline 59.387 \end{array}$$

Solve. **42.78 + 9.= ?**

What place is the 9 in? the ones

What digit has the same place in the number 42.78? 2 It has to be lined up with the 9!

Now let's represent the problem on a place value chart.

one thousands	hundreds	tens	ones	tenths	hundredths	thousandths
		4	2 .	7	8	
			9 .			

Let's practice writing the problem vertically without the chart drawn for us:

$$\begin{array}{r} {}^{1}42.78 \\ +\ \ 9. \\ \hline 51.78 \end{array}$$

Name: ANSWER KEY

Remember: We line up the same place values by lining up the decimal point.

Show your work by rewriting the numbers vertically.

1. Solve. **3.4 + 18.75 =** 22.15 $\begin{array}{r} 3.4 \\ +\,18.75 \\ \hline 22.15 \end{array}$	2. Solve. **5.62 + 0.8 =** 6.42 $\begin{array}{r} 5.62 \\ +\,0.8 \\ \hline 6.42 \end{array}$
3. Solve. **5.726 + 12. =** 17.726 $\begin{array}{r} 5.726 \\ +\,12. \\ \hline 17.726 \end{array}$	4. Solve. **7. + 4.99 =** 11.99 $\begin{array}{r} 7. \\ +\,4.99 \\ \hline 11.99 \end{array}$

Show your work by rewriting the numbers vertically.

5. Solve.

1.9 + 13. = 14.9

$$\begin{array}{r} 1.9 \\ 13. \\ \hline 14.9 \end{array}$$

6. Solve.

6.5 + 4.27 = 10.77

$$\begin{array}{r} 6.5 \\ +\ 4.27 \\ \hline 10.77 \end{array}$$

7. Solve.

876. + 42.3 = 918.3

$$\begin{array}{r} \overset{1}{8}76. \\ 42.3 \\ \hline 918.3 \end{array}$$

8. Solve.

7.8 + 1.39 + 12. = 21.19

$$\begin{array}{r} \overset{1}{7}.8 \\ 1.39 \\ \overset{1}{1}2. \\ \hline 21.19 \end{array}$$

G5 U1 Lesson 7

Subtract decimals

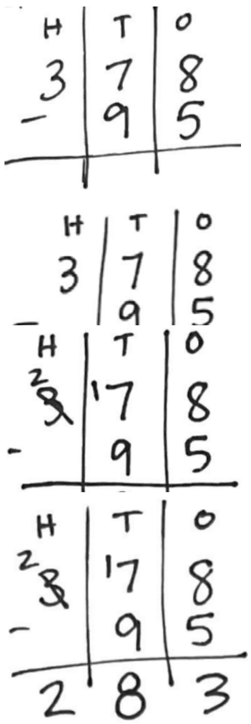
CITYTUTOR DC

G1 U1 Lesson 7 - Today we will subtract decimals.

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): Today we are going to subtract decimals. It is going to work exactly the same way as it does with whole numbers. So you are going to do great!

Let's Review (Slide 3): How do we subtract the numbers below? *You can accept any answer because you are just getting a sense of what students already know about subtracting. If they say anything that is correct, you can refer to it when you do your explanation.* I heard you say a lot of good things. Now it's time to watch me.



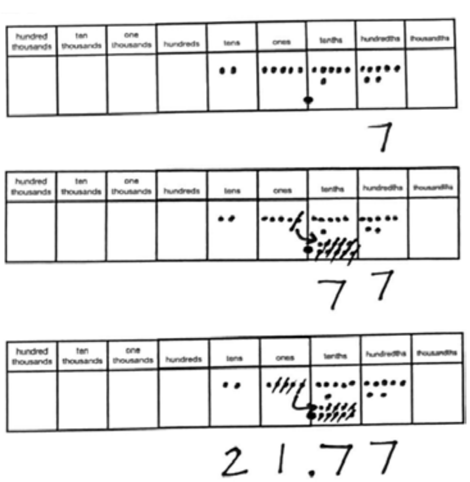
The first step is to line up the numbers. We do this like we are taking money out of a cash register drawer. We want the ones from the ones and the tens from the tens. Then we start on the right side because if we don't have enough in any place, we can regroup from the bigger places on the left. The key question we will need to ask ourselves is "Do I have enough?" If I don't have enough, I have to do something special.

Let's start with the ones place. I say, "I have 8 and they want 5. Do I have enough?" *Point to the 8 and the 5 as you talk.* Say it after me, "I have 8 and they want 5. Do I have enough?" If the answer is yes, then I can just take away like normal. If the answer is no, I have to borrow. So, what do you think? Do I have enough? Yes! 8 - 5 = 3.

Now let's go to the next place. I say, "I have 7 and they want 9. Do I have enough?" Say it after me, "I have 7 and they want 9. Do I have enough?" What do you think? No! I don't have enough because 9 is more than 5. I am going to go to the bigger place and take one. That gives me ten in the smaller place. Now I can say, "I have 17 and they want 9, do I have enough?" Now the answer is yes! 17 - 9 is 8.

Now let's go to the next place. There's nothing there to subtract. It's like, "I have 2 and they want 0. Do I have enough?" I do. 2 - 0 = 2. My final answer is 283.

Let's Talk (Slide 4): Let's use the picture to subtract decimals.

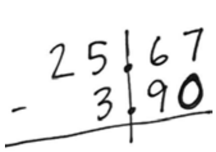


We have 2 tens, 5 ones, 6 tenths and 7 hundredths. There aren't any hundredths to subtract so that stays 7. Now it's time for tenths. I have to cross out 9 tenths. But I only have 6. This is why we ask, "I have 6 and they want 9. Do I have enough? The answer is no. When the answer is no, I have to do something special.

I can take from the bigger place. I scratch it out and move it over to the smaller place. It has ten inside. How many do I have now? Let's count! *Count.* Now, I have 16 and they want 9. Do I have enough? Yes! Let's cross out 9. Now there are 7 left.

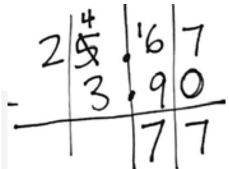
Now we look at the ones place. I have 4 and they want 3. Do I have enough? Yes. Let's cross out 3. Now there is 1 left. In the tens place, I have 2 and they want 0. Do I have enough? Yes. There is 2 left. We always do the same key steps. The first step is to put our number in a place value chart. Then every time we ask ourselves, "Do I have enough?" Then we can either regroup or subtract.

Let's Think (Slide 5): Let's show these same ideas with digits.

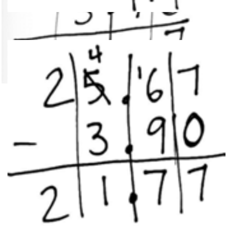


Step one is to put our numbers on a place value chart. In 25.67, the 25 is before the decimal point and it has to stay before the decimal point. The 67 is after the decimal point and it has to stay after the decimal point. In 3.9, the 3 is before the decimal point and it has to stay before the decimal point. The 9 is after the decimal point and it has to stay after the decimal point. It is super duper useful to put zeros because they can help us when we ask, "Do I have enough?" It might not seem like a big deal for this problem but it will be a really big deal for the next problem.

Now, in the hundredths place, we ask, "I have 7 and they want 0. Do I have enough?" Yes! 7 - 0 is 7.

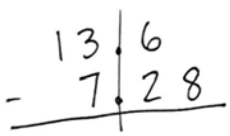


In the tenths place, we ask, "I have 6 and they want 9. Do I have enough?" No! This is when I regroup. Just like we scratch out from the ones and draw an arrow to move over ten in the smaller place, we have to scratch out the 5. It is one less. It is 4. And the 6 is 16. Now I can ask my question again. I have 16 and they want 9. Do I have enough? Yes! 16 - 9 is 7.

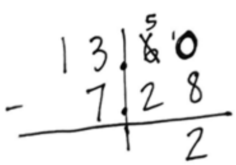


In the ones place, we ask, "I have 4 and they want 3. Do I have enough?" Yes! 4 - 3 is 1. In the tens place, we ask, "I have 2 and they want 0. Do I have enough?" Yes! 2 - 0 is 2. We get the same answer that we did with the picture!

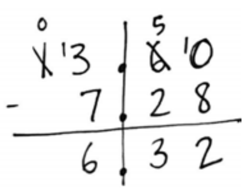
Let's Think (Slides 6): Here's another problem. It might look the same but something tricky is going to happen. See if you can figure out where the tricky part is that we have to pay attention to.



Step one is to put our numbers on a place value chart. In 13.6, the 13 is before the decimal point and it has to stay before the decimal point. The 6 is after the decimal point and it has to stay after the decimal point. In 7.28, the 7 is before the decimal point and it has to stay before the decimal point. The 28 is after the decimal point and it has to stay after the decimal point.



Now do you remember when I said it was super duper useful to put zeros? This is where it becomes super duper important. Some kids will see a number all by itself and they will just bring it down. That is wrong. That 8 is supposed to be subtracted from something. Just because nothing is there, doesn't mean we can skip it. There is a number there! It is a zero! We have to ask, "I have 0 and they want 8. Do I have enough?" Since the answer is no, we know to scratch out and get ten. If we hadn't put the zero, we wouldn't have known to subtract! So putting zero is super duper important. Now we can say, " I have 10 and they want 8. Do I have enough?" Yes! 10 - 8 is 2. When we take away 8, we get a 2. We don't just drop the 8.



Let's keep going! Now, "I have 5 and they want 2. Do I have enough?" Yes! 5 - 2 is 3. Next place! We say, "I have 3 and they want 7. Do I have enough?" No! I have to borrow. I scratch out the bigger place and get ten. Now, "I have 13 and they want 7. Do I have enough?" Yes! 13 - 7 is 6. And there is nothing left in the next place.

Let's Try It (Slides 7): Now we're ready to work through the steps together. I know you know how to subtract but there are two tricky spots - lining up our numbers and putting zeros when we need to. We'll think about it with money and then we'll practice with digits.

WARM WELCOME

Today we will subtract decimals.

Let's Review:

Let's review subtraction.

Solve. $378 - $95 = ?

Let's Talk:

Let's use the picture to subtract decimals.

Solve. 25.67 - 3.9 = ?

hundred thousands	ten thousands	one thousands	hundreds	tens	ones	tenths	hundredths	thousandths

Let's Think: **We will need to use the same ideas from the model when we use numbers.**

Solve. 25.67 - 3.9 = ?

Let's Think: **The biggest challenge is when there is nothing in a place value because we still have to subtract all the values.**

Solve. 13.6 - 7.28 = ?

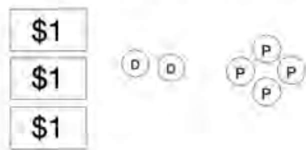
Let's Try It:

Let's practice subtracting decimals together!

Name: ______________________ G5 U1 Lesson 7 - Let's Try It

Jazmine had 3 dollar bills, 2 dimes and 4 pennies in her pocket. But there was a hole in her pocket and 1 dime fell out! How much money does Jazmine have now?

Jazmine's money is drawn for us. How can we mark up the picture to represent the story problem?



How did we decide where to draw the parts of Malcolm's money?

____

____

Now let's represent the problem on a place value chart.

ones	tenths	hundredths

On your Own:

Now it's time to subtract decimals on our own place value charts.

Name: ______________________ G5 U1 Lesson 7 - Independent Work

Remember: We line up the same place values by lining up the decimal point.

Show your work by rewriting the numbers vertically.

1. Solve.

18.75 - 3.9 = ______

2. Solve.

5.623 - 1.8 = ______

3. Solve.

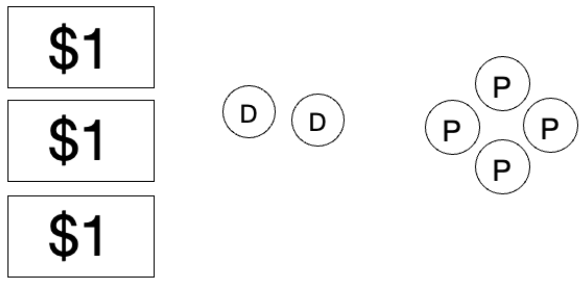
32.72 - 19 =

4. Solve.

67.2 - 4.9 =

Jazmine had 3 dollar bills, 2 dimes and 4 pennies in her pocket. But there was a hole in her pocket and 1 dime fell out! How much money does Jazmine have now?

Jazmine's money is drawn for us. How can we mark up the picture to represent the story problem?



How did we decide where to draw the parts of Malcolm's money?

____

____

Now let's represent the problem on a place value chart.

ones	tenths	hundredths

This same problem could be written as ______________ - ______________.

Let's practice writing the problem vertically without the chart drawn for us:

Solve. $56.42 - 2.9 = ?$

Let's represent the problem on a place value chart.

one thousands	hundreds	tens	ones	tenths	hundredths	thousandths

Let's practice writing the problem vertically without the chart drawn for us:

Solve. $2.6 - 0.78 = ?$

Let's set up the problem on a place value chart.

one thousands	hundreds	tens	ones	tenths	hundredths	thousandths

We want to take away 8 hundredths but there is nothing there. Write in a digit that will show what we are really subtracting from.

Let's practice writing the problem vertically without the chart drawn for us:

Name: ____ G5 U1 Lesson 7 - Independent Work

Remember: We line up the same place values by lining up the decimal point.

Show your work by rewriting the numbers vertically.

1. Solve. 18.75 - 3.9 = _________	2. Solve. 5.623 - 1.8 = _________
3. Solve. 32.72 - 19 = _________	4. Solve. 67.2 - 4.9 = _________

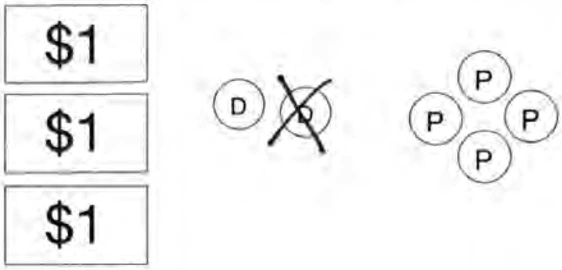
Show your work by rewriting the numbers vertically.

5. Solve. 32.7 - 0.48 = __________	6. Solve. 63 - 1.9 = __________
7. Solve. 9.11 - 7.6 = __________	8. Solve. 32.7 - 0.152 = __________

Name: ANSWER KEY

Jazmine had 3 dollar bills, 2 dimes and 4 pennies in her pocket. But there was a hole in her pocket and 1 dime fell out! How much money does Jazmine have now?

Jazmine's money is drawn for us. How can we mark up the picture to represent the story problem?



$3.14

3 1 4

How did we decide where to draw the parts of Malcolm's money?

We had to take away the dime from the dimes place.

Now let's represent the problem on a place value chart.

	ones	tenths	hundredths
	3.	2	4
−	0.	1	

This same problem could be written as 3.24 - 0.1.

Let's practice writing the problem vertically without the chart drawn for us:

$$\begin{array}{r} 3.24 \\ -\,0.1 \\ \hline 3.14 \end{array}$$

Solve. **56.42 - 2.9 = ?**

Let's represent the problem on a place value chart.

one thousands	hundreds	tens	ones	tenths	hundredths	thousandths
		5	6 .	4	2	
			2 .	9	0	

Let's practice writing the problem vertically without the chart drawn for us:

$$\begin{array}{rrrr} & & {}^{5} & & \\ & 5 & \cancel{6}\,. & {}^{1}4 & 2 \\ - & & 2\,. & 9 & 0 \\ \hline & 5 & 3\,. & 5 & 2 \end{array}$$

Solve. **2.6 - 0.78 = ?**

Let's set up the problem on a place value chart.

one thousands	hundreds	tens	ones	tenths	hundredths	thousandths
			2 .	6	0	
			0 .	7	8	

We want to take away 8 hundredths but there is nothing there. Write in a digit that will show what we are really subtracting from.

Let's practice writing the problem vertically without the chart drawn for us:

$$\begin{array}{rrrr} & {}^{1} & {}^{15} & \\ & \cancel{2}\,. & \cancel{6} & {}^{1}0 \\ - & 0\,. & 7 & 8 \\ \hline & 1\,. & 8 & 2 \end{array}$$

Name: ANSWER KEY

G5 U1 Lesson 7 - Independent Work

Remember: We line up the same place values by lining up the decimal point.

Show your work by rewriting the numbers vertically.

1. Solve.

18.75 - 3.9 = 14.85

$$\begin{array}{r} 1\cancel{8}^{7}.{}^{1}75 \\ -\ 3.90 \\ \hline 14.85 \end{array}$$

2. Solve.

5.623 - 1.8 = 3.823

$$\begin{array}{r} \cancel{5}^{4}.{}^{1}623 \\ -1.800 \\ \hline 3.823 \end{array}$$

3. Solve.

32.72 - 19. = 13.72

$$\begin{array}{r} \cancel{3}^{2}\,{}^{1}2.72 \\ -19.00 \\ \hline 13.72 \end{array}$$

4. Solve.

67.2 - 4.9 = 62.3

$$\begin{array}{r} 6\cancel{7}^{6}.{}^{1}2 \\ -\ 4.9 \\ \hline 62.3 \end{array}$$

Show your work by rewriting the numbers vertically.

5. Solve.

32.7 - 0.48 = 32.22

$$\begin{array}{r} 3\,2\,.\,\cancel{7}^{6}\,{}^{1}0 \\ -\ 0\,.\,4\,8 \\ \hline 3\,2\,.\,2\,2 \end{array}$$

6. Solve.

63,- 1.9 = 61.1

$$\begin{array}{r} 6\,\cancel{3}^{2}\,.\,{}^{1}0 \\ -\ 1\,.\,9 \\ \hline 6\,1\,.\,1 \end{array}$$

7. Solve.

9.11 - 7.6 = 1.51

$$\begin{array}{r} \cancel{9}^{8}\,.\,{}^{1}1\,1 \\ -\ 7\,.\,6\,0 \\ \hline 1\,.\,5\,1 \end{array}$$

8. Solve.

32.7 - 0.152 = 32.548

$$\begin{array}{r} 3\,2\,.\,\cancel{7}^{6}\,\cancel{{}^{1}0}^{9}\,{}^{1}0 \\ 0\,.\,1\,5\,2 \\ \hline 3\,2\,.\,5\,4\,8 \end{array}$$

G5 U1 Lesson 8

Multiply decimals by whole numbers

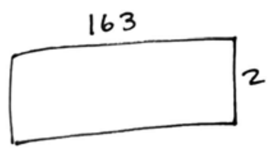
CITYTUTOR DC

G1 U1 Lesson 8 - Today we will multiply decimals by whole numbers.

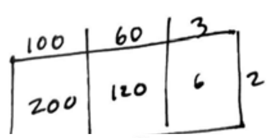
Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): Today we are going to multiply decimals. It is going to work exactly the same way as it does with whole numbers so you are going to do great!

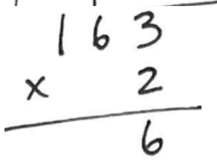
Let's Review (Slide 3): In the past, you might have learned to multiply with the area model or you might have learned to multiply with digits. Let's review.



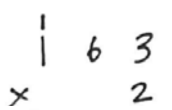
In the area model, we multiply length times width. This picture helps us think about how to break up the numbers to do the math in smaller pieces.



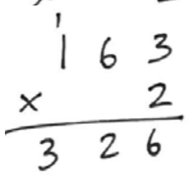
The number 163 is really 100 + 60 + 3. When we draw the model like this we can see that instead of multiplying the whole number at once, we can multiply 3 x 2, which is 6. *Use your fingers to point to each number getting multiplied together and where the answer goes.* We can multiply 60 x 2, which is 120. We can multiply 100 x 2, which is 200. Then we add all the pieces together. 200 + 120 + 6 is 326.



When we write our digits, it really works the same way. We multiply each piece of the number. But when we do it this way, we have to make sure we put things in their correct place. We don't have all those zeroes to help us. I'm going to draw some lines to help us. And if there is too much in any place, we regroup it to the bigger place. *Use your fingers to show what is getting multiplied each time and where the answer is going.* 2 x 3 ones is 6 in the ones place.

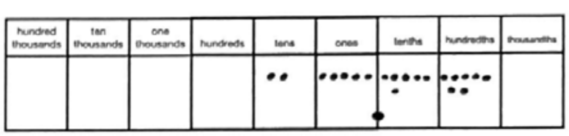


Next we move to the tens place. 2 x 6 tens is 12 tens. Now that's too much so I am going to keep the 2 and put the 1 in the bigger place.

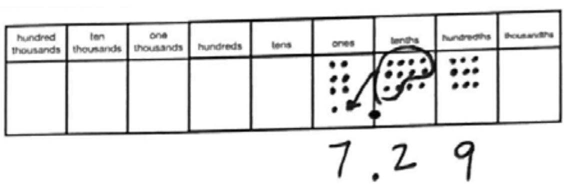


Next we move to the hundreds place. 2 x 1 hundred is 2 hundred. But we have to remember to add the 1 we regrouped. That's 3 hundreds. Look! We got the same answer.

Let's Talk (Slide 4): Let's use the picture to multiply decimals. Just like with whole numbers, we are going to keep multiplying each piece of the number by place value. And we are going to regroup if we have too much in any place.



There are 2 ones, 4 tenths and 3 hundredths. Now we can multiply each of these pieces by 3.



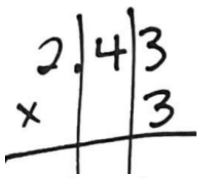
I draw the 3 hundredths, 3 times. Now I see there are 9 hundredths. I draw the 4 tenths, 3 times. Wow! That's a lot! What do you think I should do with all those pieces? Possible Student Answers, Key Points:

- Regroup.
- Circle ten and move them to the bigger place.

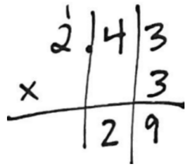
I am going to circle ten and move them to the bigger place. We have 2 stay and there is one more getting added to the ones place. Now when I draw the 2 ones, 3 times. I will get 6. But there is an extra that I added so I get 7. My answer needs a decimal point to show all these place values. We multiplied hundredths so my answer needs to be hundredths too.

Let's Think (Slide 5): Let's show these same ideas with the area model and digits. Remember we are going to multiply each piece of the number by place value. And we are going to regroup if we have too much in any place. I am not going to go through the whole area model here because it starts to be too many digits floating around. But we can still notice something important. What do you notice?
Possible Student Answers, Key Points:

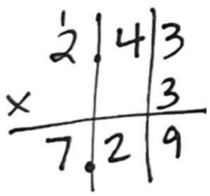
- The 2.43 is broken up into pieces.
- We will multiply 2 x 3 and 0.4 x 3 and 0.03 x 3.



Now let's work with the digits. First let's set up the problem. I don't have to worry about lining up the decimals or lining up the place values like I did for addition and subtraction because I am going to multiply each place value anyway. We just put the 3 down here so we can use it. But I will put lines because when I start multiplying, I want to keep all my answers in their correct place.



I am going to start by multiplying hundredths. I do 3 x 3. That's 9 in the hundredths place. Now I am going to multiply the tenths. I do 4 x 3. That's 12. Just like in our picture, we have too much and we have to regroup. I am going to keep the 2 in the tenths place and regroup the 1 to the next biggest place.



Now I am going to multiply the ones. I do 2 x 3. That's 6. But I have to remember to add the 1 that I regrouped. That's 7 in the ones place. Don't forget the decimal. We multiplied hundredths so my answer should be hundredths. The decimal goes straight down for now. And look! We got the same answer as in our picture!

Let's Try It (Slides 6): Now we're ready to work through the steps together. Remember we are going to multiply each piece of the number by place value. And we are going to regroup if we have too much in any place.

WARM WELCOME

Today we will multiply decimals by whole numbers.

Let's Review: Let's review multiplication with an area model and numbers.

Solve. 163 x 2 = ?

Area model:

Numbers:

Let's Talk: Let's use the place value chart to multiply decimals.

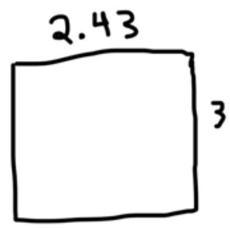
Solve. 2.43 x 3 = ?

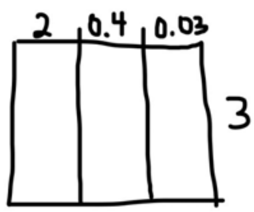
hundred thousands	ten thousands	one thousands	hundreds	tens	ones	tenths	hundredths	thousandths

Let’s Think: Let’s use the area model to multiply decimals.

Solve. 2.43 x 3 = ?

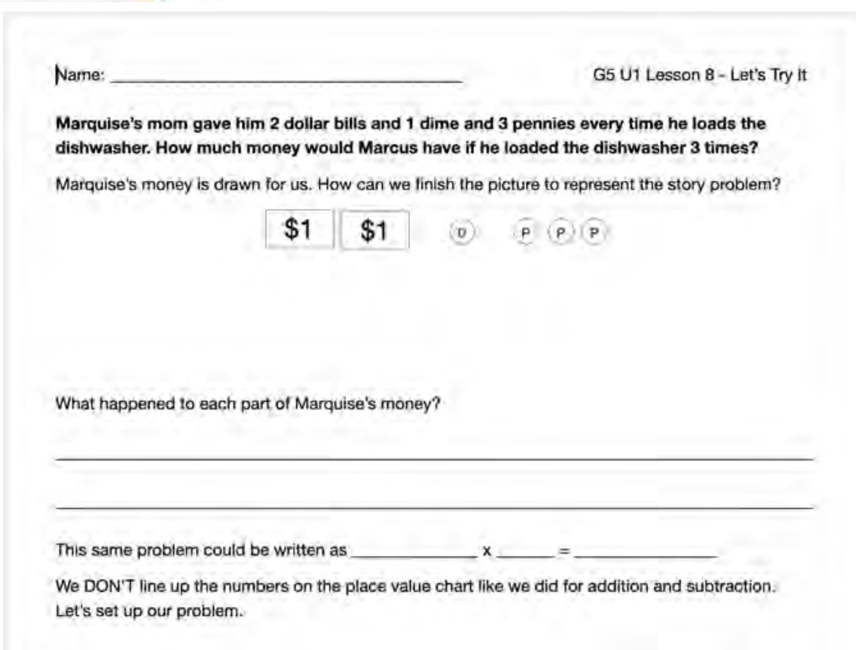
Area model:





Numbers:

Let’s Try It: Let’s practice multiplying decimals with money then digits!



Name: ______________________________ G5 U1 Lesson 8 - Let’s Try It

Marquise’s mom gave him 2 dollar bills and 1 dime and 3 pennies every time he loads the dishwasher. How much money would Marcus have if he loaded the dishwasher 3 times?

Marquise’s money is drawn for us. How can we finish the picture to represent the story problem?

$1 $1 D P P P

What happened to each part of Marquise’s money?

____

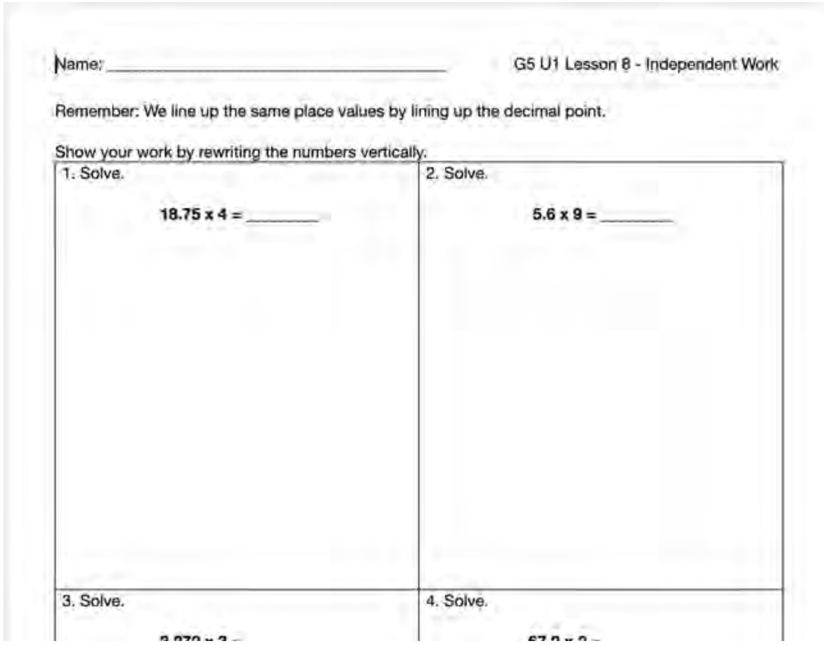
____

This same problem could be written as ___________ x _____ = ____________

We DON’T line up the numbers on the place value chart like we did for addition and subtraction. Let’s set up our problem.

On your Own:

Now it's time to for you to multiply decimals independently!



Name: ______________________ G5 U1 Lesson 8 - Independent Work

Remember: We line up the same place values by lining up the decimal point.

Show your work by rewriting the numbers vertically.

1. Solve. **18.75 x 4 =** ________	2. Solve. **5.6 x 9 =** ________
3. Solve.	4. Solve.

Marquise's mom gave him 2 dollar bills and 1 dime and 3 pennies every time he loads the dishwasher. How much money would Marcus have if he loaded the dishwasher 3 times?

Marquise's money is drawn for us. How can we finish the picture to represent the story problem?

What happened to each part of Marquise's money?

____

____

This same problem could be written as ______________ x _______ = ________________

We DON'T line up the numbers on the place value chart like we did for addition and subtraction. Let's set up our problem.

We don't want to forget the decimal in our answer because it helps us keep the place values we started with!

Fill in the value: 2.13 is 213 ________________.

Fill in with numbers and values: 213 ___________________ x 3 = ________ _____________________

Fill in with decimals: ______________ x _______ = ________________

Solve. $56.02 \times 4 = ?$

Let's represent the problem on a place value chart.

one thousands	hundreds	tens	ones	tenths	hundredths	thousandths

Let's practice writing the problem vertically without the chart drawn for us:

We can make a chart to compare how we work with each operation.

	Addition	Subtraction	Multiplication
Do we line up the place values and decimal points in both numbers?			
Which way do we need to regroup?			
Show an example with the same numbers.	34.1 + 8 = ?	34.1 - 8 = ?	34.1 x 8 = ?

Name: ____

Remember: We line up the same place values by lining up the decimal point.

Show your work by rewriting the numbers vertically.

1. Solve. 18.75 x 4 = __________	2. Solve. 5.6 x 9 = __________
3. Solve. 3.272 x 3 = __________	4. Solve. 67.2 x 2 = __________

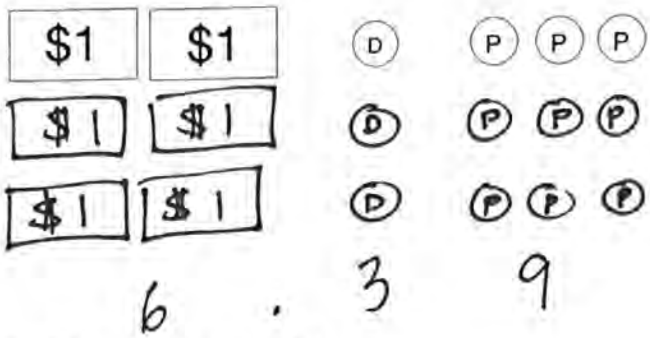
Show your work by rewriting the numbers vertically.

5. Solve. 32.47 x 5 = ________	6. Solve. 63.9 x 7 = ________
7. Solve. 9.11 x 6 = ________	8. Solve. 6.327 x 8 = ________

Name: ANSWER KEY

Marquise's mom gave him 2 dollar bills and 1 dime and 3 pennies every time he loads the dishwasher. How much money would Marcus have if he loaded the dishwasher 3 times?

Marquise's money is drawn for us. How can we finish the picture to represent the story problem?



$6.39

What happened to each part of Marquise's money?

The dollars repeated three times. The dime repeated three times. The pennies repeated three times.

This same problem could be written as 2.13 x 3 = 6.39

We DON'T line up the numbers on the place value chart like we did for addition and subtraction. Let's set up our problem.

$$\begin{array}{r} 2.13 \\ \times\ 3 \\ \hline 6.39 \end{array}$$

We don't want to forget the decimal in our answer because it helps us keep the place values we started with!

Fill in the value: 2.13 is 213 hundredths.

Fill in with numbers and values: 213 hundredths x 3 = 639 hundredths

Fill in with decimals: 2.13 x 3 = 6.39

Solve.

56.02 x 4 = ?

Let's represent the problem on a place value chart.

one thousands	hundreds	tens	ones	tenths	hundredths	thousandths

2 2 4 . 0 8

Let's practice writing the problem vertically without the chart drawn for us:

$$\begin{array}{r} \overset{2}{5}6.02 \\ \times \quad 4 \\ \hline 224.08 \end{array}$$

We can make a chart to compare how we work with each operation.

	Addition	Subtraction	Multiplication
Do we line up the place values and decimal points in both numbers?	yes	yes	no
Which way do we need to regroup?	←	→	←
Show an example with the same numbers.	34.1 + 8.= ? $\begin{array}{r} \overset{1}{3}4.1 \\ +\ 8.0 \\ \hline 42.1 \end{array}$	34.1 - 8 = ? $\begin{array}{r} \overset{2}{\cancel{3}}{}^{1}4.1 \\ -\ 8.0 \\ \hline 26.1 \end{array}$	34.1 x 8 = ? $\begin{array}{r} \overset{3}{3}4.1 \\ \times \quad 8 \\ \hline 272.8 \end{array}$

Name: ANSWER KEY

Remember: We line up the same place values by lining up the decimal point.

Show your work by rewriting the numbers vertically.

1. Solve.

18.75 x 4 = 75

$$\begin{array}{r} {}^{3}1\,{}^{3}8.{}^{2}7\,5 \\ \times \quad\quad 4 \\ \hline 75.00 \end{array}$$

2. Solve.

5.6 x 9 = 50.4

$$\begin{array}{r} {}^{5}5.6 \\ \times \quad 9 \\ \hline 50.4 \end{array}$$

3. Solve.

3.272 x 3 = 9.816

$$\begin{array}{r} 3.{}^{2}2\,7\,2 \\ \times \quad\quad 3 \\ \hline 9.816 \end{array}$$

4. Solve.

67.2 x 2 = 74.4

$$\begin{array}{r} {}^{1}6\,7.2 \\ \times \quad 2 \\ \hline 74.4 \end{array}$$

Show your work by rewriting the numbers vertically.

5. Solve.

32.47 x 5 = 162.35

$$\begin{array}{r} 32.47 \\ \times\quad 5 \\ \hline 162.35 \end{array}$$

6. Solve.

63.9 x 7 = 447.3

$$\begin{array}{r} 63.9 \\ \times\quad 7 \\ \hline 447.3 \end{array}$$

7. Solve.

9.11 x 6 = 54.66

$$\begin{array}{r} 9.11 \\ \times\quad 6 \\ \hline 54.66 \end{array}$$

8. Solve.

6.327 x 8 = 50.616

$$\begin{array}{r} 6.327 \\ \times\quad 8 \\ \hline 50.616 \end{array}$$

G5 U1 Lesson 9

Check multiplication answers with estimation

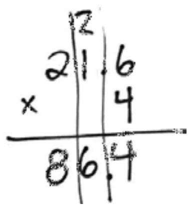
CITYTUTOR DC

G1 U1 Lesson 9 - Today we will check multiplication answers with estimation.

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): Today we are going to estimate decimal multiplication. This is going to be super helpful because it will allow us to check if our exact multiplication answer is reasonable or close to what we expect the answer to be.

Let's Review (Slide 3): What did we learn about multiplication in our last lesson? Possible Student Answers, Key Points:

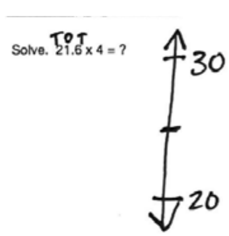


- We learned to multiply.
- We learned that we don't need to line up our place values for multiplication.
- We learned that we multiply each piece.
- We learned that we have to regroup if we have too much in one place.
- We learned that we need to put the decimal in our answer.

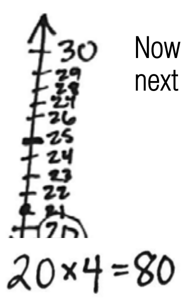
We're still going to keep practicing all of those important things! Watch me do this problem.

Let's Talk (Slide 4): Instead of saying "solve," this problem says "estimate." That means we will round our numbers before we multiply. How would we round 21.6 and what kind of work do we show? Possible Student Answers, Key Points:

- We have to turn smaller place values to zeros.
- We have to look at a 5 in the smaller place.
- We have to draw a number line.
- We have to put a halfway mark.
- We have to see what our number is closer to.



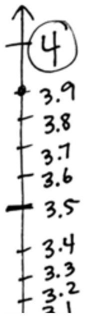
Let's draw a number line for 21.6 and round it to the biggest place. I am going to mark the place values of 21.6 above the number. All the smaller place values become zeros. 21.6 is between 20 and then next ten up, 30.



Now we can count up from 20. 21, 22, 23, 24, 25, 26, 27, 28, 29, 30! The halfway mark is 25. That has a 5 in the next smallest space. I can put a dot where 21.6 would be and now I see my number is closer to 20.

Now that we rounded, it is so easy to multiply. Instead of multiplying all of 21.6 x 4, we can estimate the answer is close to 20 x 4, which is 80. I would expect my number to be near 80, which it was. On the last slide I got 86.4! If I had gotten an answer near 8 or 800 then I would know I made a mistake with putting my decimal point in the right spot.

Let's Think (Slide 5): Let's do it again but this time we'll find an exact answer too.

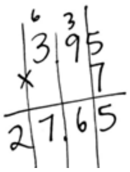


I am going to draw my regular rounding number line and round to the biggest place. I am going to mark the place values of 3.95 above the number. All the small place values become zeros. 3.95 is between 3 and the next one up, 4.

Hopefully you remember the pattern to find the halfway mark, which is a 5 in the next smallest place. But if we need to, we can count up from 3 to 4 in the next smallest place value. 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8, 3.9, 4! I can put a dot where 3.95 would be. Now I see it is closer to 4.

$$4 \times 7 = 28$$

Now I can multiply my rounded number to get an estimate. 4 x 7 = 28. My number needs to be close to 28 or I've made a mistake.



Let's set up 3.95 x 7 like we learned yesterday. 7 x 5 is 35. I keep the 5 and regroup the 3. 9 x 7 is 63 plus 3 is 68. I keep the 8 and regroup the 6. 7 x 3 is 21 plus 6 is 27. My problem has hundredths so I need hundredths in my answer. I get 27.83. Now here's the most fun part. I ask myself, "Is my exact answer close to my estimate?" Yes! 27 is pretty close to 28.

Let's Try It (Slides 6): Now we will practice together. I will take you through each step so you know what to do when you have to work on your own.

WARM WELCOME

Today we will check multiplication answers with estimation.

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Let's Review: **What did we learn about multiplication in our last lesson?**

Solve. 21.6 x 4 = ?

Let's Talk: **How would we round our number to estimate an answer instead?**

Estimate. 21.6 x 4 = ?

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Let's Think:

When we estimate, we can make sure our exact answer is reasonable.

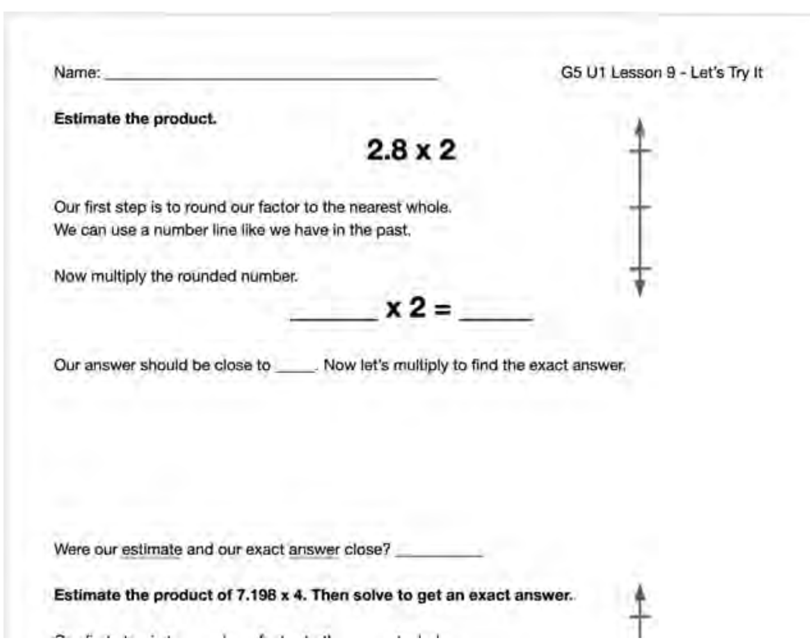
Solve. $3.95 \times 7 = ?$

Estimate:

Exact answer:

Let's Try It:

Let's practice estimating multiplication together!



Name: ______________________ G5 U1 Lesson 9 - Let's Try It

Estimate the product.

2.8 x 2

Our first step is to round our factor to the nearest whole.
We can use a number line like we have in the past.

Now multiply the rounded number.

_____ x 2 = _____

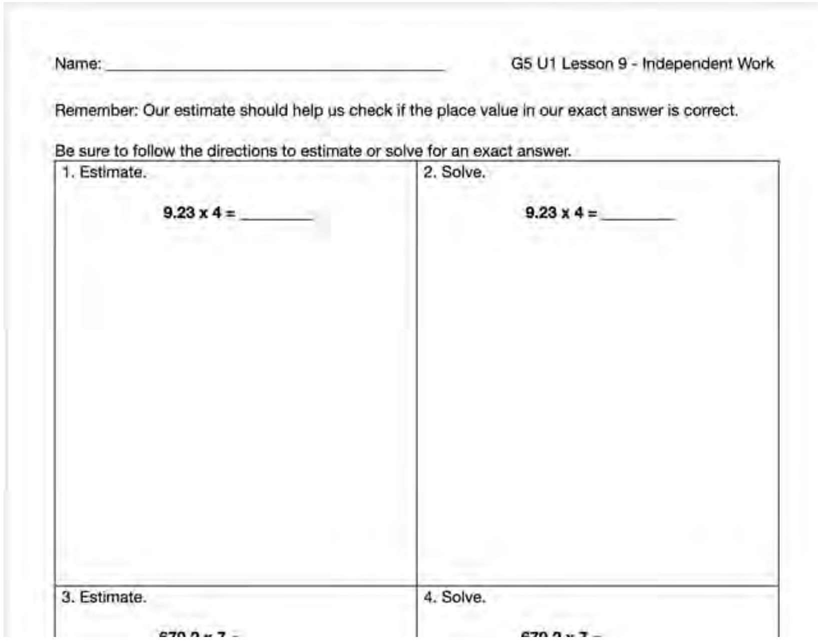
Our answer should be close to _____. Now let's multiply to find the exact answer.

Were our estimate and our exact answer close? _________

Estimate the product of 7.198 x 4. Then solve to get an exact answer.

On your Own:

Now it's time to estimate decimals and find an exact answer.



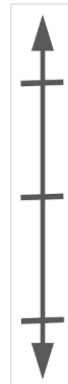
Name: ____________________ G5 U1 Lesson 9 - Independent Work

Remember: Our estimate should help us check if the place value in our exact answer is correct.

Be sure to follow the directions to estimate or solve for an exact answer.

1. Estimate. **9.23 x 4 =** ________	2. Solve. **9.23 x 4 =** ________
3. Estimate.	4. Solve.

Estimate the product.



$$2.8 \times 2$$

Our first step is to round our factor to the nearest whole.
We can use a number line like we have in the past.

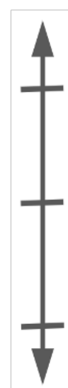
Now multiply the rounded number.

_______ x 2 = ______

Our answer should be close to ______. Now let's multiply to find the exact answer.

Were our estimate and our exact answer close? ____________

Estimate the product of 7.198 x 4. Then solve to get an exact answer.



Our first step is to round our factor to the nearest whole.
We can use a number line like we have in the past.

Now multiply the rounded number.

_______ x 4 = ______

Our answer should be close to ______. Now let's multiply to find the exact answer.

Were our estimate and our exact answer close? ____________

Name: ____ G5 U1 Lesson 9 - Independent Work

Remember: Our estimate should help us check if the place value in our exact answer is correct.

Be sure to follow the directions to estimate or solve for an exact answer.

1. Estimate. 9.23 x 4 = __________	2. Solve. 9.23 x 4 = __________
3. Estimate. 679.2 x 7 = __________	4. Solve. 679.2 x 7 = __________

Be sure to follow the directions to estimate or solve for an exact answer.

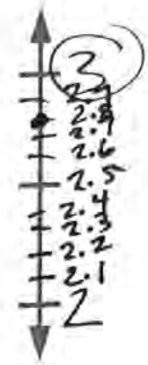
5. Estimate. 32.47 x 9 = __________	6. Solve. 32.47 x 9 = __________
7. Estimate. 9.141 x 6 = __________	8. Solve. 9.141 x 6 = __________

Name: ANSWER KEY

Estimate the product.

O T

2.8 x 2



Our first step is to round our factor to the nearest whole.
We can use a number line like we have in the past.

Now multiply the rounded number.

3 x 2 = 6

Our answer should be close to 6. Now let's multiply to find the exact answer.

$$\begin{array}{r} \overset{1}{2}.8 \\ 2 \\ \hline 5.6 \end{array}$$

Were our estimate and our exact answer close? Yes!

Estimate the product of 7.198 x 4. Then solve to get an exact answer.

Our first step is to round our factor to the nearest whole.
We can use a number line like we have in the past.

Now multiply the rounded number.

7 x 4 = 28

Our answer should be close to 28. Now let's multiply to find the exact answer.

$$\begin{array}{r} 7.\overset{3}{1}\overset{3}{9}8 \\ \times \quad 4 \\ \hline 28.792 \end{array}$$

Were our estimate and our exact answer close? Yes!

Name: ANSWER KEY

G5 U1 Lesson 9 - Independent Work

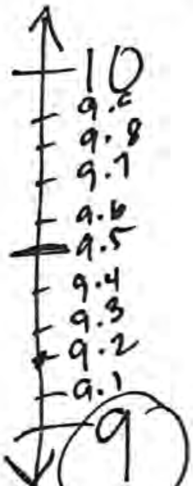
Remember: Our estimate should help us check if the place value in our exact answer is correct.

Be sure to follow the directions to estimate or solve for an exact answer.

1. Estimate.

O TH

9.23 x 4 = 36



9×4=36

2. Solve.

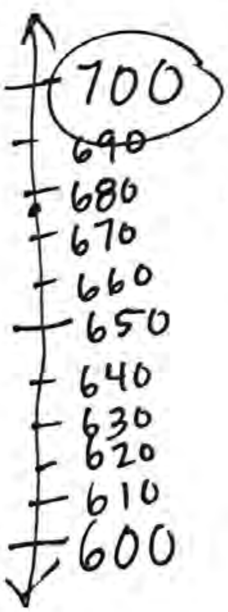
9.23 x 4 = 36.92

$$\begin{array}{r} \overset{1}{}9.23 \\ \times\quad 4 \\ \hline 36.92 \end{array}$$

3. Estimate.

H T O T

679.2 x 7 = 4,900



700×7 =

4,900

4. Solve.

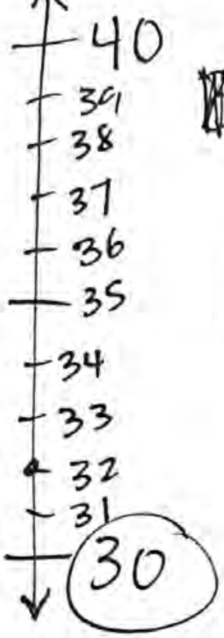
679.2 x 7 = 4,654.4

$$\begin{array}{r} {}^{4\;6\;1} \\ 679.2 \\ \times\quad 7 \\ \hline 4654.4 \end{array}$$

Be sure to follow the directions to estimate or solve for an exact answer.

5. Estimate.

T O T H
32.47 x 9 = 270



30 × 9 = 270

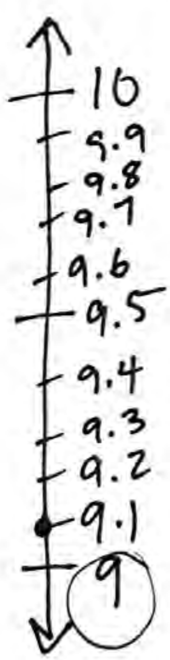
6. Solve.

32.47 x 9 = 292.23

$$\begin{array}{r} {}^{2}\,{}^{4}\,{}^{6} \\ 32.47 \\ \times \quad 9 \\ \hline 292.23 \end{array}$$

7. Estimate.

O THTh
9.141 x 6 = 54



9 × 6 = 54

8. Solve.

9.141 x 6 = 54.846

$$\begin{array}{r} {}^{2}\quad \\ 9.141 \\ \times \quad 6 \\ \hline 54.846 \end{array}$$

G5 U1 Lesson 10

Divide decimals using the place value chart

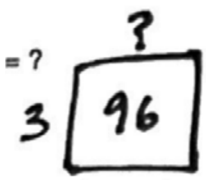
CITYTUTOR DC

G1 U1 Lesson 10 - Today we will divide decimals using the place value chart.

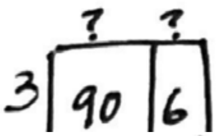
Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): Today we are going to divide decimals. It will be great because mostly we're just reviewing division, which is something you've seen before. And the decimal part of it will come.

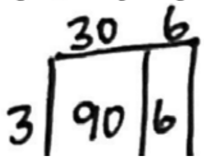
Let's Review (Slide 3): Division is the opposite of multiplication so we can use some of the same ideas we used for multiplication.



In the area model, we multiply length times width to get the total area. But in division we know the area, and we trying to figure out "3 times what makes 96?"

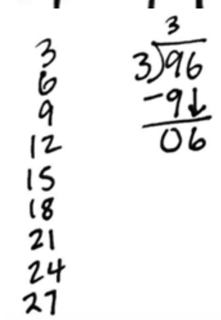


But just like multiplication, it is hard to figure out a whole big number. It is easy to break the number into pieces.



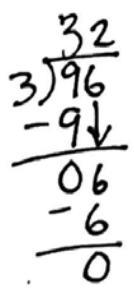
30+6=36

Then we can ask, "3 times what makes 90?" That's 30. 3 x 30 makes 90. And we ask, "3 times what makes 6?" That's 2. 2 x 3 makes 6. So our answer is 30 + 6 which is 36. What we really did was divide each piece of 96.



We're really doing the exact same thing when we draw out the long division. We look at each digit and ask ourselves, "3 times what makes each piece of the number?" If this is tricky to figure out, I can write out my 3s on the side of my paper. 3, 6, 9, 12, 15, 18, 21, 24, 27.

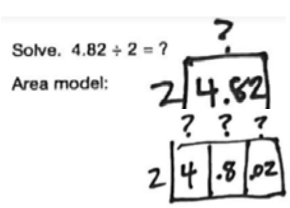
Let's do it. 3 times what makes 9? I can look here. *Pointing to each number on the list, you can say, "3 x 1 is 3 and 3 x 2 is 6 and 3 x 3 is 9."* 3 x 3 makes 9. I put the 3 on top and subtract what it makes. Now we can see the 6 is up next. But in future lessons we might have remainders so we'll draw an arrow to pull that number down next to the leftovers.



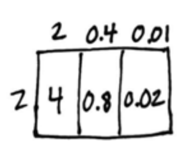
Now we ask, "3 times what makes 6?" 3 x 2 makes 6. I put the 2 on top and subtract what it makes. Look! We got the same answer that we did with the area model.

Let's Talk (Slide 4): We do things the exact same way with decimals as we do with whole numbers. Help me fill in the blanks, we are asking, "___ times what makes ______?" Possible Student Answers, Key Points:

- 2 times what makes 4.82?

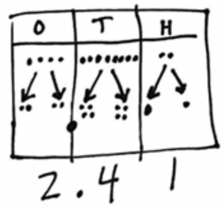


We can draw an area model with the whole 4.82 inside. Or we can break it up into 4 and 0.8 and 0.02.



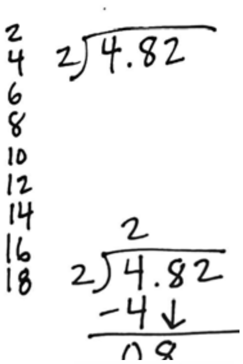
Then we can ask ourselves easier questions like, "2 times what makes 4?" The answer is 2! And 2 times what makes 8 tenths? The answer is 4 tenths. Of course if we're dividing tenths then the answer will be tenths. The place of the digit next to the decimal is the same as the place of the answer, right next to the decimal. Then we ask, "2 times what makes 2 hundredths?" The answer is 1 hundredth. Again, if we're dividing hundredths then our answer is hundredths.

We see the same breakdown if we draw a picture. I am going to put 4 dots for 4 ones. I am going to put 8 dots for 8 tenths. I am going to put 2 dots for 2 hundredths.



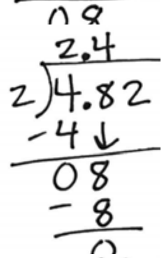
I can draw two arrows to show splitting the 4 ones. I get 2 ones. I can draw two arrows to show splitting 8 tenths. I get 4 tenths. I can draw two arrows to show splitting 2 hundredths. I get 1 hundredth. In order for each of these digits to keep the right value. I need to keep my decimal in my answer. It's super duper important I don't forget that.

Let's Think (Slide 5): Let's do it again but this time we'll find an exact answer too.

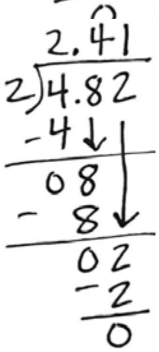


It is even easier to keep track of place values if we just keep the places during long division. Let's do it. If you want, you can list the twos out of the side of your paper. 2, 4, 6, 8, 10, 12, 14, 16, 18.

You're going to notice that we ask the exact same questions. 2 times what makes 4? *Point to the list, 2 x 1 makes 2, 2 x 2 makes 4.* 2 times 2 makes 4. 2 goes on the top and then we subtract what it makes. Pull down the next number.



Now we ask, "2 times what makes 8?" *Point to the list, 2 x 1 makes 2, 2 x 2 makes 4, 2 x 3 makes 6, 2 x 4 makes 8.* 2 times 4 makes 8. The 4 goes on the top and then we subtract what it makes. Pull down the next number.



Now we ask, "2 times what makes 2?" *Point to the list, 2 x 1 makes 2.* 2 times 1 makes 2. The 1 goes on the top and then we subtract what it makes. We got the same answer that we did with our area model. We just can't forget to keep that decimal point in the same place as it always is.

Let's Try It (Slides 6): Now we will practice together. I will take you through each step so you know what to do when you have to work on your own.

WARM WELCOME

Today we will divide decimals using the place value chart.

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Let's Review: What does each model show about how we divide place values?

Solve. $96 \div 3 = ?$

Area model:

Long division:

Let's Talk: Can we divide each place value for decimal division models as well?

Solve. $4.82 \div 2 = ?$

Area model:

Place value chart:

Let's Think: **How can we divide each place value when we use the long division set up?**

Solve. $4.82 \div 2 = ?$

Let's Think: **What do we do if there is a zero in a place value?**

Solve. $6.08 \div 2 = ?$

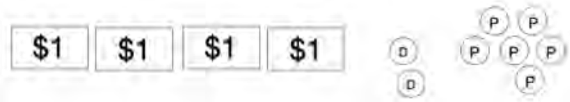
Let's Try It:

Let's practice dividing decimals together! We'll go through step by step.

Name: ______________________ G5 U1 Lesson 10 - Let's Try It

Jayden had 4 dollar bills, 2 dimes and 6 pennies. He split his money between his two younger sisters. How much money did each sister get?

Jayden's money is drawn for us. How can we finish the picture to represent the story problem?



What happened to each part of Jayden's money?

____

____

This same problem could be written as ________ ÷ _____ = ________

On your Own:

Now it's time to divide decimals with remainders on your own!

Name: ______________________ G5 U1 Lesson 10 - Independent Work

Remember: We must preserve the place values of the number by keeping them lined up.

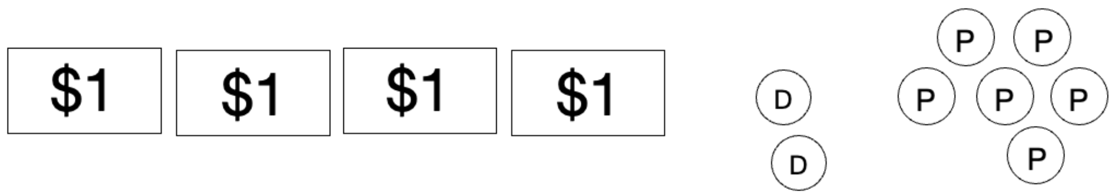
Show your work using the long division symbol.

1. Solve. **9.63 ÷ 3 =** ______	2. Solve. **4.08 ÷ 4 =** ______
3. Solve.	4. Solve.

Name: ____

Jayden had 4 dollar bills, 2 dimes and 6 pennies. He split his money between his two younger sisters. How much money did each sister get?

Jayden's money is drawn for us. How can we finish the picture to represent the story problem?



What happened to each part of Jayden's money?

____

____

This same problem could be written as ______________ ÷ ________ = ______________

We DON'T line up the numbers on the place value chart like we did for addition and subtraction. Let's set up our problem.

We don't want to forget the decimal in our answer because it helps us keep the place values we started with!

Solve. $9.069 \div 3 = ?$

Let's represent the problem on a place value chart.

ones	tenths	hundredths	thousandths

Let's practice writing the problem with the long division symbol:

Can we just skip over the zero? Why or why not?

____

____

We can make a chart to compare how we work with each operation.

	Addition	Subtraction	Multiplication	Division
Which way do we need to regroup?				

Name: ____ G5 U1 Lesson 10 - Independent Work

Remember: We must preserve the place values of the number by keeping them lined up.

Show your work using the long division symbol.

1. Solve. 9.63 ÷ 3 = _________	2. Solve. 4.08 ÷ 4 = _________
3. Solve. 682.4 ÷ 2 = _________	4. Solve. 6.393 ÷ 3 = _________

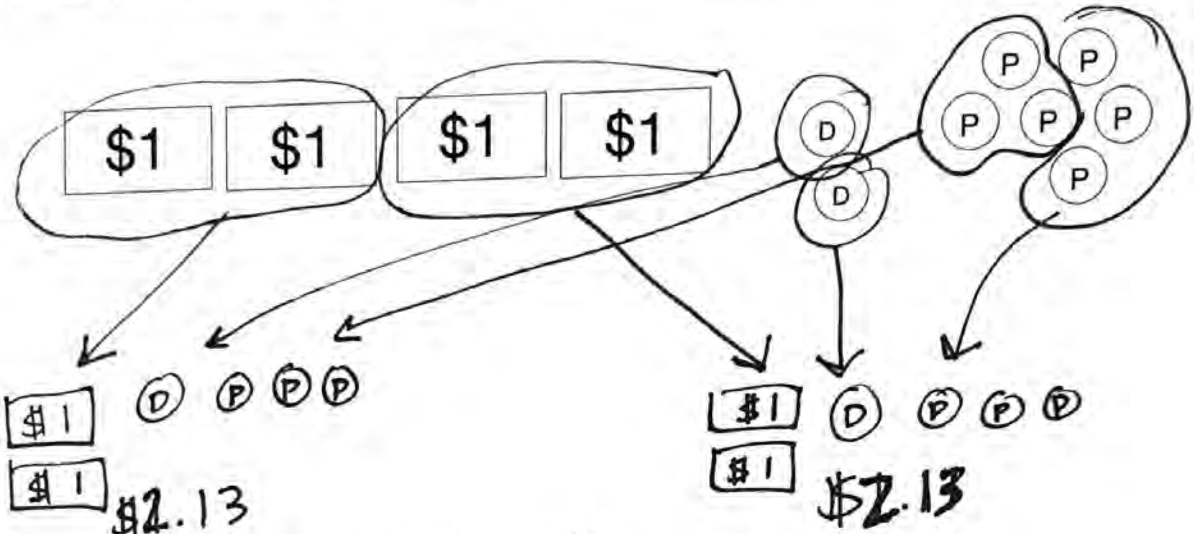
Be sure to follow the directions to estimate or solve for an exact answer.

5. Solve. $80.48 \div 4 =$ __________	6. Solve. $62.408 \div 2 =$ __________
7. Solve. $396.6 \div 3 =$ __________	8. Solve. $6.088 \div 2 =$ __________

Name: ANSWER KEY

Jayden had 4 dollar bills, 2 dimes and 6 pennies. He split his money between his two younger sisters. How much money did each sister get?

Jayden's money is drawn for us. How can we finish the picture to represent the story problem?



What happened to each part of Jayden's money?

We divided each place.

This same problem could be written as 4.26 ÷ 2 = 2.13

We DON'T line up the numbers on the place value chart like we did for addition and subtraction. Let's set up our problem.

$$\begin{array}{r} 2.13 \\ 2\overline{)4.26} \\ -4 \\ \hline 02 \\ -2 \\ \hline 06 \\ -6 \\ \hline 0 \end{array}$$

We don't want to forget the decimal in our answer because it helps us keep the place values we started with!

Solve. $9.069 \div 3 = ?$

Let's represent the problem on a place value chart.

ones	tenths	hundredths	thousandths
3 •	0	2	3

Let's practice writing the problem with the long division symbol:

$$\begin{array}{r} 3.023 \\ 3\overline{)9.069} \\ -9 \\ \hline 006 \\ -6 \\ \hline 09 \\ -9 \\ \hline 0 \end{array}$$

Can we just skip over the zero? Why or why not?

No, it holds the place for the thousandths.

We can make a chart to compare how we work with each operation.

	Addition	Subtraction	Multiplication	Division
Which way do we need to regroup?				

Name: ANSWER KEY

G5 U1 Lesson 10 - Independent Work

Remember: We must preserve the place values of the number by keeping them lined up.

Show your work using the long division symbol.

1. Solve.

9.63 ÷ 3 = 3.21

```
   3.21
3)9.63
 -9
  06
  -6
   03
   -3
    0
```

2. Solve.

4.08 ÷ 4 = 1.02

```
   1.02
4)4.08
 -4
  008
   -8
    0
```

3. Solve.

682.4 ÷ 2 = ______

```
   341.2
2)682.4
 -6
  08
  -8
   02
   -2
    04
    -4
     0
```

4. Solve.

6.393 ÷ 3 = 2.131

```
   2.131
3)6.393
 -6
  03
  -3
   09
   -9
    03
    -3
     0
```

Be sure to follow the directions to estimate or solve for an exact answer.

5. Solve.

80.48 ÷ 4 = 20.22

6. Solve.

62.408 ÷ 2 = 31.204

7. Solve.

396.6 ÷ 3 = 132.2

8. Solve.

6.088 ÷ 2 = 3.044

G5 U1 Lesson 11

Divide decimals with remainders

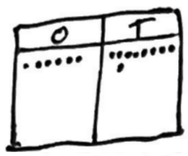
CITYTUTOR DC

G1 U1 Lesson 11 - Today we will divide decimals with remainders.

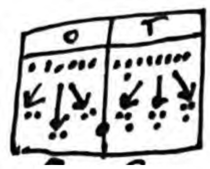
Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): Today we are going to divide decimals with remainders. And guess what? None of our steps are going to change. It will be exactly the same steps we already did. It will just help to understand why they still work so let's explore together.

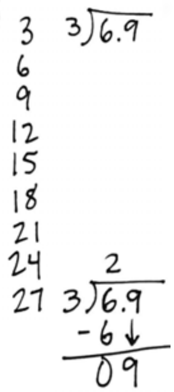
Let's Review (Slide 3): In our last lesson, we learned how to divide decimals. Let's review.



I am going to put 6 dots for 6 ones. I am going to put 9 dots for 9 tenths.



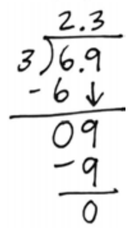
I can draw three arrows to show splitting the 6 ones. I get 2 ones each. I can draw three arrows to show splitting 9 tenths. I get 3 tenths each. In order for each of these digits to keep the right value. I need to keep my decimal in my answer. It's super duper important I don't forget that.



We know the numbers are going to match the pictures. We set up the long division. We can make a list of the threes to help us if we need to. 3, 6, 9, 12, 15, 18, 21, 24, 27. Now we have to ask ourselves a question, "___ times what makes _____?" Who can tell me what question we ask for this first digit. Possible Student Answers, Key Points:

- 3 times what makes 6?

I can see the answer in my list. 3 times 1 makes 3, 3 times 2 makes 6. My answer is 2. It goes on top. I subtract what it makes. I pull down the next number.

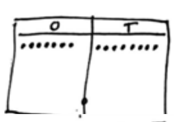


What question do I ask for the next digit? Possible Student Answers, Key Points:

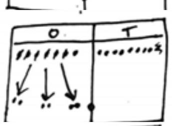
- 3 times what makes 9?

I can see the answer in my list. 3 times 1 makes 3, 3 times 2 makes 6, 3 times 3 makes 9. My answer is 3. It goes on top. I subtract what it makes. I have to make sure I put the decimal in my answer. And it matches what we got when we drew a picture.

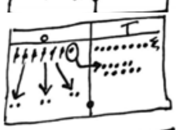
Let's Talk (Slide 4): This next problem is the same except I am going to have a remainder. Let's see what we can do to divide that too.



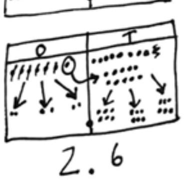
We're going to start with a picture. I am going to put 7 dots for 7 ones and 8 dots for 8 tenths.



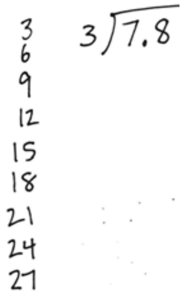
I want to divide this by 3. If I draw 3 arrows, the most I can give each arrow is 2. That leaves 1 leftover.



Now here is the super duper important part. I can't divide that 1. So, I am going to regroup it by turning it into tenths. 1 whole makes 10 tenths. Now I have 18 tenths.



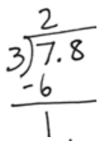
I am going to divide 18 tenths by 3 which is 6 tenths. When I write this as digits, I get 2.6.



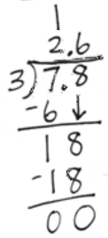
Now let's see how the long division matches exactly what we did. We just need to follow the exact same steps we did yesterday, and it will automatically regroup for us. That's cool, right? First, it helps to set up my threes next to my problem.

What question am I going to ask myself for this first digit, "____ times what makes _____?" Possible Student Answers, Key Points:

- 3 times what makes 7?

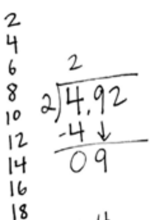


I am going to ask, "3 times what makes 7?" But here's the thing - there's not an answer! 3 times nothing makes 7. If I look at my chart, I see 3 x 1 makes 3 and 3 x 2 makes 6. If I go higher, I go past 7 with 3 x 3 makes 9. I am going to have to stop at 3 x 2 makes 6 and then there will be a remainder. Watch me. I put the 2 on top like always and I subtract what it makes. I have 1 left. This is just like in our picture when we had one left and we had to regroup it.

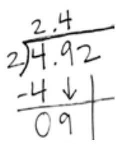


But here comes the cool part - when I pull down the next number, like I usually do, it automatically goes next to the one and regroups it. Now we can ask ourselves, "3 times what makes 18?" Let's look at the chart, 3 x 1 is 3, 3 x 2 is 6, 3 x 3 is 9, 3 x 4 is 12, 3 x 5 is 15, 3 x 6 is 18. We put the 6 up top and subtract what it makes. Let's check to make sure I remembered the decimal and look! We have the same answer that we got with the picture.

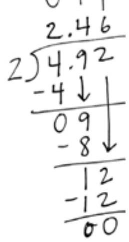
Let's Think (Slide 5): Watch how if I do the normal long division on another problem, the regrouping happens automatically.



First, we can list the twos out of the side of our paper. 2, 4, 6, 8, 10, 12, 14, 16, 18. Now we ask ourselves, 2 times what makes 4? *Point to the list, 2 x 1 makes 2, 2 x 2 makes 4.* 2 times 2 makes 4. 2 goes on the top and then we subtract what it makes. Pull down the next number.



Now we ask, "2 times what makes 9?" We go down the list, 2 x 1 makes 2, 2 x 2 makes 4, 2 x 3 makes 6, 2 x 4 makes 8, 2 x 5 makes 10. Uh-oh! We passed up 9! We're going to have to go with 2 x 4 makes 8. The 4 goes on top and we subtract what it makes, the 8. We get a remainder of 1. It is okay because we are going to pull down the next number and it will automatically regroup.



Now we ask, "2 times what makes 12?" We go down the list, 2 x 1 makes 2, 2 x 2 makes 4, 2 x 3 makes 6, 2 x 4 makes 8, 2 x 5 makes 10, 2 x 6 makes 12. That's our answer! The 6 goes on the top and then we subtract what it makes. We have to make sure we put the decimal point and then we have our answer.

Let's Try It (Slides 6): Now we will practice together. I will take you through each step so you know what to do when you have to work on your own.

WARM WELCOME

Today we will divide decimals with remainders.

Let's Review: In our last lesson, we learned how to divide decimals.

Solve. $6.9 \div 3 = ?$

Place value chart:

Numbers:

Let's Talk: Now let's think about what happens when there is a remainder in a place.

Solve. $7.8 \div 3 = ?$

Place value chart:

Numbers:

Let's Think:

Anytime we have a remainder, we can use the next place value to regroup.

Solve. $4.92 \div 2 = ?$

Let's Try It:

Let's practice dividing decimals with remainders together!

Name: ______________________________ G5 U1 Lesson 11 - Let's Try It

Aurora had 2 dollar bills, 3 dimes and 2 pennies. She split his money between her two younger sisters. How much money did each sister get?

Aurora's money is drawn for us. How can we finish the picture to represent the story problem?

Something special happened with the dimes! What was it?

____

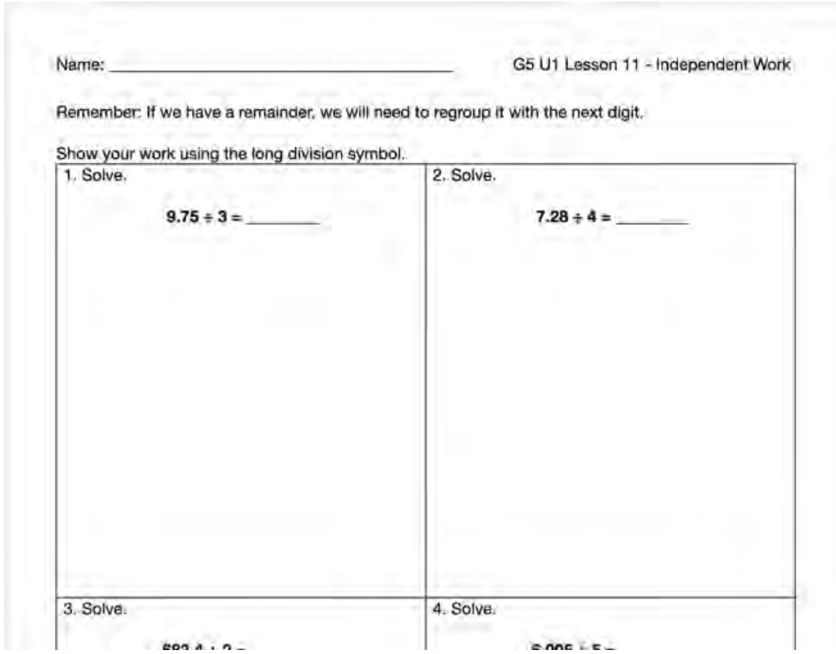
____

This same problem could be written as ____________ ÷ ______ = ____________

We DON'T line up the numbers on the place value chart like we did for addition and subtraction.

On your Own:

Now it's time to divide decimals.
Remember to keep things in line!



Name: ______________________ G5 U1 Lesson 11 - Independent Work

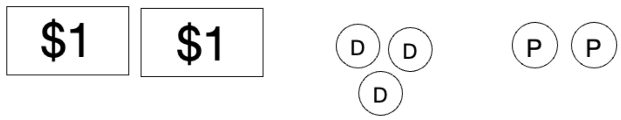
Remember: If we have a remainder, we will need to regroup it with the next digit.

Show your work using the long division symbol.

1. Solve. 9.75 ÷ 3 = ______	2. Solve. 7.28 ÷ 4 = ______
3. Solve.	4. Solve.

Aurora had 2 dollar bills, 3 dimes and 2 pennies. She split his money between her two younger sisters. How much money did each sister get?

Aurora's money is drawn for us. How can we finish the picture to represent the story problem?



Something special happened with the dimes! What was it?

____

____

This same problem could be written as ______________ ÷ _______ = _______________

We DON'T line up the numbers on the place value chart like we did for addition and subtraction. Let's set up our problem.

We don't want to forget the decimal in our answer because it helps us keep the place values we started with!

Solve. $8.46 \div 3 = ?$

Let's represent the problem on a place value chart.

ones	tenths	hundredths

Let's practice writing the problem with the long division symbol:

Where did we have a remainder and what did we do with it?

____

____

We can make a chart to compare how we work with each operation.

	Addition	Subtraction	Multiplication	Division
Do we line up the place values and decimal points in both numbers?				

Name: ______________________________ G5 U1 Lesson 11 - Independent Work

Remember: If we have a remainder, we will need to regroup it with the next digit.

Show your work using the long division symbol.

1. Solve. 9.75 ÷ 3 = ________	2. Solve. 7.28 ÷ 4 = ________
3. Solve. 683.4 ÷ 2 = ________	4. Solve. 6.005 ÷ 5 = ________

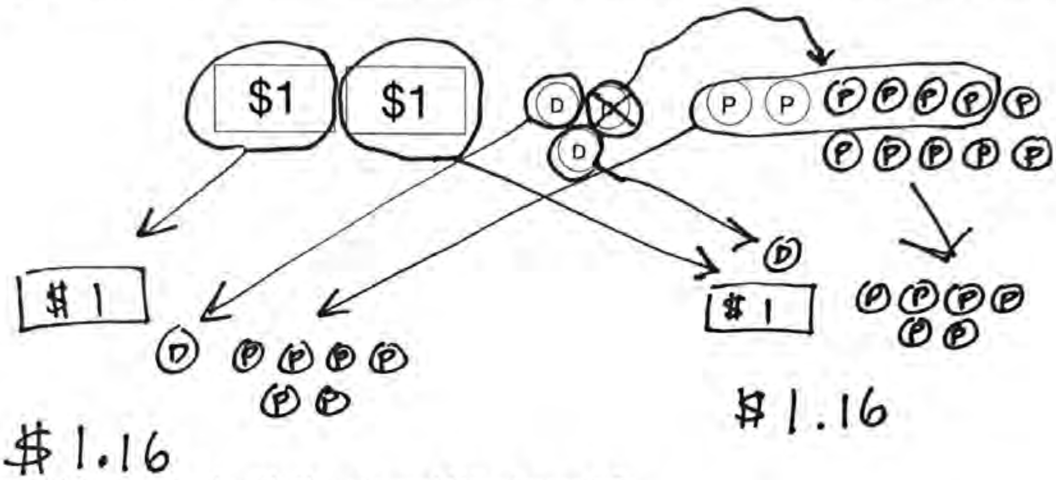
Be sure to follow the directions to estimate or solve for an exact answer.

5. Solve. $81.68 \div 4 =$ ________	6. Solve. $60.508 \div 2 =$ ________
7. Solve. $909.6 \div 6 =$ ________	8. Solve. $8.532 \div 3 =$ ________

Name: ANSWER KEY G5 U1 Lesson 11 - Let's Try It

Aurora had 2 dollar bills, 3 dimes and 2 pennies. She split his money between her two younger sisters. How much money did each sister get?

Aurora's money is drawn for us. How can we finish the picture to represent the story problem?



Something special happened with the dimes! What was it?

We had a leftover dime so we turned it into ten pennies.

This same problem could be written as 2.32 ÷ 2 = 1.16

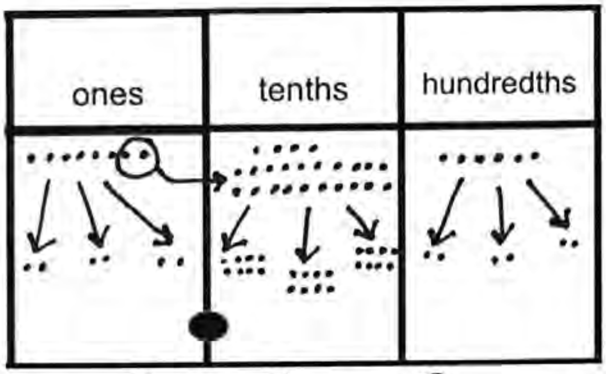
We DON'T line up the numbers on the place value chart like we did for addition and subtraction. Let's set up our problem.

$$
\begin{array}{r}
1.16 \\
2\overline{)2.32} \\
-2 \\
\hline
03 \\
-2 \\
\hline
12 \\
-12 \\
\hline
00
\end{array}
$$

We don't want to forget the decimal in our answer because it helps us keep the place values we started with!

Solve. $8.46 \div 3 = ?$

Let's represent the problem on a place value chart.



2 . 8 2

Let's practice writing the problem with the long division symbol:

$$
\begin{array}{r}
2.82 \\
3\overline{)8.46} \\
-6 \\
\hline
24 \\
-24 \\
\hline
006 \\
-6 \\
\hline
0
\end{array}
$$

Where did we have a remainder and what did we do with it?

We had a remainder of 2 in the ones place and we turned it into 20 tenths.

We can make a chart to compare how we work with each operation.

	Addition	Subtraction	Multiplication	Division
Do we line up the place values and decimal points in both numbers?	yes	yes	no	no

Name: ANSWER KEY

G5 U1 Lesson 11 - Independent Work

Remember: If we have a remainder, we will need to regroup it with the next digit.

Show your work using the long division symbol.

1. Solve.

9.75 ÷ 3 = 3.25

$$\begin{array}{r} 3.25 \\ 3 \enclose{longdiv}{9.75} \\ -9 \\ \hline 07 \\ -6 \\ \hline 15 \\ -15 \\ \hline 00 \end{array}$$

2. Solve.

7.28 ÷ 4 = 1.82

$$\begin{array}{r} 1.82 \\ 4 \enclose{longdiv}{7.28} \\ -4 \\ \hline 32 \\ -32 \\ \hline 008 \\ -8 \\ \hline 0 \end{array}$$

3. Solve.

683.4 ÷ 2 = 341.7

$$\begin{array}{r} 341.7 \\ 2 \enclose{longdiv}{683.4} \\ -6 \\ \hline 08 \\ -8 \\ \hline 03 \\ -2 \\ \hline 14 \\ -14 \\ \hline 00 \end{array}$$

4. Solve.

6.005 ÷ 5 = 1.201

$$\begin{array}{r} 1.201 \\ 5 \enclose{longdiv}{6.005} \\ -5 \\ \hline 10 \\ -10 \\ \hline 0005 \\ -5 \\ \hline 0 \end{array}$$

Be sure to follow the directions to estimate or solve for an exact answer.

5. Solve. 81.68 ÷ 4 = 20.42 $$\begin{array}{r} 20.42 \\ 4\overline{)81.68} \\ -8 \\ \hline 01 \\ -0 \\ \hline 16 \\ -16 \\ \hline 008 \\ -8 \\ \hline 0 \end{array}$$	6. Solve. 60.508 ÷ 2 = 30.254 $$\begin{array}{r} 30.254 \\ 2\overline{)60.508} \\ -6 \\ \hline 005 \\ -4 \\ \hline 10 \\ -10 \\ \hline 008 \\ -8 \\ \hline 0 \end{array}$$
7. Solve. 909.6 ÷ 6 = 151.6 $$\begin{array}{r} 151.6 \\ 6\overline{)909.6} \\ -6 \\ \hline 30 \\ -30 \\ \hline 009 \\ -6 \\ \hline 36 \\ -36 \\ \hline 00 \end{array}$$	8. Solve. 8.532 ÷ 3 = 2.844 $$\begin{array}{r} 2.844 \\ 3\overline{)8.532} \\ -6 \\ \hline 25 \\ -24 \\ \hline 13 \\ -12 \\ \hline 12 \\ -12 \\ \hline 00 \end{array}$$

G5 U1 Lesson 12

Divide decimals with remainders in the smallest place

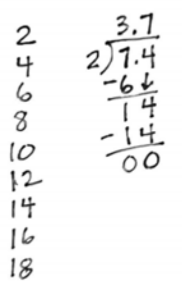
CITYTUTOR DC

G1 U1 Lesson 12 - Today we will divide decimals with remainders in the smallest place.

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): Today we are going to divide decimals with remainders in the smallest place value. The numbers are trickier but none of our steps are going to change. It will be exactly the same steps we already did. We just need to understand why they still work so let's explore together.

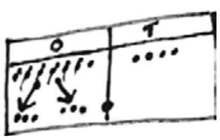
Let's Review (Slide 3): Let's review what we've learned so far. Let's talk through the steps as a class.



Call on students to tell you what to do first and what to do next while you write it out. If a student says to do something incorrect, just say, "That's not quite right. Who came help them out?" and get through one quick sample problem with the work shown here. Now that we've finished the problem, let's look back at our work. There was a remainder. What place was the remainder in and what did we do with it? Possible Student Answers, Key Points:

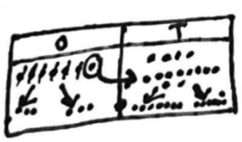
- The remainder was 1 and it became 14.
- There was a remainder in the ones place and it was regrouped into tenths.
- There was a remainder in the ones place and it was regrouped with the 4.

Let's Talk (Slide 4): Let's use a picture to understand what happened to the remainder because in our next problem the remainder is going to be in our last place and it will be a little bit trickier.



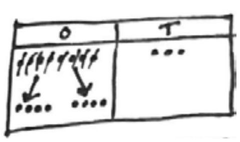
I am going to draw 7 dots for 7 ones and 4 dots for 4 tenths. I draw two arrows to split the 7 but I can only give 3 dots to each arrow. There is one left.

I can turn that 1 into 10 tenths just like I would turn a dollar into 10 dimes. It is just like if I were regrouping to subtract.

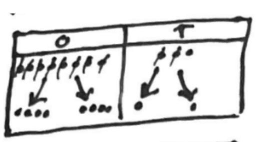


Now I have 14. I draw two arrows to split the twelve and I can give 7 dots to each arrow. We get the same answer as in our review.

Let's Think (Slide 5): The same ideas are going to show up in this next problem but the remainder will be the last number in the division. Hopefully you will see what we should do by looking at the picture on the place value chart. See if you can figure it out before I get to the number side of this slide.

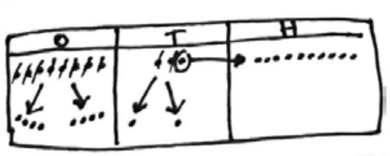


I am going to draw 8 dots for 8 ones and 3 dots for 3 tenths. I draw two arrows to split the 8 and I can give 4 dots to each arrow. No remainder there.

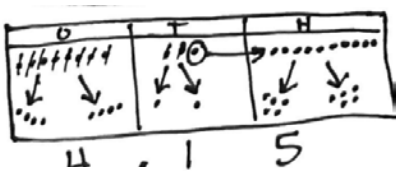


Now I need to split the 3. I can draw two arrows and give 1 to each arrow but I will have 1 left. Here's where we have to think. What did we do in the earlier problem that would help us keep dividing here. Possible Student Answers, Key Points:

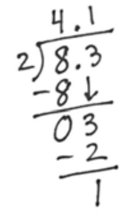
- We can regroup that 1.
- We can turn the 1 into 10.
- We can go from tenths to hundredths.



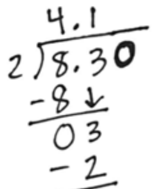
We can regroup the 1 tenth into 10 hundredths. In other words, regroup the remainder into the next smallest place and divide that instead.



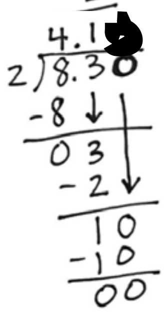
I split 10 with two arrows and give 5 to each arrow and my final answer is 4.15. The most importantly thing to realize is that even when our remainder was in the smallest place value, we could still regroup it to the next smallest place value.



Let's see what that will mean with our long division. We know we can list our twos. We ask ourselves, "2 times what makes 8?" We get 4 and subtract what it makes. Then we ask ourselves, "2 times what makes 3?" We can't make 3. We can only do 2 x 1 makes 2. So 1 goes on top and we subtract what it makes. Here is that remainder!



Now this is a really important part so watch me. We know from our picture that we want to regroup that remainder. Before regrouping, I had zero hundredths so let's put a zero in that hundredths spot. I didn't change the value of the number. I just put a zero when there was already nothing there. It's empty anyway!



But here is why our place value system is so cool. Now that I wrote in the zero that was already secretly there, I can pull it down. And now I don't have 1 tenth. I have 10 hundredths. Just like we drew in the picture. I have regrouped and I can divide. I ask, "2 times what makes 10?" It's 5. Now I have the same answer that we got with our picture.

Let's Try It (Slides 6): Now we will practice together. I will take you through each step so you know what to do when you have to work on your own. Remember: If you have a remainder, you can put a zero in the next place and it will automatically regroup so you can divide it.

WARM WELCOME

Today we will divide decimals with remainders in the smallest place.

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Let's Review: In our last lesson, we learned how to divide decimals with remainders.

Solve. $7.4 \div 2 = ?$

Let's Talk: What happens when there is a remainder in any place?

Show $7.4 \div 2$ in a place value chart.

Let's Think: **If we have a remainder in the smallest place, we can add a zero to regroup.**

Solve. $8.3 \div 2 = ?$

Place value chart:

Numbers:

Let's Think: **Sometimes we need to add more than one zero.**

Solve. $8.3 \div 4 = ?$

Place value chart:

Numbers:

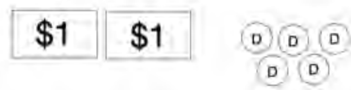
Let's Try It:

Let's practice dividing decimals with remainders in the smallest place!

Name: ______________________ G5 U1 Lesson 12 - Let's Try It

Rosa had 2 dollar bills and 5 dimes. She split her money between her two younger sisters. How much money did each sister get?

Rosa's money is drawn for us. How can we finish the picture to represent the story problem?



We had a remainder in the dimes. What did we have to do to keep dividing?

____

____

This same problem could be written as ________ ÷ ______ = __________

On your Own:

Now it's time to divide decimals with remainders on your own!

Name: ______________________ G5 U1 Lesson 12 - Independent Work

Remember: If we have a remainder in the last place, we will need to add a zero to regroup.

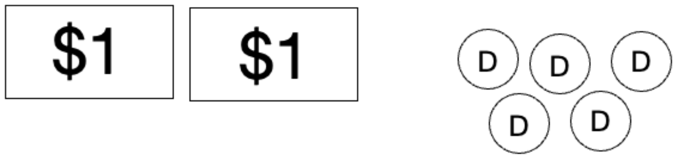
Show your work using the long division symbol.

1. Solve. 5.57 ÷ 5 = ______	2. Solve. 46.06 ÷ 4 = ______
3. Solve.	4. Solve.

Name: ________________________________ G5 U1 Lesson 12 - Let’s Try It

Rosa had 2 dollar bills and 5 dimes. She split her money between her two younger sisters. How much money did each sister get?

Rosa’s money is drawn for us. How can we finish the picture to represent the story problem?



We had a remainder in the dimes. What did we have to do to keep dividing?

____

____

This same problem could be written as ____________ ÷ ______ = ____________

We DON’T line up the numbers on the place value chart like we did for addition and subtraction. Let’s set up our problem.

We don’t want to forget the decimal in our answer because it helps us keep the place values we started with!

Solve. $84.06 \div 4 = ?$

Let’s represent the problem on a place value chart.

tens	ones	tenths	hundredths	thousandths

Let's practice writing the problem with the long division symbol:

Where did we have a remainder and what did we do with it?

____

____

We can make a chart to compare how we work with each operation.

	Addition	Subtraction	Multiplication	Division
Do we line up the place values and decimal points in both numbers?				
Which way do we need to regroup?				

Name: ____ G5 U1 Lesson 12 - Independent Work

Remember: If we have a remainder in the last place, we will need to add a zero to regroup.

Show your work using the long division symbol.

1. Solve. $5.57 \div 5 =$ __________	2. Solve. $48.06 \div 4 =$ __________
3. Solve. $692.5 \div 2 =$ __________	4. Solve. $9.684 \div 8 =$ __________

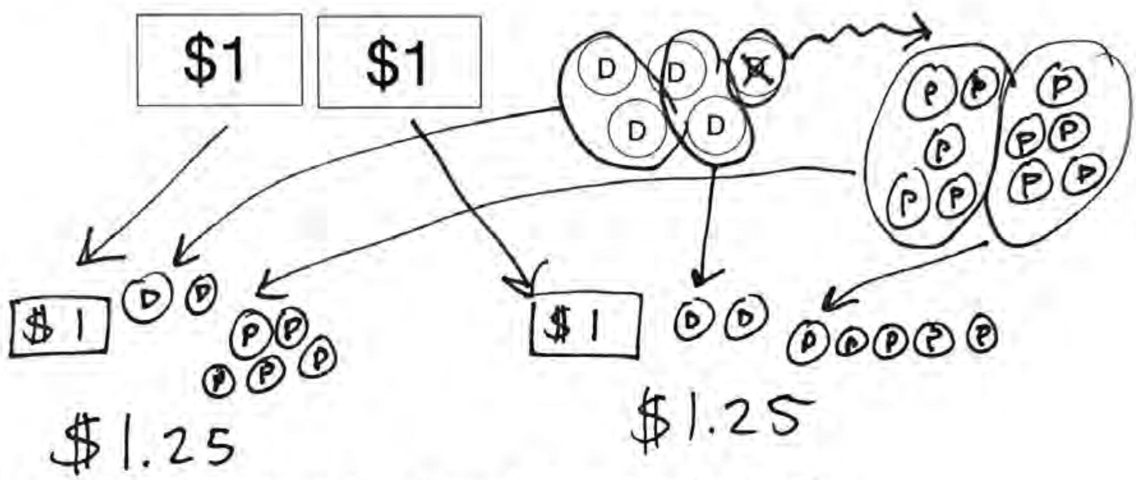
Be sure to follow the directions to estimate or solve for an exact answer.

5. Solve. $6.042 \div 4 =$ __________	6. Solve. $84.9 \div 6 =$ __________
7. Solve. $379.03 \div 2 =$ __________	8. Solve. $84.7 \div 6 =$ __________

Name: ANSWER KEY

Rosa had 2 dollar bills and 5 dimes. She split her money between her two younger sisters. How much money did each sister get?

Rosa's money is drawn for us. How can we finish the picture to represent the story problem?



We had a remainder in the dimes. What did we have to do to keep dividing?

We had to change the 1 dime into 10 pennies.

This same problem could be written as 2.5 ÷ 2 = 1.25

We DON'T line up the numbers on the place value chart like we did for addition and subtraction. Let's set up our problem.

$$\begin{array}{r}
1.25 \\
2\overline{)2.50} \\
-2 \\
\hline
05 \\
-4 \\
\hline
10 \\
-10 \\
\hline
00
\end{array}$$

We don't want to forget the decimal in our answer because it helps us keep the place values we started with!

Solve. $84.06 \div 4 = ?$

Let's represent the problem on a place value chart.

tens	ones	tenths	hundredths	thousandths
2	1 .	0	1	5

Let's practice writing the problem with the long division symbol:

$$\begin{array}{r} 21.015 \\ 4\overline{)84.060} \\ -8 \\ \hline 04 \\ -4 \\ \hline 006 \\ -4 \\ \hline 20 \\ -20 \end{array}$$

Where did we have a remainder and what did we do with it?

We had a remainder in the hundredths so we turned 2 hundredths into 20 thousandths.

We can make a chart to compare how we work with each operation.

	Addition	Subtraction	Multiplication	Division
Do we line up the place values and decimal points in both numbers?	yes	yes	no	no
Which way do we need to regroup?	↶	↷	↶	↷

Name: ANSWER KEY

Remember: If we have a remainder in the last place, we will need to add a zero to regroup.

Show your work using the long division symbol.

1. Solve.

5.57 ÷ 5 = 1.114

$$\begin{array}{r} 1.114 \\ 5\overline{)5.570} \\ -5 \\ \hline 05 \\ -5 \\ \hline 07 \\ -5 \\ \hline 20 \\ -20 \\ \hline 0 \end{array}$$

2. Solve.

48.06 ÷ 4 = 12.015

$$\begin{array}{r} 12.015 \\ 4\overline{)48.060} \\ -4 \\ \hline 08 \\ -8 \\ \hline 006 \\ -4 \\ \hline 20 \\ -20 \\ \hline 00 \end{array}$$

3. Solve.

692.5 ÷ 2 = 346.25

$$\begin{array}{r} 346.25 \\ 2\overline{)692.50} \\ -6 \\ \hline 09 \\ -8 \\ \hline 12 \\ -12 \\ \hline 05 \\ -4 \\ \hline 10 \\ -10 \\ \hline 00 \end{array}$$

4. Solve.

9.684 ÷ 8 = 1.8105

$$\begin{array}{r} 1.8105 \\ 8\overline{)9.6840} \\ -8 \\ \hline 16 \\ -16 \\ \hline 008 \\ -8 \\ \hline 040 \\ -40 \\ \hline 00 \end{array}$$

Be sure to follow the directions to estimate or solve for an exact answer.

5. Solve. $6.042 \div 4 =$ 1.5105 $4\overline{)6.0420}$ = 1.5105 −4 20 −20 04 −4 020 −20 00	6. Solve. $84.9 \div 6 =$ 14.15 $6\overline{)84.90}$ = 14.15 −6 24 −24 009 −6 30 −30 00
7. Solve. $379.03 \div 2 =$ 189.515 $2\overline{)379.030}$ = 189.515 −2 17 −16 19 −18 10 −10 003 −2 10 −10 00	8. Solve. $84.7 \div 6 =$ 14.1166... $6\overline{)84.7000}$ = 14.1166... −6 24 −24 007 −6 10 −6 40 −36 4

G5 Unit 2:

Base Ten Operations

G5 U2 Lesson 1

Multiply multi-digit whole numbers and multiples of 10

CITYTUTOR DC

G5 U2 Lesson 1 - Students will multiply multi-digit whole numbers and multiples of 10 using place value patterns and the distributive and associative properties

Warm Welcome (Slide 1): Tutor choice

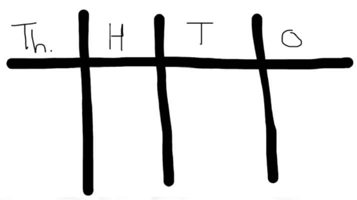
Frame the Learning/Connect to Prior Learning (Slide 2): Today, we will explore how to multiply multi-digit whole numbers by multiples of ten. That's a fancy way of saying we're going to explore ways we can efficiently find the product of some big numbers.

Let's Talk (Slide 3): Before we talk more about our topic, take a look at the problems here. What do you notice? What's similar or different about the equations? Possible Student Answers, Key Points:

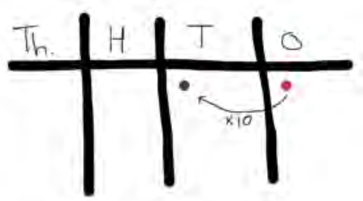
- Each involves multiplication. They all involve 3 and 4 in some way.
- The products are getting bigger. The units are different in each equation. There are more zeroes as we move along.

There is a lot to notice about these equations. I definitely notice that they all involve multiplying 3 and 4 together to make 12, but the units in each factor and product vary depending on the equation. (*point to each equation and verbally emphasize the unit*) The first one shows 3 x 4 = 12 ones. The next one is 3 x 4 tens = 12 tens. The next one is 3 x 4 hundred = 12 hundreds. The last one is 3 tens x 4 hundreds = 12 thousands. So what we'll see today is that we can use facts and the properties we know about smaller numbers to help us multiply bigger numbers quickly and with ease.

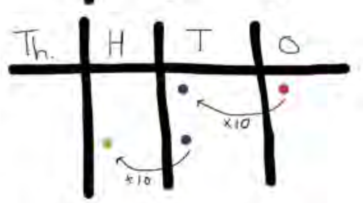
Let's Think (Slide 4): Before we talk about specific numbers, let's remember what we know about units. We know that each bigger unit is ten times as much as the unit before it.



Let's explore that using a place value chart (*sketch*). I'm going to include ones, tens, hundreds, and thousands in this chart.



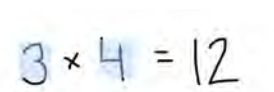
When we look at the place value chart, let's start with one one. We see that multiplying one times ten, gives us ten.



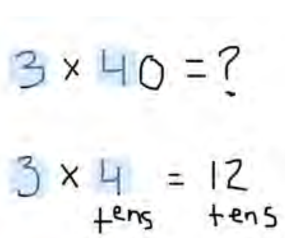
Multiplying one ten x ten, makes a hundred. *(Draw a dot for one ten in the chart. Then draw an arrow labeled "x 10" to make a new dot in the hundreds place.)*

And, finally, what unit do we get if we multiply a hundred times ten? A hundred times ten would make a thousand. It's the next unit after hundreds.

Knowing this about units, we can use unit form to help us think about multiplying by multiples of ten.



Let's consider the equations we were just looking at (*write 3 x 4 = 12*). The most simple version that we looked at was 3 x4, which is 12.



If we're asked to find 3 x 40 (*write it underneath)*, we can think of it as 3 x 4 tens.

Look, the basic fact, 3 x 4, stays the same. We are just thinking of it as 3 x 4 TENS instead of 3 x 4 ONES. And, 3 x 4 tens would be 12 tens (*write in unit form and highlight the 3 and 4 in each equation*). And, 12 tens is the same as 120.

So, what do you think would be different if I asked you to find 3 x 400? Possible Student Answers, Key Points:

- We could still use 3 x 4 as our basic fact, but we'd think of it as 3 x 4 hundreds. Our answer would be 12 hundreds or 1,200.
- We could still use 3x4 but we'd just have to pay attention to the units.

3 x 4 hundreds = 12 hundreds

Great! (*Write 3 x 4 hundreds = 12 hundreds underneath the other equations*) 3 x 4, 3 x 40, and 3 x 400 all use the same basic fact. We can use that fact to find the answer, but we need to carefully consider the units we're multiplying to make sure we end up with the correct product.

Let's Think (Slide 5): Let's consider another example and think carefully about the units in the problem. We're going to find the product of 30 x 50 using unit form to make these bigger factors simpler to multiply.

30 x 50

3 tens x 5 tens = 15 hundreds

Instead of thinking of 30 as just 30, we can think of it as 3 tens. Similarly, instead of thinking of 50 as just 50, we can think of it as 5 tens.

So, 3 x 5 is a multiplication fact we know (*highlight*). We know that 3 times 5 equals 15.

30 x 50

3 tens x 5 tens = 15 hundreds

1500

Now we have to think about the units. If we multiply (*verbally emphasize each unit and highlight each unit in the same color)* 3 TENS by 5 TENS, we know our product will be in the hundreds, because tens x tens = hundreds. So if 3 x 5 = 15, then 3 tens x 5 tens = 15 what? Hundreds! That's right, so 15 hundreds is 1,500.

Let's walk through one other similar way we can think about units when multiplying 30 x 50. We can use properties we know to rearrange the factors in a friendly way, let me show you.

$(3 \times 10) \times (5 \times 10)$

We can think of 30 as 3 tens or (3 x 10). And, we can think of 50 as 5 tens or (5 x 10).

The associative property of multiplication allows us to change the order we multiply factors in without changing the product, so watch.

$(3 \times 10) \times (5 \times 10)$

$(3 \times 5) \times (10 \times 10)$

I'm going to rearrange and regroup my factors, so I can easily see my basic fact of 3 x 5. So, I am going to group 3 and 5 as (3x5) and then I have to group the leftover factors, which is 10 and 10 so (10x10)

What do you notice about these two expressions? Possible Student Answers, Key Points:

- They're the same factors. You just grouped them differently.
- Now the basic fact of 3 x 5 is grouped together and the units of 10s are together.
- You still get the same answer, you just have the factors in a different order

$(3 \times 10) \times (5 \times 10)$

$(3 \times 5) \times (10 \times 10)$

$15 \times 100 = 1500$

Now, we can quickly solve it. I know 3 x 5 is 15 (*write*) and 10 x 10 is 100 (*write*).

So, 15 x 100 is just 1,500. Rearranging the factors made it easy for me to isolate that simple fact and keep track of the units in my product.

How is the unit form strategy on the left and the rearranging factors strategy on the right related? How are they the same and different? Possible Student Answers, Key Points:

- They both help us use an easy fact to find the product of larger numbers.
- They both help us keep track of the units we are multiplying.
- Unit form uses words to help us track the units, but when we rearrange the factors we multiply our units together in as numbers in an expression.

Let's Think (Slide 6): Before we practice some problems together, I want you to look at 6 x 50. These two students aren't sure what the correct product should be. How could we help these two think about units so they know who has the correct answer? Possible Student Answers, Key Points:

- We can think of this as 6 x 5 tens, which would be 30 tens. 30 tens is 300.
- 30 doesn't make sense as a product, because it's way too small. That's not a reasonable answer.

Excellent! When we have a basic fact that ends in 0, like 6 x 5 = 30, we have to be extra careful about writing our product accurately. So, 30 tens is 300, not just 30. Can you think of other basic facts that end in 0 that we might want to watch out for? Possible Student Answers, Key Points:

- 2 x 5 = 10, or 4 x 5 = 20.
- Lots of fives facts end in 0.

As we work today, let's slow down when we have a basic fact that ends in 0 so that we don't get the zero in our basic fact mixed up with any zeroes we use to represent the correct unit.

Let's Try it (Slides 7 - 8): Now let's work on multiplying whole numbers and multiples of 10 together. We're going to work on this page together, step-by-step. Remember, when we multiply by multiples of 10, we can use unit form or we can rearrange our factors to make multiplying the big numbers simpler.

WARM WELCOME

Today we will multiply multi-digit whole numbers and multiples of 10 using place value patterns and the distributive and associative properties.

Let's Talk:

What do you notice?

3 x 4 = 12

3 x 40 = 120

3 x 400 = 1,200

30 x 400 = 12,000

Let's Think:

What happens when we multiply with different units?

ones x tens = ________

tens x tens = _________

hundreds x tens = _________

Let's Think:

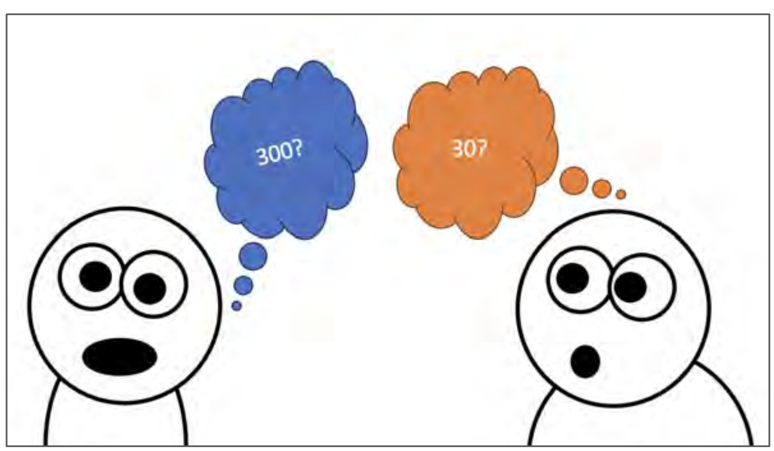
We can multiply with multiples of ten by using unit form *and* by rearranging factors.

UNIT FORM	REARRANGING FACTORS
30 x 50	30 x 50

Let's Think:

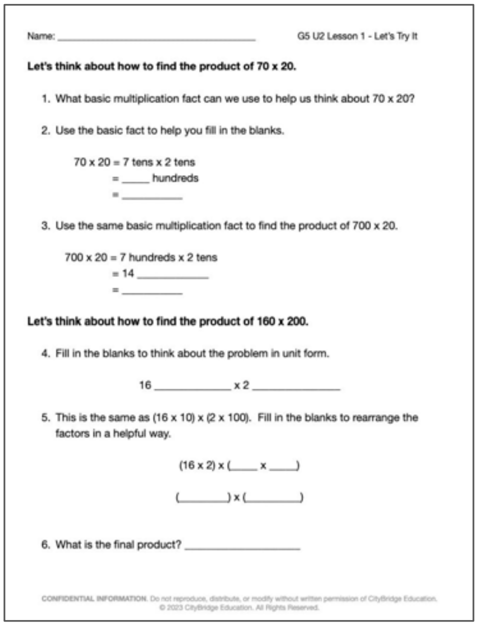
Be careful when you think about units! Who is correct?

6 x 50 = ?



Let's Try It:

Let's explore multiplying multi-digit numbers by multiples of 10 together.



Name: ______________________ G5 U2 Lesson 1 - Let's Try It

Let's think about how to find the product of 70 x 20.

1. What basic multiplication fact can we use to help us think about 70 x 20?
2. Use the basic fact to help you fill in the blanks.

   70 x 20 = 7 tens x 2 tens
   = ____ hundreds
   = ________

3. Use the same basic multiplication fact to find the product of 700 x 20.

   700 x 20 = 7 hundreds x 2 tens
   = 14 __________
   = ________

Let's think about how to find the product of 160 x 200.

4. Fill in the blanks to think about the problem in unit form.

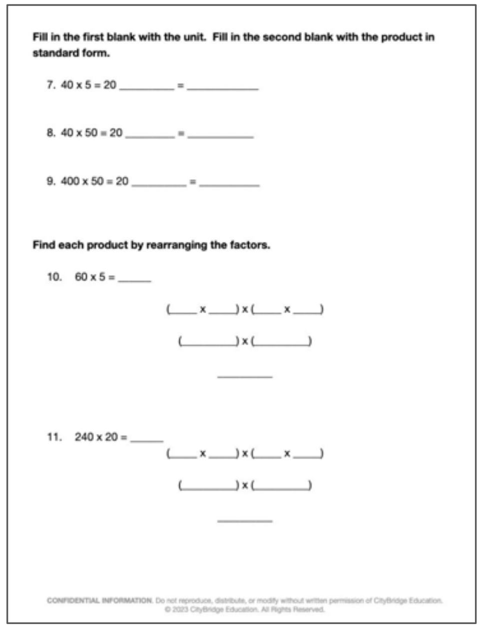
   16 __________ x 2 __________

5. This is the same as (16 x 10) x (2 x 100). Fill in the blanks to rearrange the factors in a helpful way.

   (16 x 2) x (____ x ____)

   (_______) x (_______)

6. What is the final product? ______________



Fill in the first blank with the unit. Fill in the second blank with the product in standard form.

7. 40 x 5 = 20 ________ = __________
8. 40 x 50 = 20 ________ = __________
9. 400 x 50 = 20 ________ = __________

Find each product by rearranging the factors.

10. 60 x 5 = _____

   (____ x ____) x (____ x ____)

   (_______) x (_______)

   ____

11. 240 x 20 = _____

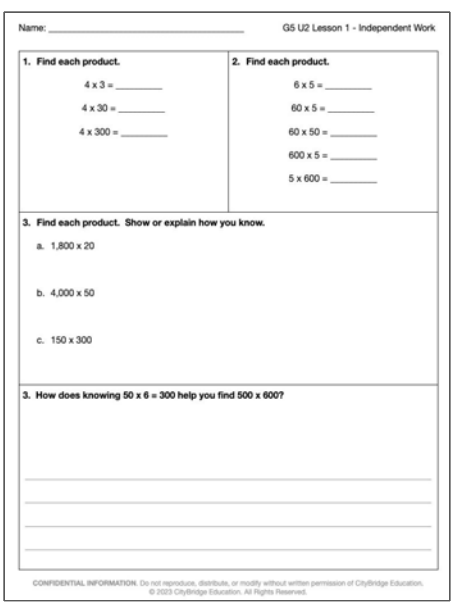
   (____ x ____) x (____ x ____)

   (_______) x (_______)

   ____

On your Own:

Now it's time to explore multiplying multi-digit numbers by multiples of 10 on your own.



Name: ______________________ G5 U2 Lesson 1 - Independent Work

1. Find each product.

4 x 3 = _______
4 x 30 = _______
4 x 300 = _______

2. Find each product.

6 x 5 = _______
60 x 5 = _______
60 x 50 = _______
600 x 5 = _______
5 x 600 = _______

3. Find each product. Show or explain how you know.

a. 1,800 x 20

b. 4,000 x 50

c. 150 x 300

3. How does knowing 50 x 6 = 300 help you find 500 x 600?

Let's think about how to find the product of 70 x 20.

1. What basic multiplication fact can we use to help us think about 70 x 20?

2. Use the basic fact to help you fill in the blanks.

   70 x 20 = 7 tens x 2 tens
   = _____ hundreds
   = ___________

3. Use the same basic multiplication fact to find the product of 700 x 20.

   700 x 20 = 7 hundreds x 2 tens
   = 14 _____________
   = ___________

Let's think about how to find the product of 160 x 200.

4. Fill in the blanks to think about the problem in unit form.

   16 ______________ x 2 ________________

5. This is the same as (16 x 10) x (2 x 100). Fill in the blanks to rearrange the factors in a helpful way.

   (16 x 2) x (_____ x _____)

   (_________) x (__________)

6. What is the final product? _____________________

Fill in the first blank with the unit. Fill in the second blank with the product in standard form.

7. 40 x 5 = 20 __________ = _____________

8. 40 x 50 = 20 _________ = ____________

9. 400 x 50 = 20 __________ = ___________

Find each product by rearranging the factors.

10. 60 x 5 = ______

(_____ x _____) x (_____ x _____)

(__________) x (__________)

____

11. 240 x 20 = ______

(_____ x _____) x (_____ x _____)

(__________) x (__________)

____

1. Find each product.

   $3 \times 3 =$ ________

   $3 \times 30 =$ ________

   $3 \times 300 =$ ________

2. Find each product.

   $6 \times 5 =$ ________

   $60 \times 5 =$ ________

   $60 \times 50 =$ ________

   $600 \times 5 =$ ________

   $5 \times 600 =$ ________

3. Find each product. Show or explain how you know.

   a. 1,800 x 20

   b. 4,000 x 50

   c. 150 x 300

3. How does knowing $50 \times 6 = 300$ help you find 500×600?

____

____

____

____

Name: KEY

Let's think about how to find the product of 70 x 20.

1. What basic multiplication fact can we use to help us think about 70 x 20?

   7 x 2 = 14

2. Use the basic fact to help you fill in the blanks.

   70 x 20 = 7 tens x 2 tens
   = 14 hundreds
   = 1,400

3. Use the same basic multiplication fact to find the product of 700 x 20.

   700 x 20 = 7 hundreds x 2 tens
   = 14 thousands
   = 14,000

Let's think about how to find the product of 160 x 200.

4. Fill in the blanks to think about the problem in unit form.

   16 tens x 2 hundreds

5. This is the same as (16 x 10) x (2 x 100). Fill in the blanks to rearrange the factors in a helpful way.

   (16 x 2) x (10 x 100)
   (32) x (1000)

6. What is the final product? 32,000

Fill in the first blank with the unit. Fill in the second blank with the product in standard form.

7. 40 x 5 = 20 tens = 200

8. 40 x 50 = 20 hundreds = 2,000

9. 400 x 50 = 20 thousands = 20,000

Find each product by rearranging the factors.

10. 60 x 5 = ______

(6 x 5) x (10 x 1)

(30) x (10)

300

11. 240 x 20 = ______

(24 x 2) x (10 x 10)

(48) x (100)

4,800

Name: KEY

1. Find each product.

3 x 3 = 9

3 x 30 = 90

3 x 300 = 900

2. Find each product.

6 x 5 = 30

60 x 5 = 300

60 x 50 = 3,000

600 x 5 = 3,000

5 x 600 = 3,000

3. Find each product. Show or explain how you know.

a. 1,800 x 20

(18 × 2) × (100 × 10)
36 × 1000 = 36,000

b. 4,000 x 50

(4 × 5) × (1,000 × 10)
20 × 10,000 = 200,000

c. 150 x 300

(15 × 3) × (10 × 100)
45 × 1,000 = 45,000

3. How does knowing 50 x 6 = 300 help you find 500 x 600?

I can think of 500 as 50 tens and 600 as 6 hundreds. I know 50 × 6 = 300 and tens × hundreds = thousands, so the product is 300 thousands or 300,000.

G5 U2 Lesson 2

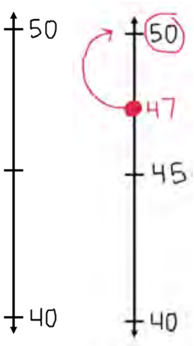
Estimate multi-digit products by rounding factors

G5 U2 Lesson 2 - Students will estimate multi-digit products by rounding factors to a basic fact and using place value patterns

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): Today, we will explore how to use rounding to estimate the product of multi-digit factors efficiently. We won't multiply to find the exact product for now; instead, we'll think of friendly numbers to multiply efficiently so we can make an educated guess about the size of the product.

Let's Review (Slide 3): Before we jump into estimating products, let's quickly revisit a strategy that can help us round. You may have seen this strategy used in 3rd and 4th grade. Let's start by thinking about rounding the number 47 to the nearest ten. Which two tens is the number 47 between? (*label on the vertical number line as student shares*) Possible Student Answers, Key Points:

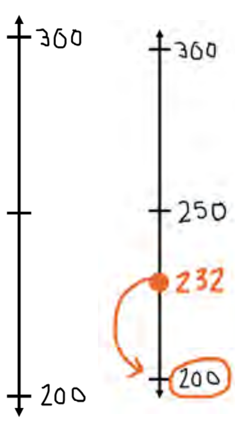


- 47 is more than 40 and less than 50. 47 is between 4 tens and 5 tens.

When we round to the nearest ten, we want to know which benchmark our number is closer to. What is the halfway point between 40 and 50? (*label on the vertical number line as student shares*) Possible Student Answers, Key Points:

- 45 is in the middle of 40 and 50. 45 is the halfway point.

Our number is 47. That's a little more than 45, so I can mark that on my number line (*plot and label 47 on the number line*). Now I can clearly see that 47 is closer to 50 than to 40 (*draw arrow from 47 to 50*). I can say that 47 ≈ 50. This wavy equal sign means approximately, so we can say 47 rounds to 50 or 47 is approximately 50.



I want to round one more number with some more help from you. This time I want to round 232 to the nearest hundred. I want to know which hundred 232 is closest to. How can I set up my number line? (*support student as they explain and mark up number line using similar modeling as the previous example*) Possible Student Answers, Key Points:

- 232 is in between 200 and 300. We can label the lower benchmark as 200 and the upper benchmark as 300. The halfway point is 250.
- 232 is less than the halfway mark of 250, so I know the closest hundred is 200. 232 is closer to 200 than 300.

We can say 232 rounds to 200, or we can write that as 232 ≈ 200. Sometimes you might just know the nearest benchmark. For example, I know 399 is really close to 400. Or I know 91 is really close to 90. If you're ever not sure, a vertical number line is a good way to round with precision. We'll use this model in some of our work today as we estimate products by rounding factors.

Let's Talk (Slide 4): Take a look at the pairs of expressions shown here. If you were asked to solve quickly using mental math strategies, which expression in each pair would you want to evaluate? Think, and give me a signal when you've made your decisions (*wait for signal*). Possible Student Answers, Key Points:

- I'd rather think about 10 x 100. The numbers are easier to think about than 12 and 99.
- I'd rather evaluate 400 x 400, because I can use 4 x 4 and unit form to help me quickly find the product.

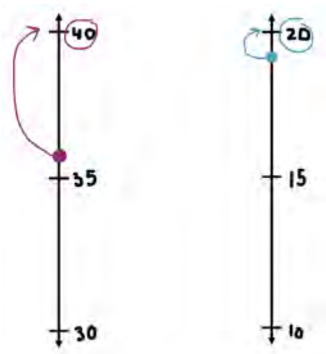
Great thinking! It's often easier to multiply basic tens and hundreds than it is to multiply multi-digit numbers with lots of different digits. If we're ever thinking about a big multiplication problem and we don't need a precise answer, we can use rounding to rewrite our multiplication problem as an easier, similar fact that we can think about without much hassle. Let's work through an example of what I mean.

Let's Think (Slide 5): (*Read the problem on the slide).* Mr. Miller is packing bags of grapes for his daycare students. He makes 36 bags, and puts 19 grapes in each bag. He wants to know about how many grapes he should buy.

Let's round to help Mr. Miller find an estimate for the number of grapes. Why do you think it is okay to round with a scenario like this? Possible Student Answers, Key Points:

- He doesn't need the exact number of grapes. He can be close and still be okay.

- You don't buy grapes one at a time, so he just needs a good guess for how many bunches he should buy to have enough. It doesn't need to be exact.

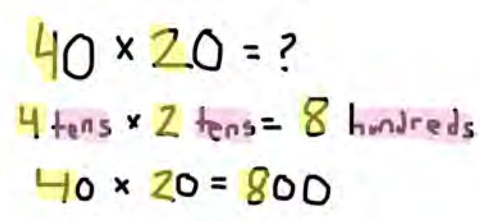


Mr. Miller needs 36 bags with 19 grapes in each. We can think of 36 x 19 as an expression we could use to find the total number of grapes. Let's round each factor to help Mr. Miller get an efficient estimate. What is 36 rounded to the nearest ten? How do you know? (*support students with sketching and labeling a vertical number line as shown here if they aren't able to clearly name what each factor rounds to and how they know)* Possible Student Answers, Key Points:

- 36 is in between 30 and 40. The halfway point between 30 and 40 is 35, and I know 36 is a little more than that. 36 round to 40.

What is 19 rounded to the nearest ten? How do you know? Possible Student Answers, Key Points:

- 19 is in between 10 and 20. The halfway point between 10 and 20 is 15, and I know 19 is more than that. 19 is really close to 20. 19 rounds to 20.



We can now use our rounded factors to find an estimate. We can think of 36 x 19 as being about 40 x 20 (*write expression)*. Just like in our previous lesson, we can use basic facts and unit form to quickly arrive at our estimate. 40 x 20 can be thought of as 4 tens x 2 tens (*write)*. Now we can think of 4 x 2 *(highlight digits)* and then think about tens x tens to consider the unit of our product. 4 tens x 2 tens = 8 hundreds or 800. (*write expression in standard form)*.

About how many grapes does Mr. Miller need? How do you know? Possible Student Answers, Key Points:

- He needs about 800 grapes. Instead of multiplying 36 bags times 19 grapes, we rounded to think about 40 x 20. This way we can use a simple fact and use place value patterns to quickly multiply.

We can use rounding to estimate factors to quickly find about how much or exact product would be. This is helpful when a precise answer isn't necessary.

Let's Think (Slide 6): Before we practice, let's pause and think about Chloe's situation. Chloe wanted to round 632 and 69 to estimate the product of the two factors. She thought of two different ways to round both factors. Both ways are correct. What do you notice about the two expressions she wrote to help her estimate? Possible Student Answers, Key Points:

- In the first example, she rounded 632 to the nearest ten and 69 to the nearest ten.
- In the second example, she rounded 632 to the nearest hundred and 69 to the nearest hundred.

Both expressions are probably easier to use than 632 x 69, and both would provide a good estimate of the product. Which expression do you think would be easiest for Chloe to solve if she was in a hurry? Possible Student Answers, Key Points:

- I think 600 x 70 is easiest, because I can think of 6 hundreds x 7 tens. 6 x 7 is an easy fact for me.
- Either could work, but 630 x 7 might be tricky. 63 tens x 7 tens would give me an estimate, but I don't know 63 x 7 off the top of my head.

There is no single correct way to round and estimate a product. As you work today, rounding to the largest place value, like Chloe did when she wrote 600 x 70, will be a quick way to arrive at a decent estimate.

Let's Try it (Slides 7 - 8): Now let's work on estimating multi-digit products by rounding factors. We're going to work on this page together, step-by-step. Remember, when we estimate a product, we want to carefully round each factor to a number that is easy to multiply with, and then we can use place value patterns and unit form to help us quickly find an accurate estimate. If at any point we need help rounding, we can always use a vertical number line to identify the closest ten or hundred.

WARM WELCOME

Today we will estimate multi-digit products by rounding factors to a basic fact and using place value patterns.

Let's Review:

Round 47 to the nearest ten.

Round 232 to the nearest hundred.

Let's Talk:

Which would you rather solve in your head? Why?

12 x 99 **or** 10 x 100

412 x 398 **or** 400 x 400

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Let's Think:

Mr. Miller is packing bags of grapes for his daycare students. He makes 36 bags, and he puts 19 grapes in each bag. He wants to know <u>about</u> how many grapes he should buy.

Let's Think:

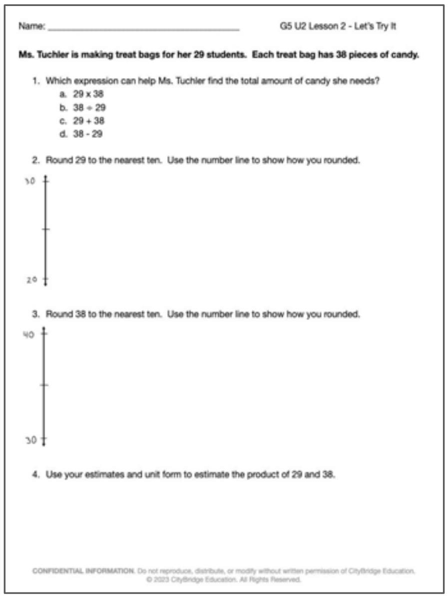
Chloe wants to estimate the product of 632 x 69. Which expression would be simplest for Chloe to estimate quickly?

630 x 70 = ?

600 x 70 = ?

Let's Try It:

Let's explore estimating multi-digit products together.



Name: ____________________ G5 U2 Lesson 2 - Let's Try It

Ms. Tuchler is making treat bags for her 29 students. Each treat bag has 38 pieces of candy.

1. Which expression can help Ms. Tuchler find the total amount of candy she needs?
   a. 29 x 38
   b. 38 ÷ 29
   c. 29 + 38
   d. 38 - 29
2. Round 29 to the nearest ten. Use the number line to show how you rounded.

30

20

3. Round 38 to the nearest ten. Use the number line to show how you rounded.

40

30

4. Use your estimates and unit form to estimate the product of 29 and 38.

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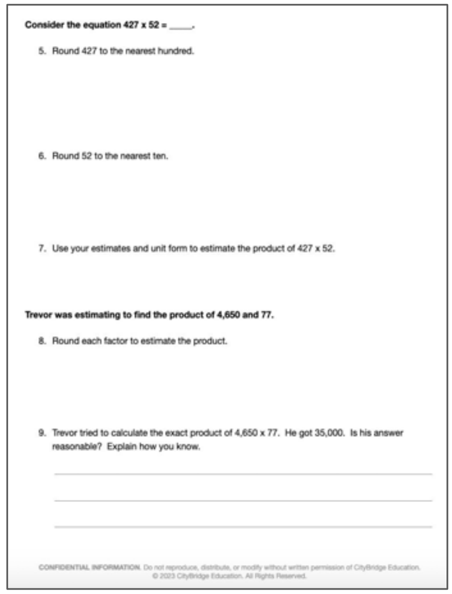

Consider the equation 427 x 52 = ____.

5. Round 427 to the nearest hundred.
6. Round 52 to the nearest ten.
7. Use your estimates and unit form to estimate the product of 427 x 52.

Trevor was estimating to find the product of 4,650 and 77.

8. Round each factor to estimate the product.
9. Trevor tried to calculate the exact product of 4,650 x 77. He got 35,000. Is his answer reasonable? Explain how you know.

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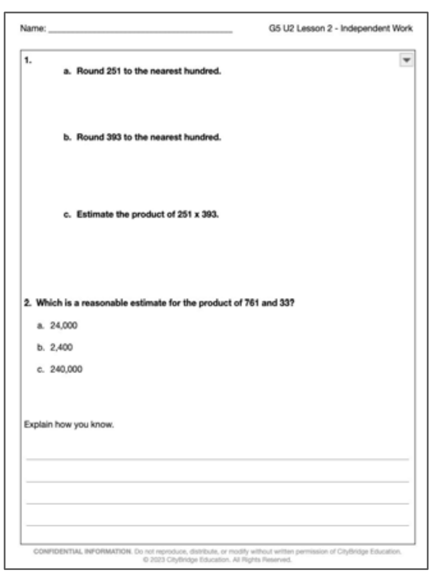
On your Own:

Now it's time to explore estimating multi-digit products on your own.



Name: ____________________ G5 U2 Lesson 2 - Independent Work

1.
   a. Round 251 to the nearest hundred.
   b. Round 393 to the nearest hundred.
   c. Estimate the product of 251 x 393.

2. Which is a reasonable estimate for the product of 761 and 33?
   a. 24,000
   b. 2,400
   c. 240,000

Explain how you know.

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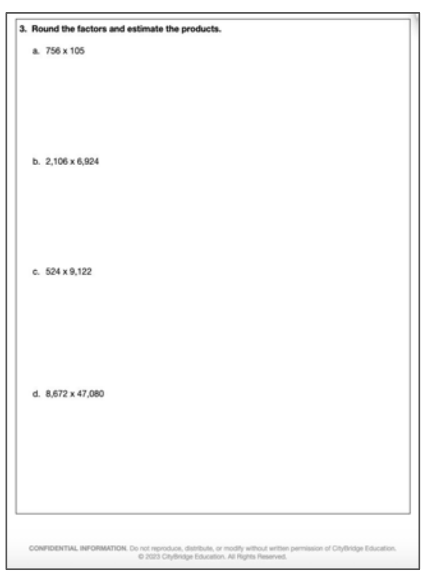

3. Round the factors and estimate the products.
   a. 756 x 105
   b. 2,106 x 6,924
   c. 524 x 9,122
   d. 8,672 x 47,080

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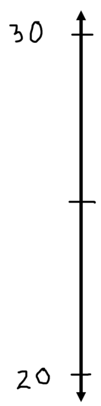
Name: ____ G5 U2 Lesson 2 - Let's Try It

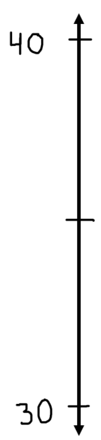
Ms. Tuchler is making treat bags for her 29 students. Each treat bag has 38 pieces of candy.

1. Which expression can help Ms. Tuchler find the total amount of candy she needs?
    a. 29 x 38
    b. 38 ÷ 29
    c. 29 + 38
    d. 38 - 29

2. Round 29 to the nearest ten. Use the number line to show how you rounded.



3. Round 38 to the nearest ten. Use the number line to show how you rounded.



4. Use your estimates and unit form to estimate the product of 29 and 38.

Consider the equation 427 x 52 = ______.

5. Round 427 to the nearest hundred.

6. Round 52 to the nearest ten.

7. Use your estimates and unit form to estimate the product of 427 x 52.

Trevor was estimating to find the product of 4,650 and 77.

8. Round each factor to estimate the product.

9. Trevor tried to calculate the exact product of 4,650 x 77. He got 35,000. Is his answer reasonable? Explain how you know.

1.
   a. Round 251 to the nearest hundred.

   b. Round 393 to the nearest hundred.

   c. Estimate the product of 251 x 393.

2. Which is a reasonable estimate for the product of 761 and 33?

   a. 24,000

   b. 2,400

   c. 240,000

Explain how you know.

____

____

____

____

3. Round the factors and estimate the products.

   a. 756 x 105

b. 2,106 x 6,924

c. 524 x 9,122

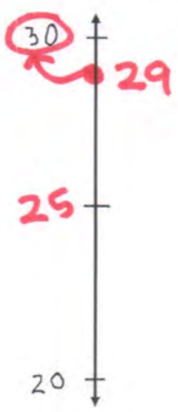
d. 8,672 x 47,080

Name: KEY

Ms. Tuchler is making treat bags for her 29 students. Each treat bag has 38 pieces of candy.

1. Which expression can help Ms. Tuchler find the total amount of candy she needs?
   a. 29 x 38
   b. 38 ÷ 29
   c. 29 + 38
   d. 38 - 29

2. Round 29 to the nearest ten. Use the number line to show how you rounded.



$29 \approx 30$

3. Round 38 to the nearest ten. Use the number line to show how you rounded.

$38 \approx 40$

4. Use your estimates and unit form to estimate the product of 29 and 38.

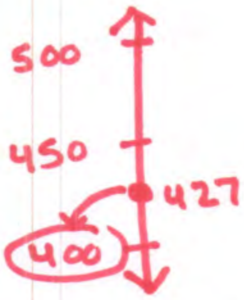
$30 \times 40 = ?$

3 tens × 4 tens = 12 hundreds

1,200 pieces

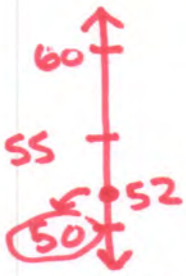
Consider the equation 427 x 52 = _____.

5. Round 427 to the nearest hundred.



$427 \approx 400$

6. Round 52 to the nearest ten.



$52 \approx 50$

7. Use your estimates and unit form to estimate the product of 427 x 52.

$400 \times 50 = ?$

4 hundred × 5 tens = 20 thousand

20,000

Trevor was estimating to find the product of 4,650 and 77.

8. Round each factor to estimate the product.

$4650 \approx 5{,}000$
$77 \approx 80$

$(5 \times 8) \times (1{,}000 \times 10)$
$40 \times 10{,}000$
$400{,}000$

9. Trevor tried to calculate the exact product of 4,650 x 77. He got 35,000. Is his answer reasonable? Explain how you know.

No. The estimate I got was 400,000 and 35,000 is far too low. It is unreasonable.

Name: KEY

1.

a. Round 251 to the nearest hundred.

$251 \approx 300$

b. Round 393 to the nearest hundred.

$393 \approx 400$

c. Estimate the product of 251 x 393.

300×400

$(3 \times 4) \times (100 \times 100)$

$12 \times (10{,}000) \rightarrow 120{,}000$

2. Which is a reasonable estimate for the product of 761 and 33?

a. 24,000

b. 2,400

c. 240,000

$\approx 800 \quad \approx 30$

$(3 \times 8) \times (100 \times 10)$

24×1000

$24{,}000$

Explain how you know.

I estimated that $761 \approx 800$ and $33 \approx 30$. I know $3 \times 8 = 24$ and tens $\times$ hundreds = thousands, so 24 thousands is reasonable.

3. Round the factors and estimate the products.

a. 756 x 105

↓ ↘

800 x 100

(8 x 1) x (100 x 100)

8 x 10,000

80,000

b. 2,106 x 6,924

↓ ↘

2,000 x 7,000

(2 x 7) x (1,000 x 1,000)

14 x 1,000,000

14,000,000

c. 524 x 9,122

↓ ↘

500 x 9,000

(5 x 9) x (100 x 1,000)

45 x (100,000)

4,500,000

d. 8,672 x 47,080

↓ ↓

9,000 x 50,000

(9 x 5) x (1,000 x 10,000)

45 x 10,000,000

450,000,000

G5 U2 Lesson 3

Write and interpret numerical expressions, and compare expressions

CITYTUTOR DC

G5 U2 Lesson 3 - Students will write and interpret numerical expressions, and compare expressions using a visual model

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): Today, we will explore how to represent numerical expressions, meaning numbers as symbols, with models and with words/verbal descriptions. As we'll see, being able to reason carefully about expressions can help us compare them without always having to find their values. Let me show you what I mean!

Let's Review (Slide 3): When we talk or write about numerical expressions, we often use common math vocabulary. Here you'll see some words that you've likely seen before. (*point and read*) Sum means the answer to an addition problem. Difference means the answer to a subtraction problem. Product means the answer to a multiplication problem. Quotient means the answer to a division problem. These words will come up today, so I want to make sure they're at the top of your mind.

We also might see the words double, triple, or half when we're interpreting numerical expressions. What do you know about the meaning of these words? Possible Student Answers, Key Points:

- Double is when you have twice as much, or you multiply by 2.
- Triple is when you have three times as much, or you multiply by 3.
- Half is when you split something evenly two ways, like dividing by 2.

Nice! These words will help us as we reason about expressions today.

Let's Talk (Slide 4): Take a second to look at the three representations here. We see a tape diagram, a numerical expression, and words or a verbal description. What do you notice? What do you wonder? (*pause for think time*) Possible Student Answers, Key Points:

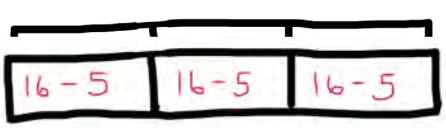
- I notice they all have 8 and 3.
- I notice the top one is a model and the other two are numbers and words.
- I notice they all have a total of 24. They're all different ways to show the same thing.

Those are all great ideas. Each of these three representations are ways we can think about "3 groups of 8". Where does each representation show "3 groups of 8"? Possible Student Answers, Key Points:

- The tape diagram shows 3 boxes with 8 in each one.
- The numerical expression in the middle show 3 times 8, which is the same as 3 groups of 8.
- Product means the answer to a multiplication problem, so it's just words that mean 3 x 8 or 3 groups of 8.

Our work today is going to involve thinking and reasoning about different ways to represent a numerical expression, just like we see here!

Let's Think (Slide 5): Let's read this numerical expression together. Then we'll draw a tape diagram and write verbal description to match. (*read 3 x (16 - 5) together*) We can think of this as 3 groups of (16 - 5). (16 - 5) is our unit, just like how 8 was our unit in the last example. We need to draw a model that shows the difference of 16 and 5 three times. Let's start by drawing three groups or boxes. (*draw three connected boxes)*

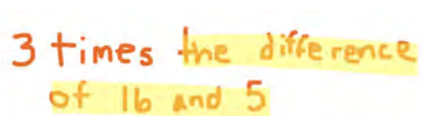


Now, we can see our 3 groups. Let's write 16 - 5 in each box, since we want 3 groups of 16 - 5. (*write 16 - 5 in each box)* This model represents the original expression. Where do we see 3 x (16 - 5) in our tape diagram? Possible Student Answers, Key Points:

- I see 3 boxes, and inside each box is 16 - 5. So we have 1, 2, 3 groups of 16 - 5.

The last thing we need to do is write our expression in words, sometimes called a verbal description. I might be tempted to write (*write as you say)* "3 times 16 minus 5", but that expression isn't really clear. That might make somebody think we took 3 groups of 16 and then subtracted 5. That's not what the model shows. (*cross out verbal expression)*. I want to think carefully about how I can describe 3 groups of our unit. How can we describe our unit (*point to 16 - 5 in tape diagram)* using one of the words we reviewed earlier? Possible Student Answers, Key Points:

- The answer to a subtraction problem is called the difference, so we can say the difference of 16 - 5.



Excellent! So a better verbal description might be (*write as you say)* "3 times the difference of 16 and 5". Writing "the difference of 16 and 5" (*highlight or underline)* makes the unit crystal clear in our verbal description.

We just interpreted the expression 3 x (16 - 5) using a visual model and a verbal description. We see three ways to think about the same mathematical relationship.

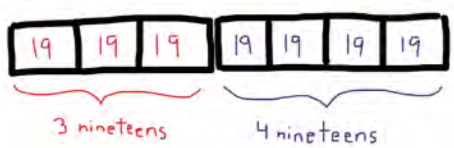
Let's Think (Slide 6): Let's look at another one. Here, we're given the verbal description, and we're being asked to interpret it using a model and a numerical expression. (*read "the sum of 3 nineteens and 4 nineteens")* What words or phrases in our expression stand out to you? Possible Student Answers, Key Points:

- I know sum means the answer to an addition problem. The word nineteen is just the number 19. 3 nineteens means 3 groups of 19. 4 nineteens means 4 groups of 19.

Let's think about how we can represent this with a model. I know I want to find the sum of 3 nineteens and 4 nineteens, so I'm combining groups of 19. Let me start by drawing a tape diagram that shows 3 groups of nineteen. (*Draw a tape diagram with three equal, connected boxes. Label each with 19 inside. Use a bracket to label the entire rectangle as 3 nineteens.)*

The verbal description wants me to find the sum of this and 4 nineteens. How could I show 4 nineteens? Possible Student Answers, Key Points:

- Draw 4 boxes with 19 in each.
- Draw what we just drew, but with another group.

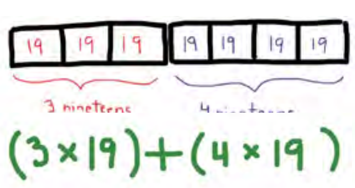


Okay, so let's draw 4 more groups of 19 attached to our 3 groups of 19. (*draw and label 4 more groups of 19).*

How does this model show "the sum of 3 nineteens and 4 nineteens"? Possible Student Answers, Key Points:

- We are adding 3 groups of 19 to 4 groups of 19. We show that in the model by drawing three equal boxes with 19 in each, then we join that with 4 more boxes of 19.

Now we just need to represent our verbal description and model using a numerical expression, or numbers and symbols. You already named that we were adding groups of 19 together, because we were finding the sum of the groups. (*write a + sign*) And since I know we were adding two quantities, I'm going to use parentheses to clearly show what we were adding (*write sets of parentheses on both sides of the plus sign, aligned with the tape diagram)*



What expressions can I use to fill in my parentheses? Think about how we can write 3 nineteens and 4 nineteens as numbers and symbols. (*write as student shares*) Possible Student Answers, Key Points:

- nineteens is 3 x 19. 4 nineteens is 4 x 19.
- see 3 boxes of 19, so that's 3 x 19. I see 4 boxes of 19, so that's 4 x 19.

We know there are many ways to write and say expressions. We could have said 19 + 19 + 19 to show 3 nineteens, for example. There are multiple numerical expressions that can work for our problems today; we just have to make sure they actually match the problem.

Let's Think (Slide 7): Before we wrap up today and jump into practicing, I want us to think about these two expressions. What do you notice about both expressions? Possible Student Answers, Key Points:

- They both have x and +. They both have 20 and 4 and 9.
- They both have (4 + 9) as a unit. The first expression is 20 groups of that, and the other is 18 groups of that.

Nice work. If we wanted to compare these expressions, we <u>could</u> compute the value of each. You noticed some things that each expression has in common that will actually help us compare much faster. They both show groups of 4 + 9 (*highlight 4 + 9 in each expression using the same color)*. The first expression shows 20 groups of 4 + 9 (*highlight 20 in another color)*. The second expression shows 18 groups of 4 + 9 (*highlight 18 in a different color).* Since our unit, 4 + 9, is the same in both, we can compare without doing the computation. I know 20 groups of anything will be greater than 18 groups of the same unit. (*fill in > symbol)*.

$20 \times (4 + 9)$ ______ $(4 + 9) \times 18$

$20 \times (4 + 9)$ __>__ $(4 + 9) \times 18$

Sometimes pausing to think about expressions can help us interpret and compare them more efficiently than if we were to sit down and find the value of each.

Let's Try it (Slides 8 - 9): Now let's work on writing, interpreting, and comparing numerical expressions. We're going to work on this page together, step-by-step. Remember, we can represent an expression using a model, numbers and symbols, and words/verbal descriptions. Tape diagrams can help us think carefully about the relationship between the numbers. We know that sometimes we can use the relationship between the numbers to compare numerical expressions without having to do the computation.

WARM WELCOME

Today we will write and interpret numerical expressions and compare expressions using a visual model.

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Let's Review:

15 + 5 = 20	sum
15 - 5 = 10	difference
15 x 5 = 45	product
15 ÷ 5 = 3	quotient

DOUBLE

TRIPLE

HALF

Let's Talk:

What do you notice? What do you wonder?

8	8	8

3 x 8

the product of 3 and 8

Let's Think:

3 x (16 - 5)

MODEL	VERBAL DESCRIPTION

Let's Think:

the sum of 3 nineteens and 4 nineteens

MODEL	NUMERICAL EXPRESSION

Let's Think:

Can we compare using <, >, or = without evaluating?

$$20 \times (4 + 9) \_\_\_\_\_ (4 + 9) \times 18$$

Let's Try It:

Let's explore estimating multi-digit products together.

Name: ______________________ G5 U2 Lesson 3 - Let's Try It

1. **Match each equation to the corresponding term.**

12 + 3 = ?	sum
12 ÷ 3 = ?	product
12 - 3 = ?	quotient
12 x 3 = ?	difference

2. **Choose the expression that matches each tape diagram. Then write a verbal description to match.**

9	9	9	9

a. 4 x 9
b. 4 + 4 + 4 + 4
c. 9 + 9
d. 9 + 4

VERBAL DESCRIPTION: ______________________

17 – 2	17 – 2	17 – 2	17 – 2

a. 4 x 17 x 2
b. 4 + 17 + 2
c. 4 x (17 - 2)
d. 4 + (17 - 2)

VERBAL DESCRIPTION: ______________________

3. **Draw a model to match the verbal description. Then write an expression using numbers and symbols.**

7 times the sum of 14 and 8

EXPRESSION: ______________________

4. **Draw a model to match the verbal description. Then write an expression using numbers and symbols.**

The difference between 5 thirteens and 3 thirteens

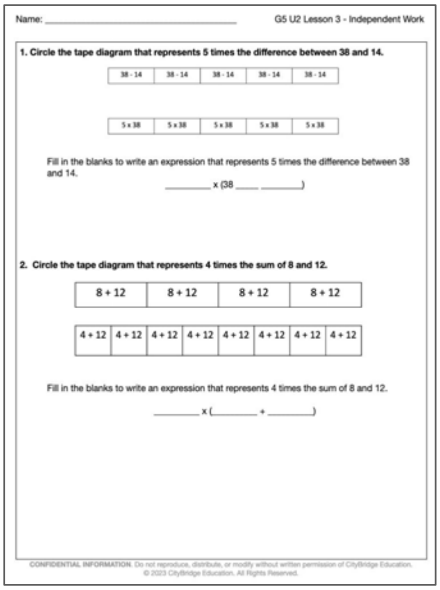
EXPRESSION: ______________________

5. **Derrick said that in order to compare the expressions below, you <u>must</u> do the math to find the value of each expression. Explain why Derrick is incorrect and compare the expressions using <, >, or =.**

9 x 14 ____ 7 fourteens

On your Own:

Now it's time to explore estimating multi-digit products on your own.



Name: ______________________ G5 U2 Lesson 3 - Independent Work

1. Circle the tape diagram that represents 5 times the difference between 38 and 14.

38 - 14	38 - 14	38 - 14	38 - 14	38 - 14

5 x 38	5 x 38	5 x 38	5 x 38	5 x 38

Fill in the blanks to write an expression that represents 5 times the difference between 38 and 14.

________ x (38 ____ ________)

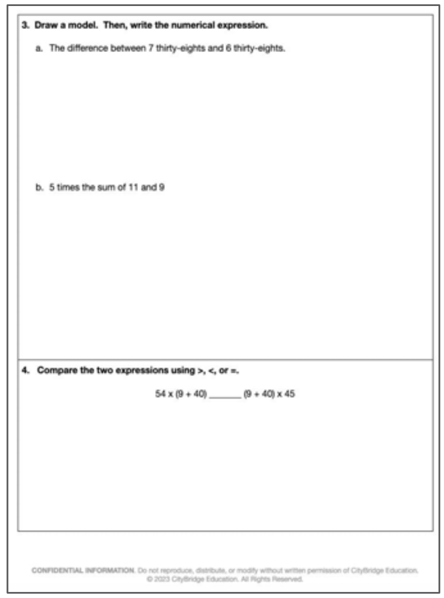
2. Circle the tape diagram that represents 4 times the sum of 8 and 12.

8 + 12	8 + 12	8 + 12	8 + 12

4 + 12	4 + 12	4 + 12	4 + 12	4 + 12	4 + 12	4 + 12	4 + 12

Fill in the blanks to write an expression that represents 4 times the sum of 8 and 12.

________ x (________ + ________)



3. Draw a model. Then, write the numerical expression.

a. The difference between 7 thirty-eights and 6 thirty-eights.

b. 5 times the sum of 11 and 9

4. Compare the two expressions using >, <, or =.

54 x (9 + 40) ______ (9 + 40) x 45

Name: ____

1. Match each equation to the corresponding term.

12 + 3 = ?	sum
12 ÷ 3 = ?	product
12 - 3 = ?	quotient
12 x 3 = ?	difference

2. Choose the expression that matches each tape diagram. Then write a verbal description to match.

9	**9**	**9**	**9**

a. 4 x 9
b. 4 + 4 + 4 + 4
c. 9 + 9
d. 9 + 4

VERBAL DESCRIPTION:

____

17 – 2	**17 – 2**	**17 – 2**	**17 – 2**

a. 4 x 17 x 2
b. 4 + 17 + 2
c. 4 x (17 - 2)
d. 4 + (17 - 2)

VERBAL DESCRIPTION:

____

3. Draw a model to match the verbal description. Then write an expression using numbers and symbols.

7 times the sum of 14 and 8

EXPRESSION:

4. Draw a model to match the verbal description. Then write an expression using numbers and symbols.

The difference between 5 thirteens and 3 thirteens

EXPRESSION:

5. Derrick said that in order to compare the expressions below, you must do the math to find the value of each expression. Explain why Derrick is incorrect and compare the expressions using <, >, or =.

9 x 14 ______ 7 fourteens

1. Circle the tape diagram that represents 5 times the difference between 38 and 14.

38 - 14	38 - 14	38 - 14	38 - 14	38 - 14

5 x 38	5 x 38	5 x 38	5 x 38	5 x 38

Fill in the blanks to write an expression that represents 5 times the difference between 38 and 14.

__________ x (38 _____ __________)

2. Circle the tape diagram that represents 4 times the sum of 8 and 12.

8 + 12	8 + 12	8 + 12	8 + 12

4 + 12	4 + 12	4 + 12	4 + 12	4 + 12	4 + 12	4 + 12	4 + 12

Fill in the blanks to write an expression that represents 4 times the sum of 8 and 12.

__________ x (__________ + __________)

3. Draw a model. Then, write the numerical expression.

   a. The difference between 7 thirty-eights and 6 thirty-eights.

b. 5 times the sum of 11 and 9

4. Compare the two expressions using >, <, or =.

54 x (9 + 40) ________ (9 + 40) x 45

*expect some variety in models and expressions

Name: KEY

1. Match each equation to the corresponding term.

12 + 3 = ? → sum

12 ÷ 3 = ? → quotient

12 - 3 = ? → difference

12 x 3 = ? → product

2. Choose the expression that matches each tape diagram. Then write a verbal description to match.

9	9	9	9

a. 4 x 9 ← I see 4 groups of 9
b. 4 + 4 + 4 + 4
c. 9 + 9
d. 9 + 4

VERBAL DESCRIPTION:

The product of 4 nines

17 – 2	17 – 2	17 – 2	17 – 2

a. 4 x 17 x 2
b. 4 + 17 + 2
c. 4 x (17 - 2) ← I see "17-2" four times
d. 4 + (17 - 2)

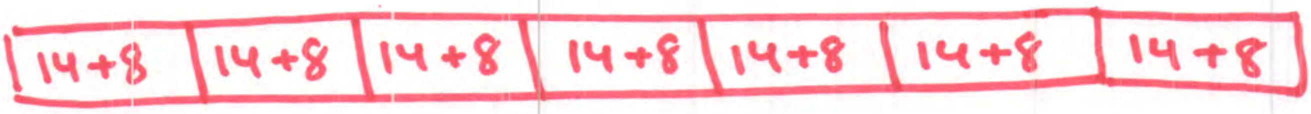
VERBAL DESCRIPTION:

Four times the difference of 17 and 2

3. **Draw a model to match the verbal description. Then write an expression using numbers and symbols.**

(14 +8)

7 times the sum of 14 and 8



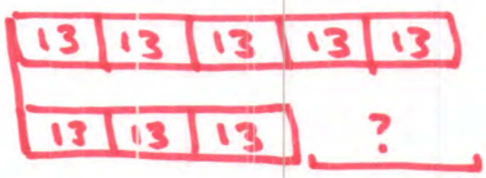
EXPRESSION:

$7 \times (14+8)$

4. **Draw a model to match the verbal description. Then write an expression using numbers and symbols.**

(5×13) (3×13)

The difference between 5 thirteens and 3 thirteens



EXPRESSION:

$(5\times 13) - (3\times 13)$

5. **Derrick said that in order to compare the expressions below, you <u>must</u> do the math to find the value of each expression. Explain why Derrick is incorrect and compare the expressions using <, >, or =.**

9 x 14 __>__ 7 fourteens

I can think of 9×14 as "9 fourteens". I know that 9 groups of 14 is going to be more than 7 groups of 14.

Name: KEY

1. Circle the tape diagram that represents 5 times the difference between 38 and 14. (38 - 14)

38 - 14	38 - 14	38 - 14	38 - 14	38 - 14

5 x 38	5 x 38	5 x 38	5 x 38	5 x 38

Fill in the blanks to write an expression that represents 5 times the difference between 38 and 14.

5 x (38 - 14)

2. Circle the tape diagram that represents 4 times the sum of 8 and 12. (8 + 12)

8 + 12	8 + 12	8 + 12	8 + 12

4 + 12	4 + 12	4 + 12	4 + 12	4 + 12	4 + 12	4 + 12	4 + 12

Fill in the blanks to write an expression that represents 4 times the sum of 8 and 12.

4 x (8 + 12)

3. **Draw a model. Then, write the numerical expression.**

a. The difference between 7 thirty-eights and 6 thirty-eights.

38	~~38~~	~~38~~	~~38~~	~~38~~	~~38~~	~~38~~

$(7 \times 38) - (6 \times 38)$

b. 5 times the sum of 11 and 9

11+9	11+9	11+9	11+9	11+9

$5 \times (11+9)$

4. **Compare the two expressions using >, <, or =.**

54 x (9 + 40) > (9 + 40) x 45

54 groups

45 groups

G5 U2 Lesson 4

Connect visual models and the distributive property to partial products of the standard algorithm without renaming

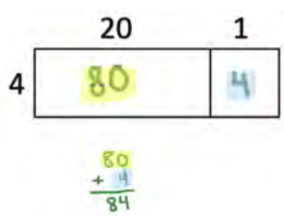
G5 U2 Lesson 4 - Students will connect visual models and the distributive property to partial products of the standard algorithm without renaming

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): Today, we will revisit how to multiply factors using an area model and the distributive property. We'll use similar thinking and apply that to showing our work using the standard algorithm.

Let's Talk (Slide 3): Take a look at how a student multiplied 21 x 4. What do you notice about their representation? What do you wonder? Possible Student Answers, Key Points:

- I notice it's an area model. I notice they broke apart 21 into 20 and 1. I notice they found 20 x 4 and 1 x 4 and then added those together. I notice the answer is 84.
- I wonder why they broke apart their numbers. I wonder if their answer is correct. I wonder why they solved this way.



Thanks for sharing. I heard a lot of great things. This is called an area model. An area model helps us break apart and distribute with our factors to find partial products that are easy to work with. (*point to features as you explain them*) In this case, the student was multiplying 21 x 4. They broke the factor of 21 into 20 and 1 and distributed by multiplying each part by 4 inside the rectangles. 4 x 20 is the same as 4 x 2 tens. They got 8 tens, or 80. 4 x 1 one is 4. Then they added the partial products to get their answer of 84. *(Highlight or circle 80 in one color in the model and the addition. Do the same with the 1, but use a different color.)*

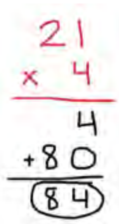
Breaking apart a factor is a quick way to make multiplying big numbers more manageable. An area model is one way to show that work; today, we'll see how we can show similar thinking using a written, vertical form called the standard algorithm.

Let's Think (Slide 4): When using the standard algorithm, we start by stacking the factors vertically. It looks similar to how you might stack two addends by lining up the place value of each digit, but we're multiplying. (*set up 21 x 4 in vertical form*).

Now, just like when we use the area model, we can think carefully about each digit and its place value to help us multiply in parts. In an area model, we broke 21 into 20 + 1. When we use the algorithm, we'll think of it in the same way, but we'll keep 21 in standard form. *(point to 4, then to 1)* What is 4 x 1 one? Possible Student Answers, Key Points:

- 4 x 1 one equals 4 ones.

(*write 4 under the line*) Great! I'll record that partial product underneath the line. Now let's think about the 2 in 21. The 2 in 21 isn't just 2, it's 2 tens. (*point to 4, then to 2*) What is 4 times 2 tens? Possible Student Answers, Key Points:

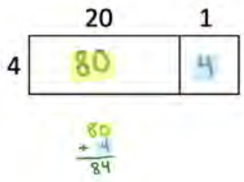


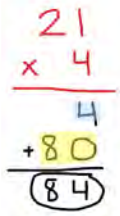
- 4 x 2 tens equals 8 tens or 80.

Excellent. I'll record the partial product of 80 underneath the other partial product of 4. Now all we have to do is add the two partial products. (*write as you talk*) 80 + 4 = 84. That's how you multiply using the standard algorithm.

Let's look at the area model and the standard algorithm, or vertical form, side-by-side. (*put work samples side-by-side*) What's the same? What's different? (*have student point or highlight each representation as they mention valid similarities and differences*) Possible Student Answers, Key Points:

- They both have factors of 21 and 4. They have the same product of 84. They each show partial products of 4 and 80, because we multiplied 4 x 20 and 4 x 1 in both. I see multiplication and addition in both.
- The area model actually breaks apart the 21, but in the algorithm we only really break up the 21 in our heads. The area model uses boxes to think about each partial product, but the standard algorithm just writes them beneath the line. The area model requires you to add off to the side, but the standard algorithm includes the addition at the bottom.



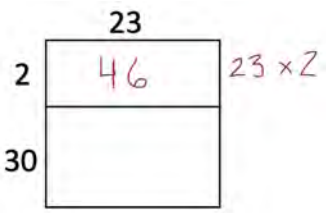


Nicely done. They're two ways to represent very similar thinking. In both cases we break apart 21 into 20 and 1, whether in the model or just by thinking about the place value of each digit. In both cases, we distribute the 4 by multiplying it by each part of 21. We get the same partial products (*highlight with corresponding colors*), and then we add to get the same final product. The two representations look different at first glance, but are very similar!

Let's Think (Slide 5): Let's try one more. This problem involves multiplying a 2-digit number by another 2-digit number. We'll see that the process for using the area model and the standard algorithm don't change; we'll just need to be a bit more careful as we multiply.

We're multiplying 32 x 23. Let's start with the area model. This model decomposed 32 into 30 and 2. How can I find the area of this top rectangle? Possible Student Answers, Key Points:

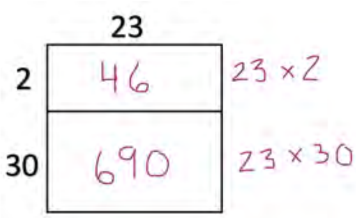
- That section has a length of 23 and a width of 2, so 23 x 2 = 46.



23 times 2 equals 46, or 23 times 2 ones equals 46 ones. (*fill 46 in the area model and write 23 x 2 outside of the area model)*

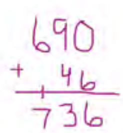
Let's carefully think about the other partial product. How can I find the area of the bottom rectangle? Use unit form for 30, if that helps you explain. Possible Student Answers, Key Points:

- I need to multiply 23 x 30. I can think of that as just 23 x 3 tens, which is 69 tens. 69 tens is 690.



23 times 30 is the same as 23 x 3 tens. This means I just need to think about the product of 23 x 3, then I can adjust based on the place value. If I don't know 23 x 3, I could use repeated addition to add 23 + 23 + 23. No matter how I get there, the 23 x 3 = 69, so 23 x 3 = 69 tens or 690. (*fill in 690 in the area model and write 23 x 30 outside the area model)*

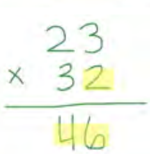
Now let's add the partial products. (*write addition vertically as you talk)* 690 plus 46 equals 736.



Just like with the previous problem, we used the area model to break apart a factor, multiply to find our partial products, then add the partial products together. Now let's see if we get the same answer when we use the standard algorithm.

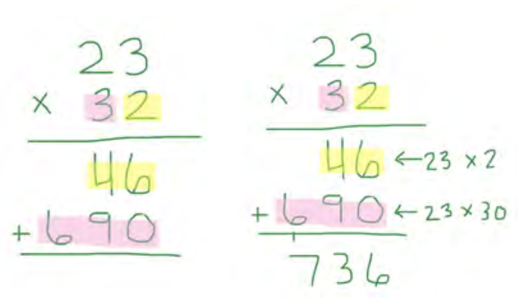
(*draw a line to separate the area model from the standard algorithm on your workspace)*

Let's begin by stacking our factors vertically. We can put them in either order, but let's put the 23 on top and the 32 on bottom for this example.



To find our first partial product, we'll multiply 23 by the 2 ones in 32. (*point to each number as you refer to it, then highlight the 2)* 23 times 2 ones is 46. *(highlight 46 in the same color as the 2)*

Now, we're not finished. We only multiplied 23 by 2, but we know we need to multiply 23 x 32, so we still need to distribute 23 to 30. 23 times 3 would be 69, but I know this 3 is really 3 tens (*highlight 3 in a different color)*. So 23 times 3 tens is 69 tens. I'll write 690 as my other partial product (*write and highlight in the same color as 3)*. I'll line up with 46 so



each place value is stacked; this will make it easier to add our partial products. We multiplied 23 x 2 (*write to the side of 46)* and 23 x 30 (*write to the side of 690*) and found our partial products of 46 and 690. When we add them, we end up with a product of 736.

Take a look at our two representations. Where do you see each step of the area model in our vertical form or standard algorithm? Possible Student Answers, Key Points:

- First, we broke up 32. We see that on the side of the area model, but in the algorithm we just think of 32 as being 3 tens and 2 ones in our brains.
- Then we multiplied 23 x 2 ones. I see that in the first section of the area model. In the algorithm, we wrote the partial product below the line.
- Then we multiplied 23 x 30. I see that in the second section of the area model. In the algorithm, we thought of the 3 as 3 tens, then wrote 690 beneath the other partial product.
- We added next to the area model, but in the algorithm, we add at the bottom as the last step.

As we saw in each example today, both representations break apart and distribute to find the product. The area model is a more visual way of thinking of multiplication, while the vertical form/algorithm relies more on carefully thinking about the place value of each digit as you multiply. Either works, and today we're practicing both!

Let's Try it (Slides 6 - 7): Now let's work together on connecting visual models and the distributive property to partial products with the standard algorithm. Just like we break apart factors and distribute in an area model, we can carefully think about multiplying a factor by each unit in the other factor and record our thinking in two partial products. Just like with the area model, once we find our partial products, we can add to combine them into our final answer.

WARM WELCOME

Today we will connect visual models and the distributive property to partial products of the standard algorithm without renaming.

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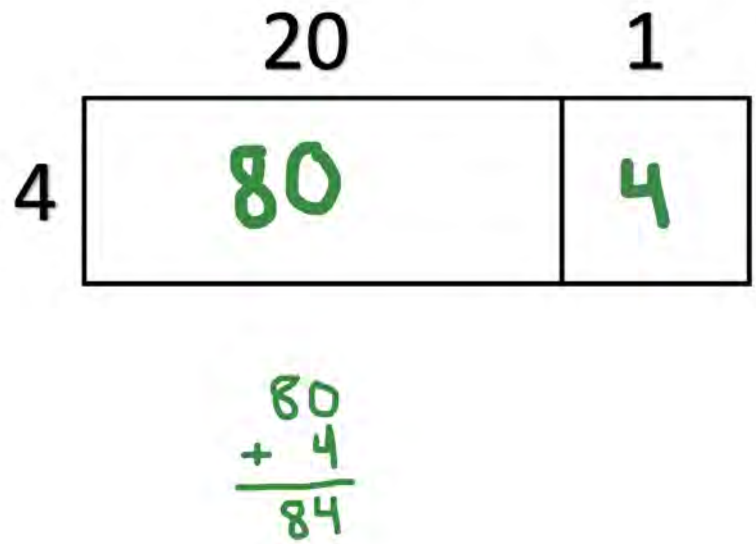
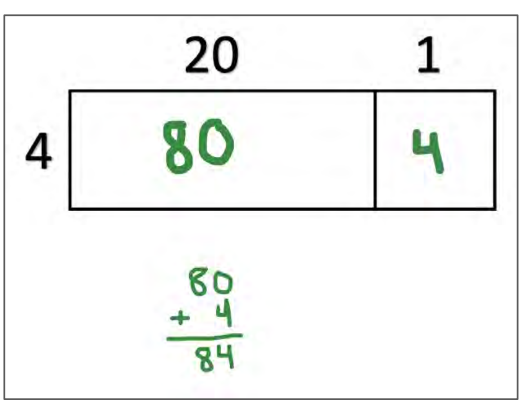
Let's Talk:

What do you notice or wonder about the work shown here?



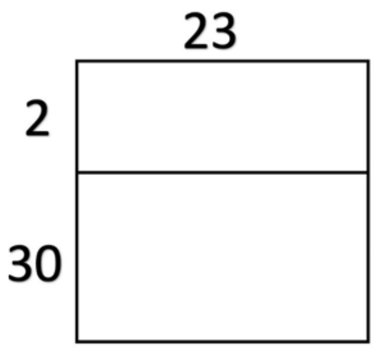
Let's Talk:

We can show similar thinking using the standard algorithm.



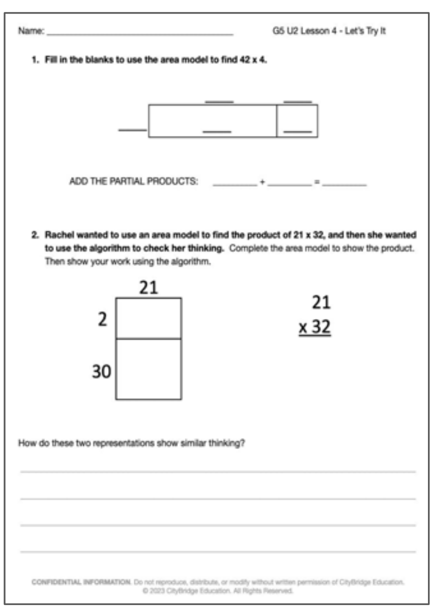
Let's Talk:

Find the product of 32 and 23 using the area model and the standard algorithm.



Let's Try It:

Let's explore connecting visual models to partial products with the standard algorithm together.



Name: ______________________ G5 U2 Lesson 4 - Let's Try It

1. Fill in the blanks to use the area model to find 42 x 4.

ADD THE PARTIAL PRODUCTS: ________ + ________ = ________

2. Rachel wanted to use an area model to find the product of 21 x 32, and then she wanted to use the algorithm to check her thinking. Complete the area model to show the product. Then show your work using the algorithm.

21
2
30

21
x 32

How do these two representations show similar thinking?

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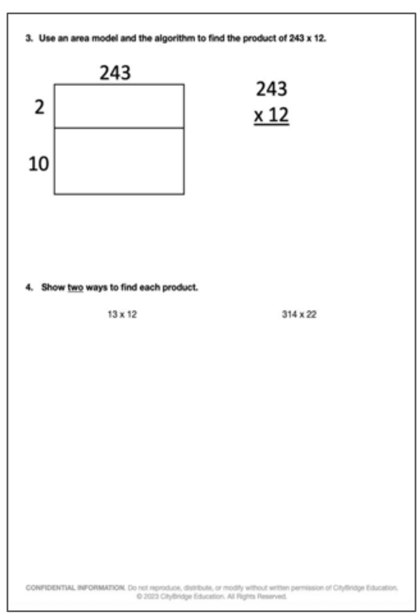

3. Use an area model and the algorithm to find the product of 243 x 12.

243
2
10

243
x 12

4. Show two ways to find each product.

13 x 12 314 x 22

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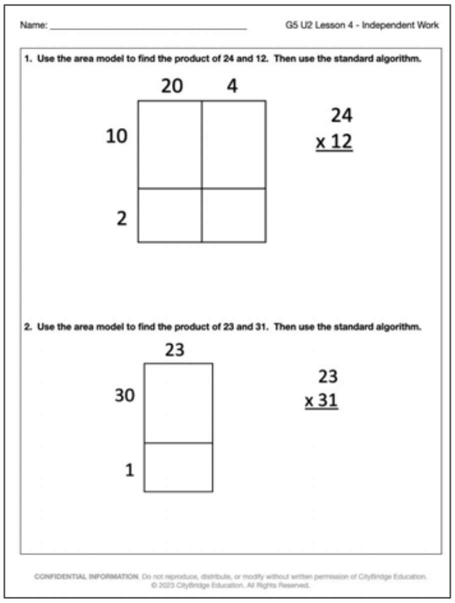
On your Own:

Now it’s time to explore connecting visual models to partial products with the standard algorithm on your own.


Name: ______________________ G5 U2 Lesson 4 - Independent Work

1. Use the area model to find the product of 24 and 12. Then use the standard algorithm.

2. Use the area model to find the product of 23 and 31. Then use the standard algorithm.

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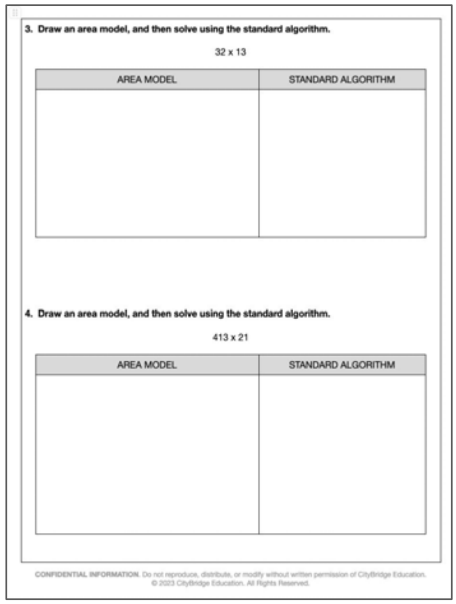
3. Draw an area model, and then solve using the standard algorithm.

32 x 13

AREA MODEL	STANDARD ALGORITHM

4. Draw an area model, and then solve using the standard algorithm.

413 x 21

AREA MODEL	STANDARD ALGORITHM

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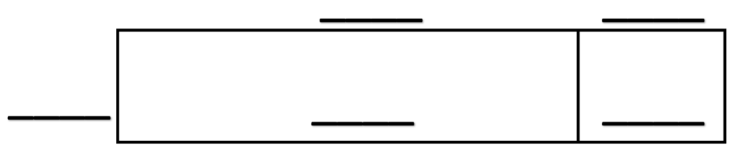
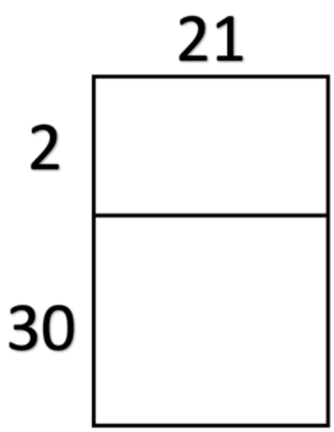
Name: ______________________________ G5 U2 Lesson 4 - Let's Try It

1. Fill in the blanks to use the area model to find 42 x 4.



ADD THE PARTIAL PRODUCTS: __________ + __________ = __________

2. Rachel wanted to use an area model to find the product of 21 x 32, and then she wanted to use the algorithm to check her thinking. Complete the area model to show the product. Then show your work using the algorithm.



$$\begin{array}{r} 21 \\ \underline{\times\ 32} \end{array}$$

How do these two representations show similar thinking?

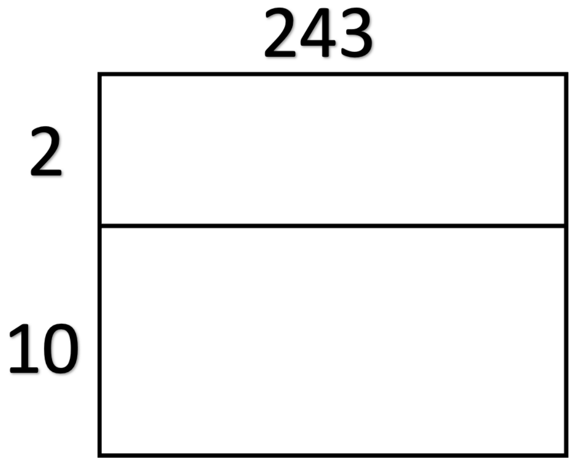
____

____

____

____

3. Use an area model and the algorithm to find the product of 243 x 12.



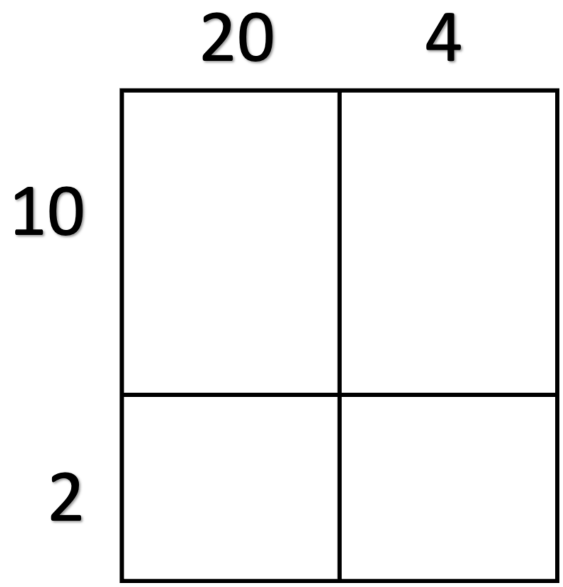
$$\begin{array}{r} 243 \\ \underline{\times\ 12} \end{array}$$

4. Show two ways to find each product.

13 x 12

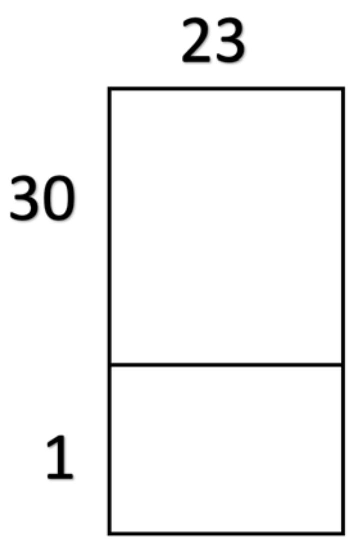
314 x 22

1. Use the area model to find the product of 24 and 12. Then use the standard algorithm.



$$\begin{array}{r} 24 \\ \underline{\times\ 12} \end{array}$$

2. Use the area model to find the product of 23 and 31. Then use the standard algorithm.



$$\begin{array}{r} 23 \\ \underline{\times\ 31} \end{array}$$

3. Draw an area model, and then solve using the standard algorithm.

32 x 13

AREA MODEL	STANDARD ALGORITHM

4. Draw an area model, and then solve using the standard algorithm.

413 x 21

AREA MODEL	STANDARD ALGORITHM

Name: KEY

1. Fill in the blanks to use the area model to find 42 x 4.

	40	2
4	160	8

ADD THE PARTIAL PRODUCTS: 160 + 8 = 168

2. Rachel wanted to use an area model to find the product of 21 x 32, and then she wanted to use the algorithm to check her thinking. Complete the area model to show the product. Then show your work using the algorithm.

	21
2	42
30	630

672

$$\begin{array}{r} 21 \\ \times\ 32 \\ \hline 42 \\ +\ 630 \\ \hline 672 \end{array}$$

How do these two representations show similar thinking?

They each show 21 x 32 multiplied to find 2 partial products (42 and 630). They both have the same final product.

3. **Use an area model and the algorithm to find the product of 243 x 12.**

	243
2	486
10	2,430

$$
\begin{array}{r}
243 \\
\times\ 12 \\
\hline
486 \\
+\ 2430 \\
\hline
2,916
\end{array}
$$

$$
\begin{array}{r}
2430 \\
+\ 486 \\
\hline
2,916
\end{array}
$$

4. **Show two ways to find each product.**

13 x 12

	10	3
10	100	30
2	20	6

$$
\begin{array}{r}
100 \\
+\ 30 \\
20 \\
6 \\
\hline
156
\end{array}
$$

	12
10	120
3	36

$$
\begin{array}{r}
120 \\
+\ 36 \\
\hline
156
\end{array}
$$

314 x 22

	314
20	6,280
2	628

$$
\begin{array}{r}
6280 \\
+\ 628 \\
\hline
6,908
\end{array}
$$

$$
\begin{array}{r}
314 \\
\times\ 22 \\
\hline
628 \\
+\ 6280 \\
\hline
6,908
\end{array}
$$

Name: KEY

1. **Use the area model to find the product of 24 and 12. Then use the standard algorithm.**

	20	4
10	200	40
2	40	8

$$\begin{array}{r} 200 \\ 40 \\ 40 \\ +\ \ 8 \\ \hline 288 \end{array}$$

$$\begin{array}{r} 24 \\ \times\ 12 \\ \hline 48 \\ +240 \\ \hline 288 \end{array}$$

2. **Use the area model to find the product of 23 and 31. Then use the standard algorithm.**

	23
30	690
1	23

$$\begin{array}{r} 690 \\ +\ 23 \\ \hline 713 \end{array}$$

$$\begin{array}{r} 23 \\ \times\ 31 \\ \hline 23 \\ +690 \\ \hline 713 \end{array}$$

3. **Draw an area model, and then solve using the standard algorithm.**

32 x 13

AREA MODEL	STANDARD ALGORITHM

	32
10	320
3	96

$$\begin{array}{r} 320 \\ +\ 96 \\ \hline 416 \end{array}$$

$$\begin{array}{r} 32 \\ \times\ 13 \\ \hline 96 \\ +\ 320 \\ \hline 416 \end{array}$$

4. **Draw an area model, and then solve using the standard algorithm.**

413 x 21

AREA MODEL	STANDARD ALGORITHM

	400	10	3
20	8000	200	60
1	400	10	3

$$\begin{array}{r} 8260 \\ +\ 413 \\ \hline 8,673 \end{array}$$

$$\begin{array}{r} 413 \\ \times\ 21 \\ \hline 413 \\ +\ 8260 \\ \hline 8,673 \end{array}$$

G5 U2 Lesson 5

Connect area models and the distributive property to partial products of the standard algorithm with renaming

CITYTUTOR DC

G5 U2 Lesson 5 - Students will connect area models and the distributive property to partial products of the standard algorithm with renaming.

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): In our last lesson, we multiplied multi-digit numbers and made connections between the area model and the standard algorithm. In this lesson, we're going to practice that some more. The only difference today is that we'll need to play extra close attention to our units, because some will need to be renamed. Let me show you what I mean.

Let's Talk (Slide 3): Take a look at these two work samples. One shows how to find the product of 12 x 42, and the other shows how to find the product of 36 x 42. What do you notice or wonder about the two samples? Possible Student Answers, Key Points:

- I notice they both have 42 as a factor. I notice they both show the standard algorithm. I notice they both add partial products. I notice 36 x 42 is greater than 12 x 42.
- I wonder why they're different colors. I wonder what the area model would look like for each one. I wonder why the blue one shows regrouping on both lines.

Thanks for sharing! One big difference between these two is that the second example requires us to rename units in our standard algorithm. Last lesson, when we multiplied, we didn't need to rename our units. For example, (*write as you explain)* 2 times 2 ones equals 4 ones. Our unit stayed the same, just ones!

2 x 2 ones = 4 ones

If we were to do 2 times 6 ones (*write as you explain)*, then we'd need to rename our unit. 2 times 6 ones is 12 ones. We can't have more than 9 of a unit in each place value when we write numbers in standard form, so we'd rename 12 ones as 1 ten and 2 ones (*write number bond underneath 12 ones to show 1 ten and 2 ones)*.

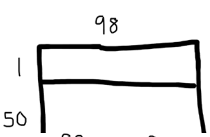
2 x 6 ones = 12 ones

1 ten 2 ones

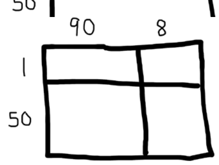
$$\begin{array}{r} 36 \\ \times\ 42 \\ \hline 72 \\ +1440 \\ \hline 1512 \end{array}$$

Look at the second example. They multiplied 6 times 2, and they wrote 2 in the ones place and regrouped 1 ten on the line (*highlight or point to where this shows up in the algorithm example*) We see this type of renaming or regrouping often in addition as well. Today, we'll want to think carefully when we have 10 or more of a unit so that we can rename as we move through out multiplication with the standard algorithm.

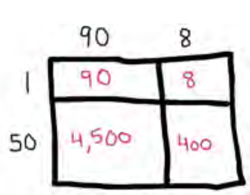
Let's Think (Slide 4): Let's consider how we could draw an area model to find the product of 98 x 51. I can break 51 into 50 and 1 (*draw area model*). Hm, this area model actually doesn't seem that helpful. Why might this area model be challenging to use? Possible Student Answers, Key Points:



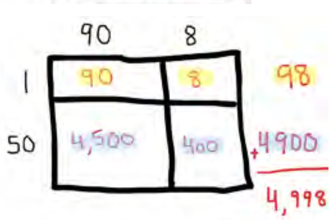
- The numbers are big, so it's hard to think about the partial products in my head.
- I don't know what 98 x 50 is. I'd still have to do some calculations to figure it out.



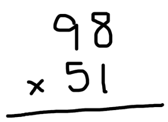
The way I've broken up only one factor could make it challenging to quickly find the partial products. To help, I'll break up the other factor. How can I break up 98 for my area model? (98 is 9 tens, 8 ones, so 90 and 8) Great, let's show that (*partition the area model vertically to show 90 and 8)*. This will be much easier to work with.



Help me out. (*fill in products as student shares*) 90 x 50 is what? (4,500) 8 x 50 is what? (400) What are my remaining two partial products? (90 x 1 = 90, and 8 x 1 = 8) Well done! Let's combine the partial products to get our answer.



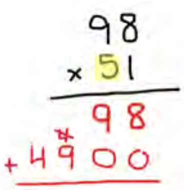
If I combine the partial products for 98 x 1 (*highlight 90 and 8 in a color)*, I get 98. (*write 98 to the side and highlight in the same color)* If I combine the partial products for 98 x 50, I get 4,900 (*write 4,900 to the side and highlight 4,500, 400 and 4,900 in a different color)*. Now we add those together to get our full product of 4,998. We broke apart each factor, found all four partial products, and added them to determine the final product. Nice work!



Let's see what's the same and different about showing this work in vertical form using the standard algorithm. Let's start by neatly stacking our factors. (*write 98 x 51 in vertical form with 98 on top and 51 on bottom)*

(*highlight or point to the 1 in 51)* Let's start by multiplying 98 x 1. 98 x 1 is pretty easy to think about, since 1 is a friendly factor to multiply with. If we were to break this step down, we could think of 8 x 1 = 8 (*point to the digits and then write 8 below the line)* and then 9 tens x 1 is 9 tens. (*point to the digits and then write 9 in the tens place next to the 8)* Where do we see this thinking in our area model? Possible Student Answers, Key Points:

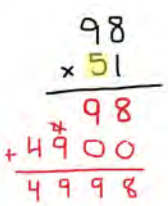
- This is like the top row of our area model where we said 90 x 1 = 90 and 8 x 1 = 8. I see we got 98 when we combined those partial products off to the side of our area model.



Now we have to think about 98 x 50 (*highlight or point to the 5 in 51*). Where do we see 98 x 50 in our area model? Possible Student Answers, Key Points:

- 98 x 50 is in the bottom part of our area model. We did 90 x 50 and 8 x 50, which gave us 4,500 and 400. 98 x 50 is 4,900.

Let's record that in our vertical form. 8 x 50 is 400. *(record 0 in the ones place, 0 in the tens place, and a small 4 above the hundreds place)* 90 x 50 is 4,500. We have to remember that we have 4 hundreds already, so 45 hundred plus 4 hundred is 49 hundred. (*record 4,900 and cross out the small 4 from 400)*



Take a second to add the partial products, and let me know when you're ready. (*wait and support as needed)* Excellent, when we add both partial products we get 4,998. (*write 4,998 in the vertical form)* What's the same about the work we just showed? What's different? Possible Student Answers, Key Points:

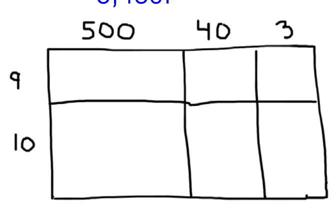
- We used the same factors, 98 and 51, and we ended up with the same answer. Instead of finding four partial products, we found two. The 98 is like when we added the partial products of 90 x 1 and 8 x 1. The 4,900 is like when we added the partial products of 90 x 50 and 8 x 50.

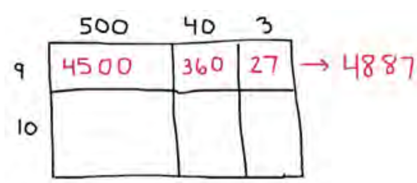
We mentally broke apart 51 into 50 and 1, and we multiplied each part by 98. When we found our partial products, we carefully renamed units when necessary.

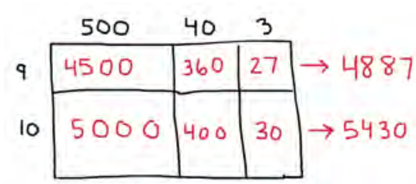
Let's Think (Slide 5): Let's look at one more problem. For this one, I want you to take a second to try to spot the error. If you're not sure at first glance, try making your own area model and compare your work to the work of this student. I'll give you a minute to think and work. Let me know when you're ready. (*wait and support as needed)*

What did you notice this student did to solve? What did they do right? What did they do wrong? (*if student needes support, build an area model following the sequence below to ground the discussion)* Possible Student Answers, Key Points:

- I think this student multiplied 543 x 9 first, and got 4,887. When I did my area model, that part was correct. When the student multiplied 543 x 10, they got 543. That doesn't make sense, because 543 x 1 is 543. 543 times 10 should be 5,430.







This student found two partial products. The first partial product, 543 x 9, is correct. When the student multiplied 543 x 10, they got a product of 543. What do you think led to this mistake? Possible Student Answers, Key Points:

- They probably 543 x 1. Maybe they didn't remember that the 1 in 19 is really 1 ten.

From the work we can see, it seems like the student just multiplied by 1 instead of 1 ten. If he got the correct partial products, we would have seen 4,887 plus 5,430 in their work. What would the correct product be? (10,317) Great!

As we multiply with the algorithm, it's so important to keep the place value of each digit we're multiplying by in mind. If we just multiply by the <u>digit</u> without thinking about its value, our partial products will be incorrect. Be on the lookout for that common error as we work through some more problems.

Let's Try it (Slides 6 - 7): Now let's work together on connecting area models and the distributive property to partial products with the standard algorithm. We'll make area models like we did in previous lessons by breaking apart our factors and carefully multiplying to find each partial product. We'll show that work using our standard algorithm, paying close attention to anytime we have more than ten of a unit so that we rename properly.

WARM WELCOME

Today we will connect area models and the distributive property to partial products of the standard algorithm with renaming

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Let's Talk: **What do you notice or wonder?**

$$\begin{array}{r} 12 \\ \times\ 42 \\ \hline 24 \\ +\ 480 \\ \hline 504 \end{array} \qquad\qquad \begin{array}{r} 36 \\ \times\ 42 \\ \hline 72 \\ +\ 1440 \\ \hline 1512 \end{array}$$

Let's Think: **Use a model and the standard algorithm to find 98 x 51.**

AREA MODEL	STANDARD ALGORITHM

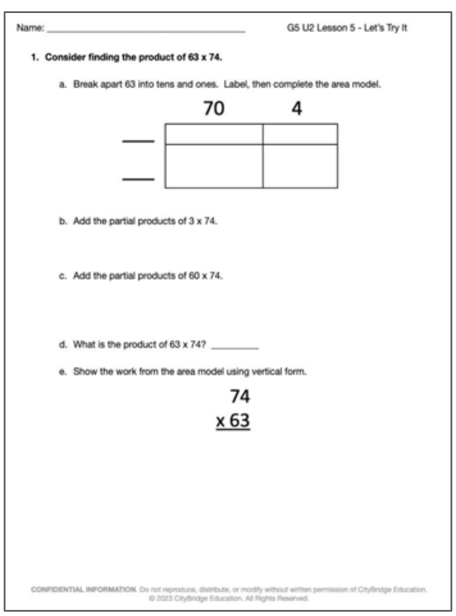
Let's Think:

What mistake did this student make?

$$
\begin{array}{r}
543 \\
\times\ 19 \\
\hline
4887 \\
+\ 543 \\
\hline
5430
\end{array}
$$

Let's Try It:

Let's explore connecting visual models to partial products with the standard algorithm together.



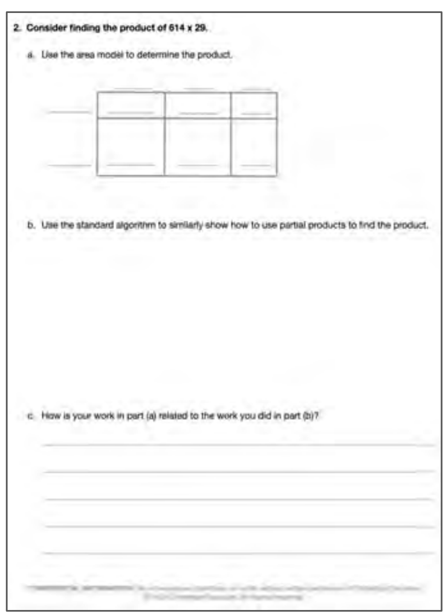
Name: ______________ G5 U2 Lesson 5 - Let's Try It

1. **Consider finding the product of 63 x 74.**
   a. Break apart 63 into tens and ones. Label, then complete the area model.

	70	4
___		
___		

   b. Add the partial products of 3 x 74.
   c. Add the partial products of 60 x 74.
   d. What is the product of 63 x 74? ______
   e. Show the work from the area model using vertical form.

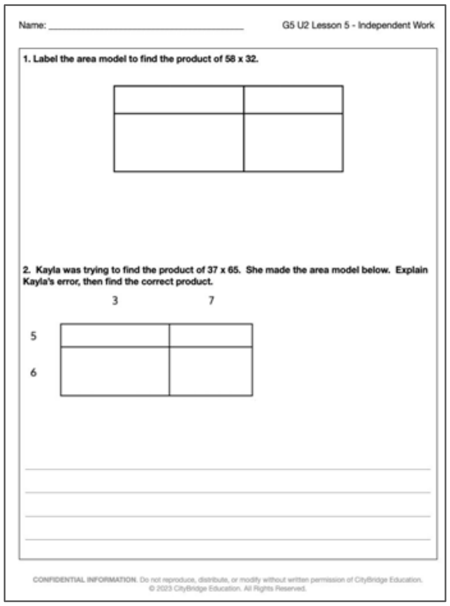
$$
\begin{array}{r}
74 \\
\times\ 63 \\
\hline
\end{array}
$$



2. **Consider finding the product of 614 x 29.**
   a. Use the area model to determine the product.
   b. Use the standard algorithm to similarly show how to use partial products to find the product.
   c. How is your work in part (a) related to the work you did in part (b)?

On your Own:

Now it's time to explore connecting visual models to partial products with the standard algorithm on your own.


Name: ______________________ G5 U2 Lesson 5 - Independent Work

1. Label the area model to find the product of 58 x 32.

2. Kayla was trying to find the product of 37 x 65. She made the area model below. Explain Kayla's error, then find the correct product.

	3	7
5		
6		

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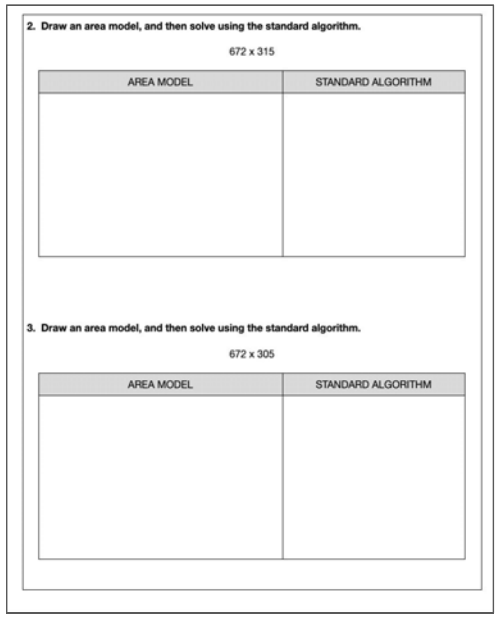

2. Draw an area model, and then solve using the standard algorithm.

672 x 315

AREA MODEL	STANDARD ALGORITHM

3. Draw an area model, and then solve using the standard algorithm.

672 x 305

AREA MODEL	STANDARD ALGORITHM

Name: ____

1. Consider finding the product of 63 x 74.

   a. Break apart 63 into tens and ones. Label, then complete the area model.

	70	4
____		
____		

   b. Add the partial products of 3 x 74.

   c. Add the partial products of 60 x 74.

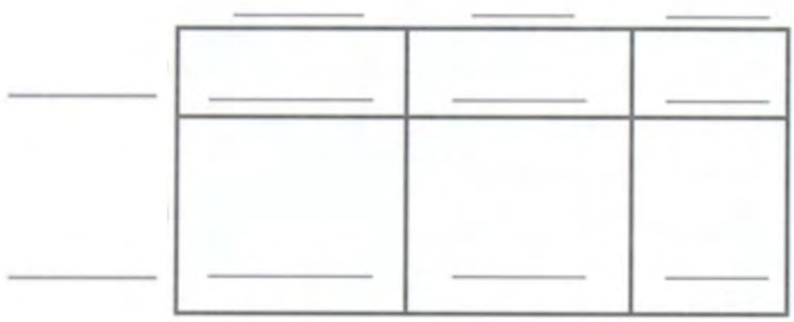
   d. What is the product of 63 x 74? __________

   e. Show the work from the area model using vertical form.

$$\begin{array}{r} 74 \\ \underline{\times\ 63} \end{array}$$

2. Consider finding the product of 614 x 29.

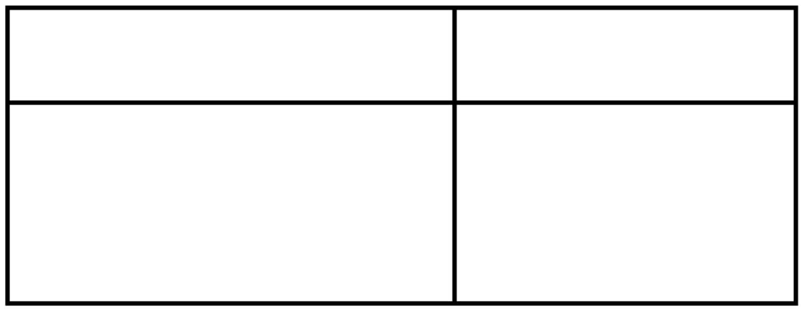
   a. Use the area model to determine the product.



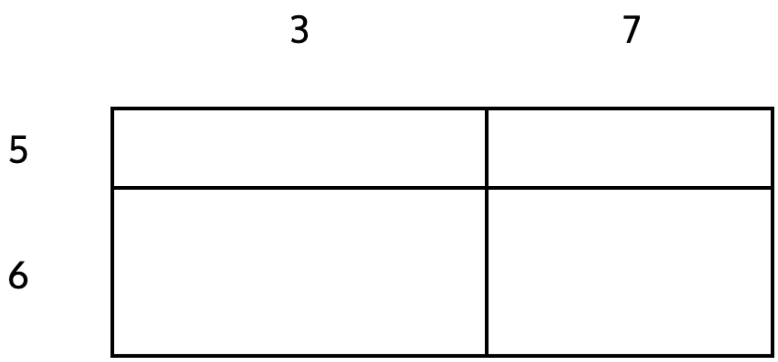
b. Use the standard algorithm to similarly show how to use partial products to find the product.

c. How is your work in part (a) related to the work you did in part (b)?

1. Label the area model to find the product of 58 x 32.



2. Kayla was trying to find the product of 37 x 65. She made the area model below. Explain Kayla's error, then find the correct product.



____

____

____

____

2. Draw an area model, and then solve using the standard algorithm.

672 x 315

AREA MODEL	STANDARD ALGORITHM

3. Draw an area model, and then solve using the standard algorithm.

672 x 305

AREA MODEL	STANDARD ALGORITHM

Name: KEY

1. Consider finding the product of 63 x 74.

a. Break apart 63 into tens and ones. Label, then complete the area model.

	70	4
60	4,200	240
3	210	12

b. Add the partial products of 3 x 74.

$$\begin{array}{r} 210 \\ +\ 12 \\ \hline 222 \end{array}$$

c. Add the partial products of 60 x 74.

$$\begin{array}{r} 4,200 \\ +\ 240 \\ \hline 4,440 \end{array}$$

$$\begin{array}{r} 4,440 \\ +\ 222 \\ \hline 4,662 \end{array}$$

d. What is the product of 63 x 74? 4,662

e. Show the work from the area model using vertical form.

$$\begin{array}{r} 74 \\ \times\ 63 \\ \hline 222 \\ +\ 4440 \\ \hline 4,662 \end{array}$$

2. **Consider finding the product of 614 x 29.**

a. Use the area model to determine the product.

	600	10	4
9	5400	90	36
20	12000	200	80

$$\begin{array}{r} 12{,}000 \\ 5{,}400 \\ 200 \\ 90 \\ 80 \\ +\quad 36 \\ \hline 17{,}806 \end{array}$$

b. Use the standard algorithm to similarly show how to use partial products to find the product.

$$\begin{array}{r} 614 \\ \times\quad 29 \\ \hline 5526 \\ +12280 \\ \hline 17{,}806 \end{array}$$

c. How is your work in part (a) related to the work you did in part (b)?

They both show the same product as a sum of partial products. The area model has 6 partial products, but the algorithm only had 2 partial products.

Name: KEY

1. Label the area model to find the product of 58 x 32.

	50	8	
2	100	16	→ 116
30	1500	240	→ 1740
			1,856

2. Kayla was trying to find the product of 37 x 65. She made the area model below. Explain Kayla's error, then find the correct product.

	30	7
5	150	35
60	1800	420

185
+ 2220
2,405

She did not decompose her factors correctly. 37 is 30 and 7. 65 is 60 and 5.

2. **Draw an area model, and then solve using the standard algorithm.**

672 x 315

AREA MODEL	STANDARD ALGORITHM

	600	70	2
300	180000	21000	600
10	6000	700	20
5	3000	350	10

$$\begin{array}{r} 201600 \\ 6720 \\ +\ 3360 \\ \hline 211680 \end{array}$$

$$\begin{array}{r} 672 \\ \times\ 315 \\ \hline 3360 \\ 6720 \\ +\ 201600 \\ \hline 211{,}680 \end{array}$$

3. **Draw an area model, and then solve using the standard algorithm.**

672 x 305

AREA MODEL	STANDARD ALGORITHM

	600	70	2
300	180000	21000	600
5	3000	350	10

$$\begin{array}{r} 672 \\ \times\ 305 \\ \hline 3360 \\ +\ 201600 \\ \hline 204{,}960 \end{array}$$

$$\begin{array}{r} 201{,}600 \\ +\ 3360 \\ \hline 204{,}960 \end{array}$$

G5 U2 Lesson 6

Fluently multiply multi-digit whole numbers using the standard algorithm

CITYTUTOR DC

G5 U2 Lesson 6 - Students will fluently multiply multi-digit whole numbers using the standard algorithm and use estimation to check for the reasonableness of the product.

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): Today we will continue to use the standard algorithm to multiply multi-digit numbers like we have been doing in previous lessons. What makes today unique is that we're going to focus on estimating our products to make sure that the answers we get are reasonableness. Estimating can be very useful! It can help us get a sense of what our product should be close to, and estimating can also help us avoid common place value errors when multiplying.

Let's Talk (Slide 3): Imagine for as second that you're at the store, and you see some big screen TVs on sale for a major discount. The sign says they're on sale for $199. It's such a good deal, that you want to buy four of the TV sets. You don't have a calculator or anything to write with, but you want to know about how much that will cost. Can you think of a way that you could estimate about how much money 4 TV sets will cost? Possible Student Answers, Key Points:

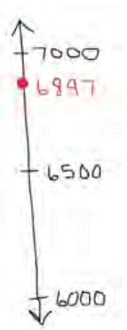
- I notice that $199 is almost $200, which is easier to think about. If you bought 4 TV sets that each cost about $200, you could think 4 x 200 = 800. You'd spend about $800.

Great thinking! We can use estimation when we're in a hurry or when we don't need to think about the exact product. If we are calculating the exact product, we can use estimation as a way to make sure our answer is reasonable. We'll use estimation today to help us think about products as we multiply multi-digit whole numbers.

Let's Think (Slide 4): Let's estimate and then find the product of 6,897 and 206. To start with, let's round each factor to its greatest place value. We could round to other place values if we wanted to, but rounding to the greatest place value will often be the most efficient way to determine a general estimate of the product. Let's round 6,897 to the nearest thousand. How can I determine which thousand 6,897 rounds to?

Possible Student Answers, Key Points:

- We can use a number line. We can think about which two thousands the number is between, so 6,000 and 7,000. Then we can think about whether 6,897 is greater than or less than the halfway point of 6,500.

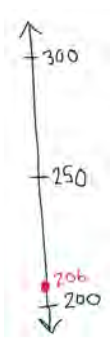


There are many ways we can think about rounding. I'm going to use a vertical number line to quickly think about which two thousands 6,897 is between (*sketch vertical number line, and label 6,000 at the bottom and 7,000 at the top*). I know our number is greater than 6,000 and less than 7,000. To determine which benchmark thousand our factor is closest to, I need to think about the halfway point. What is halfway between 6,000, and 7,000? (6,500) Great, let's label that and then roughly plot where 6,897 would go on our number line. (*label a halfway tickmark with 6,500 and label 6,897 on the number line)* Which thousand is 6,897 closest to? (7,000) We can say 6,897 rounds to 7,000, or (*write as you speak)* 6,500 $\approx$ 7,000.

Let's round our other factor, 206, to the nearest hundred. Why might I not need to go through the process of drawing a number line to round 206? Possible Student Answers, Key Points:

- 206 is a smaller number than 6,897 so it's easier to think about. I know 206 is *really* close to 200, so it's simpler to round in my head; it's obvious that it's closer to 200 than 300.

Nice. You don't always need to use a vertical number line to round, but it can help if you're not certain which benchmark to round to.



Here is what 206 rounded to the nearest hundred would look like. 206 is in between 200 and 300 (*label 200 at the bottom and 300 at the top)*. Halfway between 200 and 300 is 250, so I can label my halfway tickmark as 250. (*label halfway as 250)* I know 206 would go about here (*label 206 close to 200*), so I can clearly see that 206 rounds to 200.

From this point on, as you work, choose the rounding strategy that works best for you.

ESTIMATE

7000 x 200

≈ 1400000

So 7,000 x 200 (*fill in 7,000 x 200*) means our estimated product would…hm, that's a lot of zeroes, and I want to be careful about the place value, so let's think about unit form. What is my expression in unit form? (7 thousand x 2 hundred)

7 thousand × 2 hundred = 14 hundred thousand

(*write the equation in unit form*) So I know my answer would be 14 hundred thousands, because 7 x 2 is 14 and thousands x hundreds is hundred thousands. I can write 14 hundred thousands as 1,400,000. (*fill in 1,400,000*) Our final product should be about 1,400,000.

$$\begin{array}{r} 6897 \\ \times \quad 206 \\ \hline \end{array}$$

Now let's calculate the actual product. Let's start by stacking our numbers vertically, so that we can use the standard algorithm. (*neatly stack 6,897 over 206 in vertical form*)

$$\begin{array}{r} 6897 \\ \times \quad 206 \\ \hline {}^{5\,5\,4} \\ 41382 \end{array}$$

Let's start by multiplying 6,897 x 6. 7 x 6 is 42. (*write 2 beneath the line and a small 4 on the line in the tens place*) 9 tens x 6 is 54 tens, plus the 4 renamed tens is 58 tens. (*write 8 beneath the line in the tens place and a small 5 on the line in the hundreds place*) 8 hundreds x 6 is 48 hundreds plus the 5 renamed hundreds is 53 hundreds. (*write 3 beneath the line in the hundreds place and a small 5 on the line in the thousands place*) Lastly, 6 thousands x 6 is 36 thousands plus the 5 renamed thousands is 41 thousands. *(write 41 thousands beneath the line)*. So 6,897 x 6 is 41,382. We multiplied 6,897 by the ones place of 206. Do I need to multiply by the tens place in 206? Possible Student Answers, Key Points:

- No, there are zero tens in the tens place of 206.
- You can, but 6,897 x 0 tens would just be zero.

$$\begin{array}{r} 6897 \\ \times \quad 206 \\ \hline {}^{1\,1\,1\,\cancel{5}\,\cancel{5}\,\cancel{4}} \\ 41382 \\ +1379400 \\ \hline \end{array}$$

Okay, so let's multiply 6,897 x 2 hundreds. (*cross out renamed digits from previous multiplication*) 7 times 2 hundred is 14 hundred. (*write 4 in the hundreds place and a small 1 on the line in the thousands place*) 9 tens times 2 hundred is 18 thousand plus the 1 renamed thousand is 19 thousand. (*write 9 in the thousands place and a small 1 on the line in the ten thousands place*) 8 hundred times 2 hundred is 16 ten thousands, plus the 1 renamed ten thousand is 17 ten thousands. (*write 7 in the ten thousands place and a small 1 on the line in the hundred thousands place)* Lastly, 6 thousand times 2 hundred is 12 hundred thousand, plus the 1 renamed hundred thousand is 13 hundred thousand. (*write 13 hundred thousand)* 6,897 times 200 is 1,379,400.

$$\begin{array}{r} 6897 \\ \times \quad 206 \\ \hline {}^{1\,1\,1\,\cancel{5}\,\cancel{5}\,\cancel{4}} \\ 41382 \\ +1379400 \\ \hline 1420782 \end{array}$$

Now we can add the partial products. Take a moment to add the two partial products. Let me know when you're ready to check. (*wait as needed*) When we added the two partial products, we got 1,420, 782. Is our answer reasonable? How do you know? Think back to your estimate to explain your reasoning.
Possible Student Answers, Key Points:

- Yes, our answer is reasonable. We estimated that the answer would be close to 1,400,000. The actual product is 1,420,782 which is not far from our estimate.

Excellent! We estimated that the product would be close to 1,400,000 and it was. Our actual product seems reasonable based on the estimate we found earlier.

Let's Think (Slide 5): Let's consider one more problem. This problem says that Lily thought 30,000 was a reasonable estimate for 613 x 482. How could we assess whether her estimate is reasonable without actually solving for 613 times 482? Possible Student Answers, Key Points:

- We could round each of the factors to use mental math to multiply and find an estimate.

Let's round 613 and 482 to the greatest place value. How can we round them? Possible Student Answers, Key Points:

- We can think about which two hundreds each factor is between to figure out which one each is closest to. If we're not sure, we can use a vertical number line to visualize the rounding.

600 × 500 = ?

613 is in between 600 and 700. 613 is less than the halfway point of 650, so 613 rounds to 600. 482 is in between 400 and 500. 482 is more than the halfway point of 450, so 482

rounds to 500. How can we use unit form to help us estimate 600 x 500? Possible Student Answers, Key Points:

- We can think about 6 hundred x 5 hundred. I know 6 x 5 is 30, and hundreds times hundreds is ten thousands. Our estimate is 30 ten thousands.

To find 6 hundreds times 5 hundreds, we can multiply 6 times 5 and hundreds times hundreds. 6 x 5 = 30 and hundreds x hundreds = ten thousands. Our estimate is 30 ten thousands, which is 300,000. Is Lily's estimate reasonable? Possible Student Answers, Key Points:

- No, Lily said the estimate is 30,000. 30,000 is not close to 300,000 at all! She most likely didn't think about her place value carefully when she estimated.

Her estimate is not reasonable. Maybe she thought 30 ten thousands was written as 30,000. Regardless, a better estimate is 300,000. When we estimate, it's crucial that we think carefully about the units we are multiplying.

Let's Try it (Slides 6 - 7): Now let's work together on fluently multiplying multi-digit factors and estimating to assess the reasonableness of the product. We can round each factor to quickly find an estimated product, work carefully by showing our work using the standard algorithm, and then check our product against our original estimate to make sure we ended up with something reasonable.

WARM WELCOME

Today we will fluently multiply multi-digit whole numbers using the standard algorithm and using estimation to check for reasonableness of the product.

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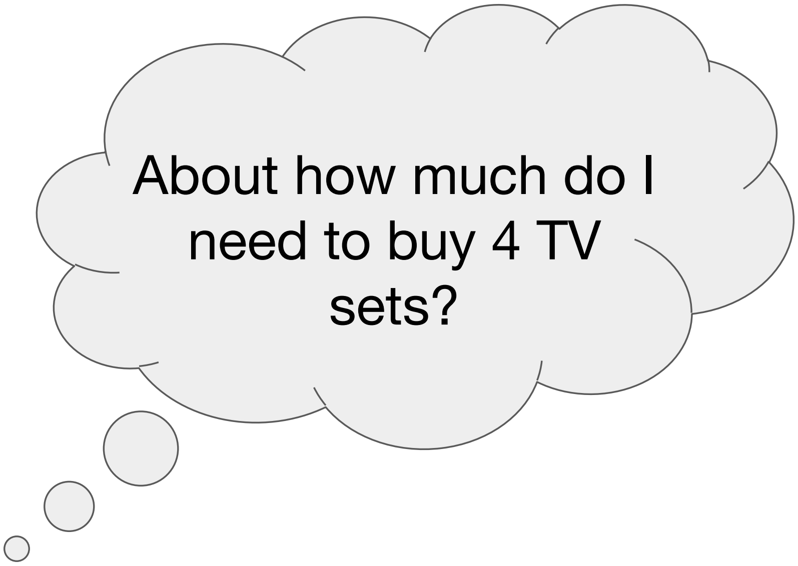
Let's Talk:



Let's Think:

Estimate the product of 6,897 and 206. Then find the actual product.

ESTIMATE

_______ x _______

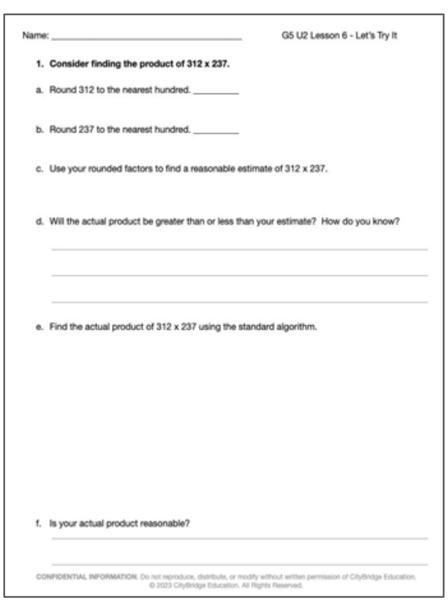
≈ __________

Let's Think:

Lily says that 30,000 is a reasonable estimate for 613 x 482. Do you agree or disagree?

Let's Try It:

Let's explore using estimation to assess the reasonableness of products.


Name: ______________________ G5 U2 Lesson 6 - Let's Try It

1. Consider finding the product of 312 x 237.

a. Round 312 to the nearest hundred. ________

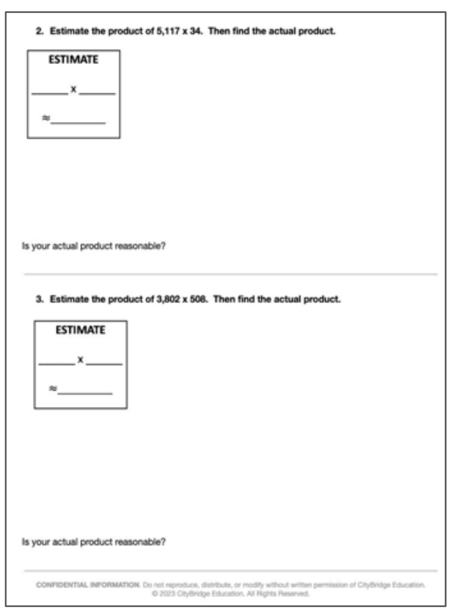
b. Round 237 to the nearest hundred. ________

c. Use your rounded factors to find a reasonable estimate of 312 x 237.

d. Will the actual product be greater than or less than your estimate? How do you know?

e. Find the actual product of 312 x 237 using the standard algorithm.

f. Is your actual product reasonable?


2. Estimate the product of 5,117 x 34. Then find the actual product.

ESTIMATE

______ x ______

≈ ________

Is your actual product reasonable?

3. Estimate the product of 3,802 x 508. Then find the actual product.

ESTIMATE

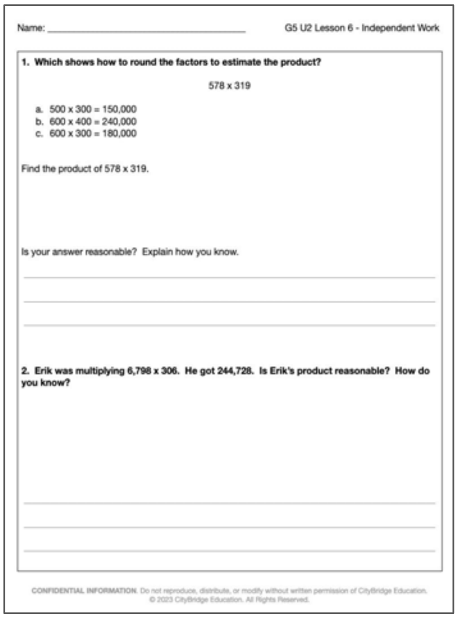
______ x ______

≈ ________

Is your actual product reasonable?

On your Own:

Now it's time to use estimation to assess the reasonableness of products on your own.



Name: ______________________ G5 U2 Lesson 6 - Independent Work

1. Which shows how to round the factors to estimate the product?

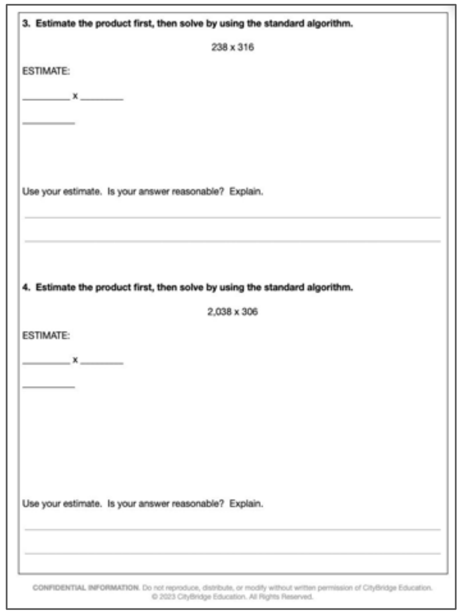
578 x 319

a. 500 x 300 = 150,000
b. 600 x 400 = 240,000
c. 600 x 300 = 180,000

Find the product of 578 x 319.

Is your answer reasonable? Explain how you know.

2. Erik was multiplying 6,798 x 306. He got 244,728. Is Erik's product reasonable? How do you know?



3. Estimate the product first, then solve by using the standard algorithm.

238 x 316

ESTIMATE:

________ x ________

____

Use your estimate. Is your answer reasonable? Explain.

4. Estimate the product first, then solve by using the standard algorithm.

2,038 x 306

ESTIMATE:

________ x ________

____

Use your estimate. Is your answer reasonable? Explain.

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Name: ____

1. Consider finding the product of 312 x 237.

a. Round 312 to the nearest hundred. __________

b. Round 237 to the nearest hundred. __________

c. Use your rounded factors to find a reasonable estimate of 312 x 237.

d. Will the actual product be greater than or less than your estimate? How do you know?

____

____

____

e. Find the actual product of 312 x 237 using the standard algorithm.

f. Is your actual product reasonable?

____

____

2. Estimate the product of 5,117 x 34. Then find the actual product.

ESTIMATE

_______ x _______

≈__________

Is your actual product reasonable?

---

3. Estimate the product of 3,802 x 508. Then find the actual product.

ESTIMATE

_______ x _______

≈__________

Is your actual product reasonable?

---

1. Which shows how to round the factors to estimate the product?

578 x 319

a. 500 x 300 = 150,000
b. 600 x 400 = 240,000
c. 600 x 300 = 180,000

Find the product of 578 x 319.

Is your answer reasonable? Explain how you know.

____

____

____

2. Erik was multiplying 6,798 x 306. He got 244,728. Is Erik's product reasonable? How do you know?

____

____

____

3. Estimate the product first, then solve by using the standard algorithm.

238 x 316

ESTIMATE:

__________ x __________

____

Use your estimate. Is your answer reasonable? Explain.

---

4. Estimate the product first, then solve by using the standard algorithm.

2,038 x 306

ESTIMATE:

____________ x ___________

____

Use your estimate. Is your answer reasonable? Explain.

Name: KEY

1. Consider finding the product of 312 x 237.

a. Round 312 to the nearest hundred. 300

b. Round 237 to the nearest hundred. 200

c. Use your rounded factors to find a reasonable estimate of 312 x 237.

300×200

$(3 \times 2) \times (100 \times 100)$

$6 \times 10{,}000$

$\boxed{60{,}000}$

d. Will the actual product be greater than or less than your estimate? How do you know?

The actual product will be greater, because I rounded both factors down.

e. Find the actual product of 312 x 237 using the standard algorithm.

$$
\begin{array}{r}
312 \\
\times\ 237 \\
\hline
2184 \\
9360 \\
+\ 61400 \\
\hline
72{,}944
\end{array}
$$

f. Is your actual product reasonable? Yes, because 72,944 is fairly close to 60,000.

2. **Estimate the product of 5,117 x 34. Then find the actual product.**

ESTIMATE
5000 x 30
≈ 150,000

$$\begin{array}{r} 5117 \\ \times \quad 34 \\ \hline 20468 \\ +153510 \\ \hline 173{,}978 \end{array}$$

Is your actual product reasonable?

Yes, because 173,978 is fairly close to 150,000.

3. **Estimate the product of 3,802 x 508. Then find the actual product.**

ESTIMATE
4000 x 500
≈ 2,000,000

$$\begin{array}{r} 3802 \\ \times \quad 508 \\ \hline 30416 \\ +1901000 \\ \hline 1{,}931{,}416 \end{array}$$

Is your actual product reasonable?

Yes. It is a little less than my estimate.

Name: KEY

1. Which shows how to round the factors to estimate the product?

578 x 319

600 300

a. 500 x 300 = 150,000
b. 600 x 400 = 240,000
c. 600 x 300 = 180,000

Find the product of 578 x 319.

$$
\begin{array}{r}
578 \\
\times\ 319 \\
\hline
5202 \\
5780 \\
+\ 173400 \\
\hline
184382
\end{array}
$$

Is your answer reasonable? Explain how you know.

Yes. My estimate was 180,000 which is pretty close to 184,382.

2. Erik was multiplying 6,798 x 306. He got 244,728. Is Erik's product reasonable? How do you know?

7000 × 300 ≈ 2,100,000

His answer is not reasonable. It is too small. It should be about 2,100,000.

3. **Estimate the product first, then solve by using the standard algorithm.**

238 x 316

ESTIMATE:

200 x 300

60,000

$$
\begin{array}{r}
238 \\
\times\ 316 \\
\hline
1428 \\
2380 \\
+\ 71400 \\
\hline
75{,}208
\end{array}
$$

Use your estimate. Is your answer reasonable? Explain.

It's a little off, but 75,208 is still reasonable based on my estimate.

4. **Estimate the product first, then solve by using the standard algorithm.**

2,038 x 306

ESTIMATE:

2000 x 300

600,000

$$
\begin{array}{r}
2038 \\
\times\ 306 \\
\hline
12228 \\
+\ 611400 \\
\hline
623{,}628
\end{array}
$$

Use your estimate. Is your answer reasonable? Explain.

Yes, 623,628 is not far off of 600,000.

G5 U2 Lesson 7

Fluently multiply multi-digit whole numbers using the standard algorithm to solve multi-step word problems

CITYTUTOR DC

G5 U2 Lesson 7 - Students will fluently multiply multi-digit whole numbers using the standard algorithm to solve multi-step word problems.

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): For the past several lessons, we've been working on multiplying multi-digit whole numbers using the standard algorithm. We've seen that we need to play close attention to the units we are multiplying, and we've seen how estimation can help make sure the product we get is reasonable. Today, we're going to tie all that hard work together to tackle multi-step word problems.

Let's Talk (Slide 3): Let's look at these two questions. As we read, I want you thinking about what is the same and different about these two questions. (*read both questions*) What did you notice? Possible Student Answers, Key Points:

- They both are about Louis. They both involve 5 bags with 6 books in each bag.
- The second question is longer and asks for the cost rather than how many books. The second question looks like it has two parts to it.

The first question here is considered a one-step problem, because it takes one step to solve. The second question is considered a multi-step problem, because it will take more than one step to solve. These are the types of questions we'll think about today. Since we'll be dealing with multiple steps, we'll want to make sure we keep our work organized so our steps don't get mixed up. We'll also want to draw models to help us think about each step of the problem and use estimation to make sure our answers are reasonable. Let's try one out!

Let's Think (Slide 4): Let's read this problem. "A school prints 1,324 copies of a 26 page newsletter. The school also prints 539 copies of a 15 page handbook. How many pages did the school print in all?" I'm going to read it one more time, and I want you to be thinking about what information we <u>know</u> and what information we're trying to <u>find out</u>. (*re-read*)

What information do we know based on this problem? (*sketch a T-chart labeled "know" and "find out" and fill in information as the student shares*) Possible Student Answers, Key Points:

- The school needs 1,324 newsletters. Each newsletter is 26 pages.
- The school needs 539 handbooks. Each handbook is 15 pages.

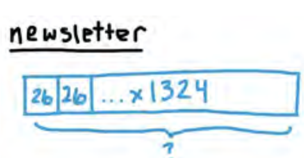
What information do we need to find out based on this problem? (*fill in information as the student shares*) Possible Student Answers, Key Points:

- We need to figure out how many pages are needed for all the newsletters. We need to figure out how many pages are needed for all the handbooks.
- We need to figure out how many pages they need copied altogether.

Based on this, we know a lot that can help us find out the information we need. Let's work systematically to figure out each piece of information we need. We'll use models and estimation along the way.

Let's Think (Slide 5): I separated my workspace into three sections. Why do you think I did that for this problem? Possible Student Answers, Key Points:

- This will keep our work organized. We need to find out three pieces of information to arrive at our answer.



It's always important to organize your work, and especially so when we have a few steps. Let's start by thinking about the newsletter. (*label the first section "newsletter"*) We know that each newsletter is 26 pages, and we need 1,324 of them. I can draw a tape diagram (*draw a long rectangle*) and cut it into pieces to represent each newsletter. (*partition one box and write 26 in it*) This box represent a newsletter that needs 26 pages. (*partition a second box and write 26 in it*) Here is another newsletter that needs 26 pages. How many do I need? (1,324 newsletters) That's a lot to draw! I'll just write "...x 1,324" in this extra space so I know how many newsletters there should be. (*write that in the tape diagram*)

Now we're about ready to figure out how many pages the school needs to copy for the newsletter. I can multiply 1,324 x 26 to find the total, because I need 1,324 groups of 26. How could we find a reasonable estimate for what the product should be? *(write EST: 30 x 1,000 = 30,000 underneath the tape diagram after student shares)*

EST: $30 \times 1000 = 30{,}000$

Possible Student Answers, Key Points:
- We can round each factor and multiply.
- 26 rounded to the nearest ten is 30. 1,324 rounded to the nearest thousand is 1,000. So, 30 x 1,000 is 30,000. They'll need about 30,000 pages.

$$\begin{array}{r} 1324 \\ \times\ 26 \\ \hline 7944 \end{array}$$

Now let's find the actual product. (*write 1,324 x 26 in vertical form)* Take a moment to find 1,324 x 6. When you're ready, let me know and we can check the partial product. (*wait, support student as needed, and fill in vertical form*) 1,324 times 6 is 7,944.

$$\begin{array}{r} 1324 \\ \times\ 26 \\ \hline 7944 \\ +26480 \\ \hline 34424 \end{array}$$

What is 1,324 x 20 or 2 tens? Take a moment to find 1,324 x 20. Let me know when you're ready. (*wait, support student as needed, and fill in vertical form*). 1,324 x 20 is 26,480. What is the final product, once we add the two partial products? (34,424) Excellent. Is our answer reasonable, so far? How do you know?
Possible Student Answers, Key Points:
- Our estimate from earlier was 30,000. Our actual product is 34,424, which is fairly close. I think the product is reasonable.

We've found one of our pieces of information. We know the school will need 34,424 pages copied to make all the newsletters. What information should we try to find out next? Look back at our list if you need a reminder. (We need to know how many copies they need to print the handbooks)

handbooks

(*label the next section of work with the word "handbooks")* We know we need 534 copies of the handbook and that each copy requires 15 pages. What could the model look like to help us think about how many pages we need for all the handbooks? (*sketch tape diagram as student explains, supporting as needed)* Possible Student Answers, Key Points:
- It can look similar to the other tape diagram we drew. We can draw a rectangle for the total, and put 15 in each partitioned box. Instead of drawing 534 boxes, we can write "...x 534" so we know how many there are.

Now I see we need 534 groups of 15, or 534 x 15. Before we calculate how many pages the school needs for all handbook, what is a reasonable estimate for the product? *(write EST: 20 x 500 = 10,000 underneath the tape diagram after student shares)* Possible Student Answers, Key Points:

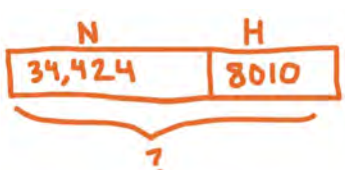
EST: $20 \times 500 = 10{,}000$

- 15 rounds to 20, and 534 rounds to 500. 20 x 500 means our answer should be about 10,000. I know 2 x 5 = 10 and hundreds x tens = thousands.

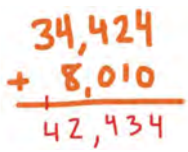
$$\begin{array}{r} 534 \\ \times\ 15 \\ \hline 2670 \\ +5340 \\ \hline 8010 \end{array}$$

The school will need about 10,000 pages to make all the copies of the handbook. Let's find the actual product now. Stack each factor in vertical form. I want you to find 534 x 5 and 534 x 10, and then add the partial products. Let me know when you're ready or if you have a question, and I'll support. (*wait and provide support as needed*)

Nicely done! 534 x 5 = 2,670. 534 x 10 = 5,340. When we add both partial products together, we get a product of 8,010. Explain how you know our answer is reasonable. Possible Student Answers, Key Points:
- Our estimated product was 10,000. 8,010 is not too far off from that.



We've put in a lot of work, and we're almost done. What was the final thing we needed to figure out? (How many total pages the school needed to print.) Right! We want to combine the copies needed for the newsletter (*draw a box labeled N and write 34,424 inside*) and the copies needed for the handbook (*draw an adjacent box labeled H and write 8,010 inside*) to determine how many copies the school needs in all. Can you think of a way we could determine a reasonable estimate? Then, we'll calculate our final answer. Possible Student Answers, Key Points:
- 34,424 is close to 34,000. 8,010 is close to 8,000. If we combine those, 34,000 + 8,000 is 42,000.



Take a second to add the two actual amounts. When you're ready, what's the total number of pages the school needs copied? (42,434 pages) (*support as needed, and write out the addition in vertical form)* It looks like our actual answer, 42,434 pages is reasonable, because your estimate was 40,000 pages. Excellent work with each step.

Multi-step problems require some extra thought and attention. What did we do throughout this problem to keep ourselves on track?
Possible Student Answers, Key Points:

- We listed out what we knew and what we needed to find out.
- We organized our workspace so that our work did not get jumbled.
- We drew a model and estimated before each step we took. We checked for reasonableness at each stage.

Let's Try it (Slides 6 - 7):   Now let's work together on fluently multiplying multi-digit factors to solve multi-step word problems. Before solving every problem, we pause and think about what we know and what we're trying to find out. Drawing a picture or a model can help us think about a solution pathway that makes sense to us, and estimation can make sure our final answer is reasonable and makes sense.. Once we're ready, we can carefully make our calculations to arrive at an accurate answer.

WARM WELCOME

Today we will fluently multiply multi-digit whole numbers using the standard algorithm to solve multi-step word problems.

Let's Talk:

What do you notice and wonder about these two problems?

Louis has 5 bags with 6 books in each bag.

How many books does Louis have?

Louis has 5 bags with 6 books in each bag.

Each book cost $7. How much money did Louis spend on all the books?

Let's Think:

A school prints 1,324 copies of a 26 page newsletter. The school also prints 539 copies of a 15 page handbook. How many pages did the school print in all?

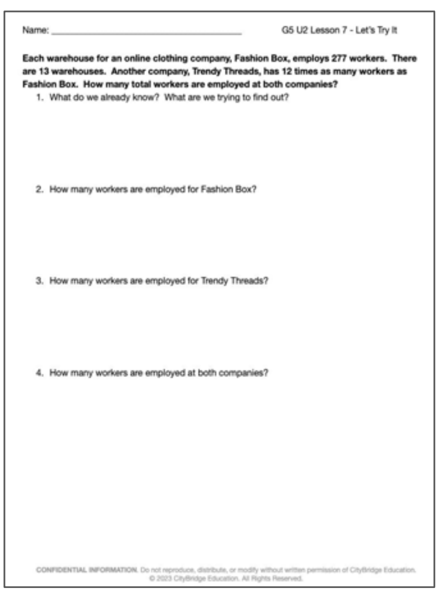
What do I know?
What am I trying to find out?

Let's Think:

A school prints 1,324 copies of a 26 page newsletter. The school also prints 539 copies of a 15 page handbook. How many pages did the school print in all?

Let's Try It:

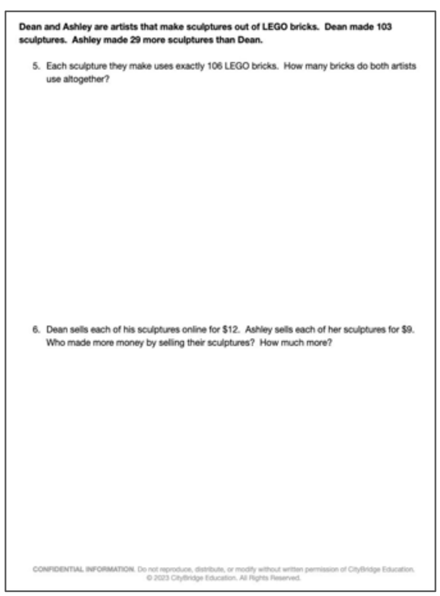
Let's explore using the standard algorithm to solve multi-step problems together.



Name: ______________________ G5 U2 Lesson 7 - Let's Try It

Each warehouse for an online clothing company, Fashion Box, employs 277 workers. There are 13 warehouses. Another company, Trendy Threads, has 12 times as many workers as Fashion Box. How many total workers are employed at both companies?

1. What do we already know? What are we trying to find out?
2. How many workers are employed for Fashion Box?
3. How many workers are employed for Trendy Threads?
4. How many workers are employed at both companies?



Dean and Ashley are artists that make sculptures out of LEGO bricks. Dean made 103 sculptures. Ashley made 29 more sculptures than Dean.

5. Each sculpture they make uses exactly 106 LEGO bricks. How many bricks do both artists use altogether?
6. Dean sells each of his sculptures online for $12. Ashley sells each of her sculptures for $9. Who made more money by selling their sculptures? How much more?

On your Own:

Now it's time to use the standard algorithm to solve multi-step problems on your own.

Name: ______________________________ G5 U2 Lesson 7 - Independent Work

1. Each auditorium at a movie theater has 289 seats.

a. If there are 14 auditoriums, how many people would it take to fill every seat in the movie theater?

b. The movie theater company plans to build a new movie theater complex that holds 12 times as many people. How many people will fit in the new movie theater?

2. Gary is lining the edge of 2 rectangular rugs with decorative trim. Each rug measures 9 feet long and 7 feet wide. If it takes Gary 3 minutes to attach 1 inch of trim, how many minutes will it take him to complete the project? Write an expression, and then solve.

3. A tutoring company employs 27 tutors. The manager pays each tutor $510 per week. After one week, the manager has $152 left in the bank account. How much money did the manager have at first?

4. Sylvia owns a hotel. She buys 36 new televisions that each cost $1,334. She also buys 19 desks for $649 each. How much does Sylvia spend in all? Write an expression, and then solve.

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Each warehouse for an online clothing company, Fashion Box, employs 277 workers. There are 13 warehouses. Another company, Trendy Threads, has 12 times as many workers as Fashion Box. How many total workers are employed at both companies?

1. What do we already know? What are we trying to find out?

2. How many workers are employed for Fashion Box?

3. How many workers are employed for Trendy Threads?

4. How many workers are employed at both companies?

Dean and Ashley are artists that make sculptures out of LEGO bricks. Dean made 103 sculptures. Ashley made 29 more sculptures than Dean.

5. Each sculpture they make uses exactly 106 LEGO bricks. How many bricks do both artists use altogether?

6. Dean sells each of his sculptures online for $12. Ashley sells each of her sculptures for $9. Who made more money by selling their sculptures? How much more?

1. Each auditorium at a movie theater has 289 seats.

   a. If there are 14 auditoriums, how many people would it take to fill every seat in the movie theater?

   b. The movie theater company plans to build a new movie theater complex that holds 12 times as many people. How many people will fit in the new movie theater?

2. Gary is lining the edge of 2 rectangular rugs with decorative trim. Each rug measures 9 feet long and 7 feet wide. If it takes Gary 3 minutes to attach 1 inch of trim, how many minutes will it take him to complete the project? Write an expression, and then solve.

3. A tutoring company employs 27 tutors. The manager pays each tutor $510 per week. After one week, the manager has $152 left in the bank account. How much money did the manager have at first?

4. Sylvia owns a hotel. She buys 36 new televisions that each cost $1,334. She also buys 19 desks for $649 each. How much does Sylvia spend in all? Write an expression, and then solve.

Name: KEY

Each warehouse for an online clothing company, Fashion Box, employs 277 workers. There are 13 warehouses. Another company, Trendy Threads, has 12 times as many workers as Fashion Box. How many total workers are employed at both companies?

1. What do we already know? What are we trying to find out?

KNOW
- FB has 13 warehouses → 277 workers in each
- TT has 12 x as many employees

FIND OUT
- How many workers are there in all?

2. How many workers are employed for Fashion Box?

277 workers × 13 warehouses

$$\begin{array}{r} 277 \\ \times\ 13 \\ \hline 831 \\ +\ 2770 \\ \hline 3601 \end{array}$$

FB → 3,601 workers

3. How many workers are employed for Trendy Threads?

12 × 3,601

	10	2
3601	36010	7202

$$\begin{array}{r} 36010 \\ +\ 7202 \\ \hline 43,212 \end{array}$$

43,212 workers TT

4. How many workers are employed at both companies?

$$\begin{array}{r} 43,212 \\ +\ 3,601 \\ \hline 46,813 \end{array}$$

46,813 total workers

Dean and Ashley are artists that make sculptures out of LEGO bricks. Dean made 103 sculptures. Ashley made 29 more sculptures than Dean.

5. Each sculpture they make uses exactly 106 LEGO bricks. How many bricks do both artists use altogether?

A | 103 | 29 |

D | 103 |

? sculptures

$$\begin{array}{r} 103 \\ 103 \\ +\ 29 \\ \hline 235 \end{array}$$

235 sculptures

235 × 106 = ?
sculptures bricks

$$\begin{array}{r} 235 \\ \times\ 106 \\ \hline 1410 \\ +\ 23500 \\ \hline 24{,}910 \end{array}$$

24,910 bricks

6. Dean sells each of his sculptures online for $12. Ashley sells each of her sculptures for $9. Who made more money by selling their sculptures? How much more?

DEAN

103 × $12

$$\begin{array}{r} 103 \\ \times\ 12 \\ \hline 206 \\ +\ 1030 \\ \hline \$1{,}236 \end{array}$$

ASHLEY

132 × 9

$$\begin{array}{r} 132 \\ \times\ 9 \\ \hline \$1188 \end{array}$$

1236 > 1188

Dean earns more money.

$$\begin{array}{r} 1236 \\ -\ 1188 \\ \hline 48 \end{array}$$

He earns $48 more.

Name: KEY

1. Each auditorium at a movie theater has 289 seats.

a. If there are 14 auditoriums, how many people would it take to fill every seat in the movie theater?

$\underset{\text{seats}}{289} \times \underset{\text{aud.}}{14} = ?$

$$\begin{array}{r} 289 \\ \times \quad 14 \\ \hline 1156 \\ +\ 2890 \\ \hline 4{,}046 \end{array}$$

4,046 people

b. The movie theater company plans to build a new movie theater complex that holds 12 times as many people. How many people will fit in the new movie theater?

$4046 \times 12 = ?$

$$\begin{array}{r} 4046 \\ \times \quad 12 \\ \hline 8092 \\ +\ 40460 \\ \hline 48{,}552 \end{array}$$

48,552 people

2. Gary is lining the edge of 2 rectangular rugs with decorative trim. Each rug measures 9 feet long and 7 feet wide. If it takes Gary 3 minutes to attach 1 inch of trim, how many minutes will it take him to complete the project? Write an expression, and then solve.

$3 \text{ min} = 1 \text{ inch}$ (×12)

$36 \text{ min} = 1 \text{ foot}$ (×12)

$\underbrace{2 \times (9+9+7+7)}_{\text{perimeter of 2 rugs}} \times \underbrace{36}_{\text{time per foot}}$

$2 \times 32 \times 36$

64×36

2,304 minutes

	60	4
30	1800	120
6	360	24

$$\begin{array}{r} 1920 \\ +\ 384 \\ \hline 2304 \end{array}$$

3. **A tutoring company employs 27 tutors. The manager pays each tutor $510 per week. After one week, the manager has $152 left in the bank account. How much money did the manager have at first?**

$\underbrace{?}_{\text{TOTAL}} - \underbrace{(27 \times 510)}_{\text{TUTOR PAY}} = 152$

$$\begin{array}{r} 510 \\ \times \quad 27 \\ \hline 3570 \\ +10200 \\ \hline \$13{,}770 \end{array}$$

tutor pay

$? - 13{,}770 = 152$

$$\begin{array}{r} 13770 \\ +\quad 152 \\ \hline \$13{,}922 \end{array}$$

4. **Sylvia owns a hotel. She buys 36 new televisions that each cost $1,334. She also buys 19 desks for $649 each. How much does Sylvia spend in all?** Write an expression, and then solve.

$$\underbrace{\overset{\text{TV}}{\boxed{36 \times 1334}}\ \overset{\text{DESK}}{\boxed{19 \times 649}}}_{?}$$

$(36 \times 1334) + (19 \times 649)$

$$\begin{array}{r} 1334 \\ \times \quad 36 \\ \hline 8004 \\ 40020 \\ \hline \$48{,}024 \end{array}$$

TV

$$\begin{array}{r} 649 \\ \times \quad 19 \\ \hline 5841 \\ +6490 \\ \hline \$12{,}331 \end{array}$$

DESKS

$$\begin{array}{r} 48{,}024 \\ +\ 12{,}331 \\ \hline \$60{,}355 \end{array}$$

G5 U2 Lesson 8

Multiply decimal fractions with tenths by multi-digit whole numbers using place value understanding to record partial products

G5 U2 Lesson 8 - Students will multiply decimal fractions with tenths by multi-digit whole numbers using place value understanding to record partial products

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): We've been working to multiply multi-digit whole numbers for the past several lessons. Have you ever wondered: What happens if one of our factors is a decimal? Today, you'll be able to answer that question! We're going to find out how to multiply multi-digit whole numbers by decimal fractions with tenths.

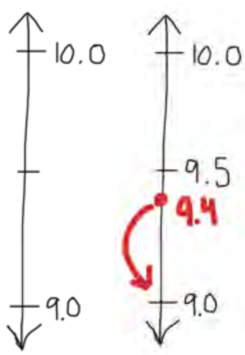
Let's Talk (Slide 3): Take a look at the pairs of equations you see here. I'll give a minute to look over them, and I want you to think about what you notice or wonder about the pairs of equations. (*wait*) Possible Student Answers, Key Points:

- I notice each pair uses the same digits, but one of the equations has decimals in it.
- I notice the first equation in each pair uses whole numbers, and the second equation has whole numbers and decimals in the tenths place.
- I notice the first product is always a whole number, and the second product ends in the tenths place.

When we multiply a whole number by a decimal fraction, or decimal number,in the tenth place, we'll see that the only thing that we have to consider differently is the place value. Let's learn what that looks like and why it works.

Let's Think (Slide 4): Let's think about the problem 52 x 9.4. Before we multiply, let's estimate. How could we round these factors to find a reasonable estimate of the product? Possible Student Answers, Key Points:

- We could round each number to the nearest ten or whole number, and multiply them together.

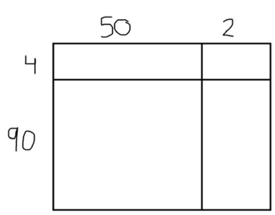


Sure! How would you round 52? (It's close to 50) 50 will work. Now let's think about 9.4. We'll round it to the nearest whole number, or to the one's place. If you're not sure what it rounds to right away, know that we can round 9.4 the same way we'd round whole numbers on a vertical number line. I know 9.4 is in between 9 wholes and 10 wholes. (*label 9.0 and 10.0 on a vertical number line*) Halfway between 9.0 and 10.0 is 9.5 or 9 and 5 tenths. (*label 9.5*) Where would we place 9.4 on the vertical number line, and what would it round to? Possible Student Answers, Key Points:

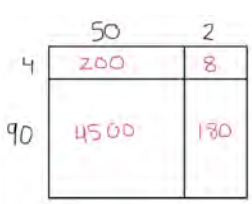
- .4 is a little less than 9.5, so I'd label it right below 9.5 9.4 is closer to 9 than to 10, so 9.4 rounds to 9.

Based on our rounding, we could think of a reasonable estimate for 52 x 9.4 as being 50 x 9. Our actual product should be about 450.

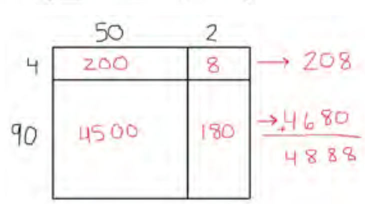
Now let's actually multiply 52 x 9.4. To do that, let's think of 9.4 as only tenths. How can we write 9.4 as just tenths? (94 tenths) So we can think about this problem as 52 x 94 tenths.



Let's set up an area model as if we're multiplying 52 x 94, and we'll keep in the back of our mind that the 94 is actually tenths. Don't forget that, we'll come back to it, I promise! (*sketch a 2x2 area model decomposed with 50 and 2 on top and 4 and 90 along the side)* When you're ready, take a moment to find each partial product like we've done in previous area models. Let me know when you're ready to check our answers. (*wait, and support as needed)*

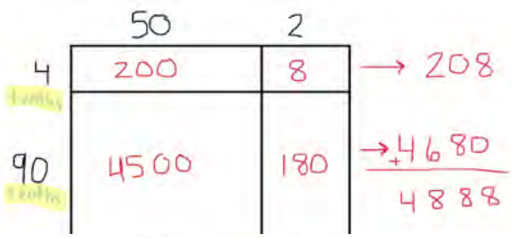


50 x 4 is 200, 2 x 4 is 8, 50 x 90 is 4,500, and 2 x 90 is 180. Combine the partial products for 52 x 4 and for 52 x 90, and let me know when you're ready to check. (*wait, and support as needed*) Let's check! (*write out 208 and 4,680 to the side of the area model, and then write the sum of 4,888)*

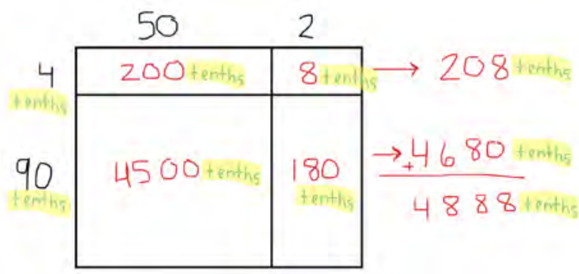


When we combine 208 and 4,680 we end up with a product of 4,888. So 52 x 94 = 4,888. Is 4,888 a reasonable product for 52 x 9.4? Possible Student Answers, Key Points:

- No! Our estimate was 450, so 4,888 is way too big. Maybe it has something to do with the decimal.



Remember when we started our area model, I told you to keep in mind that the 90 and 4 actually represented 90 tenths and 4 tenths from 94 tenths. Let's keep our work, and think about tenths. (*label tenths under 90 and 4*)



We were multiplying by 94 tenths, not 94. So our partial products, should also be tenths. Think about it! 50 x 4 tenths isn't 200, it's 200 tenths. 2 x 4 tenths isn't 8, it's 8 tenths. 50 x 90 tenths isn't 4,500, it's 4,500 tenths. 2 x 90 tenths isn't 180, it's 180 tenths. (*label each partial product as tenths, including the final product)*

So, if we've been dealing with tenths this whole time, what is 4,888 tenths? (488.8) 488.8 is a much more reasonable product based on our estimate, than 4,888. (*write 488.8)*

488.8

So when we multiply a whole number by a decimal fraction in the tenths, we can think of the digits as if they were simply a whole number, then multiply, then think of our partial products as tenths to make sure the digits in our answer are in the proper place value. Our estimate is also a great way to make sure the place value of the digits in the product make sense.

Let's Think (Slide 5): Before we jump into practicing, let's look at Janiya's sample work. She used the standard algorithm to multiply 13.4 times 7 instead of using an area model. Janiya did a lot of really strong work, and she also made one common error. Take 1 minute to look at Janiya's work. While you review her work, I want you to start thinking about what Janiya did correctly. (*wait*) What do you notice Janiya did well? Possible Student Answers, Key Points:

- She lined up her numbers, stacking them according to place value. She multiplied each digit correctly, and renamed units when necessary. Her product is correct had she been multiplying 134 x 7.

Nearly all of her computation is correct, which brings me back to the original questions being asked. What mistake did she make? What is the correct answer?
Possible Student Answers, Key Points:

- She wrote tenths next to 134 to remember that she was multiplying by 13.4, but she forgot to write her product as tenths. 134 tenths x 7 would not be 938 ones; it would be 938 tenths.
- The correct product is 9.38.

$13.4 \approx 10$

$10 \times 7 = 70$

Nice work! Another tool we have to make sure our answer is reasonable is estimation. 13.4 is about 10 (*write 13.4 is approximately 10)*, so 10 x 7 means our answer should be about 70. (*write 10 x 7 = 70)* That alone tells me 938 is definitely too big. We always want to make sure we keep track of the place value of our factors, so that the place value of digits in our product is accurate.

At the beginning of our lesson, I said you'd be able to answer the question: "What happens if one of our factors is a decimal?" Having seen a couple examples so far, how would you answer that question? Possible Student Answers, Key Points:

- It's fairly similar, just the place value is different.
- The process of multiplying by a decimal fraction isn't too different from multiplying with whole numbers. We can actually treat the decimal fraction as if it was a whole number to multiply the digits like we usually do; we just have to remember that, if we're multiplying a whole number by tenths, the answer we get needs to be in the tenths place.

Let's Try it (Slides 6 - 7): Now let's work together to multiply decimal fractions with tenths by multi-digit whole numbers using place value understanding. We've seen already that multiplying with decimal fractions has a lot in common with multiplying with whole numbers. One major difference that we'll keep an eye out for is keeping track of the place value of our factors and the final product.

WARM WELCOME

Today we will multiply decimal fractions with tenths by multi-digit whole numbers using place value understanding to record partial products

Let's Talk:

What do you notice and wonder about the equations shown here?

$50 \times 3 = 150$

$5.0 \times 3 = 15.0$

$3 \times 17 = 51$

$3 \times 1.7 = 5.1$

$123 \times 6{,}987 = 859{,}401$

$123 \times 698.7 = 85{,}940.1$

Let's Think:

What is 52 x 9.4?

ESTIMATE

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Let's Think:

Janiya multiplied 13.4 x 7. What mistake did she make? What is the correct answer?

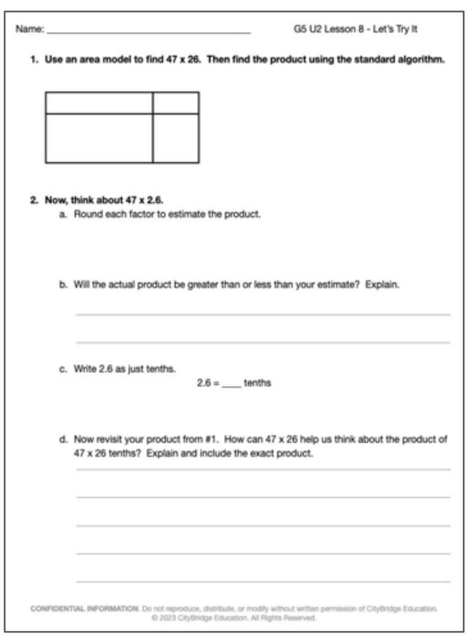
134 tenths

$$\begin{array}{r} 134 \\ \times\ 7 \\ \hline 9\ 38 \end{array}$$

938

Let's Try It:

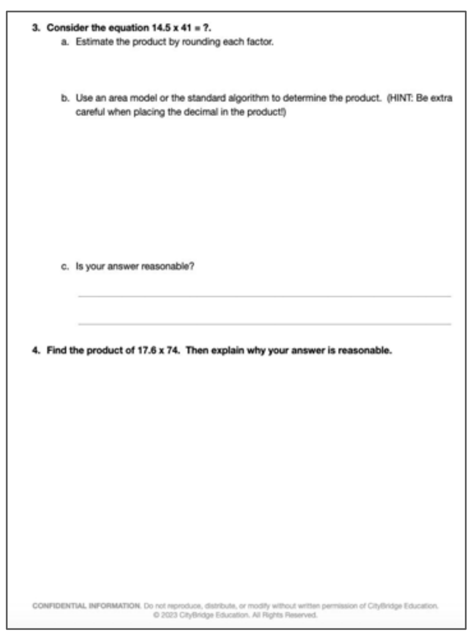
Let's explore multiplying decimal fractions with tenths by multi-digit whole numbers together.



Name: ______________________ G5 U2 Lesson 8 - Let's Try It

1. **Use an area model to find 47 x 26. Then find the product using the standard algorithm.**

2. **Now, think about 47 x 2.6.**
   a. Round each factor to estimate the product.
   b. Will the actual product be greater than or less than your estimate? Explain.
   c. Write 2.6 as just tenths.
   2.6 = ____ tenths
   d. Now revisit your product from #1. How can 47 x 26 help us think about the product of 47 x 26 tenths? Explain and include the exact product.

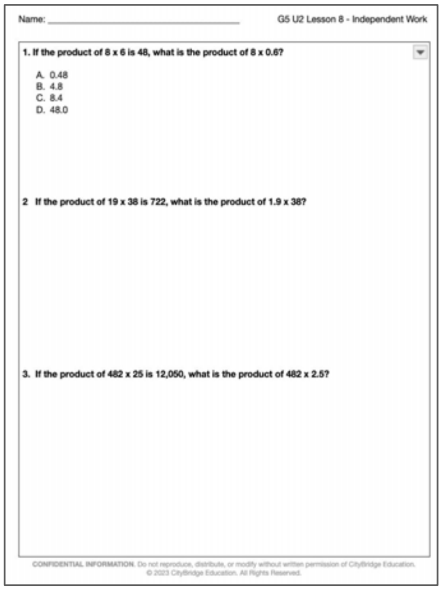


3. **Consider the equation 14.5 x 41 = ?.**
   a. Estimate the product by rounding each factor.
   b. Use an area model or the standard algorithm to determine the product. (HINT: Be extra careful when placing the decimal in the product!)
   c. Is your answer reasonable?

4. **Find the product of 17.6 x 74. Then explain why your answer is reasonable.**

On your Own:

Now it’s time to multiply decimal fractions with tenths by multi-digit whole numbers on your own.


Name: ______________________ G5 U2 Lesson 8 - Independent Work

1. If the product of 8 x 6 is 48, what is the product of 8 x 0.6?

A. 0.48
B. 4.8
C. 8.4
D. 48.0

2 If the product of 19 x 38 is 722, what is the product of 1.9 x 38?

3. If the product of 482 x 25 is 12,050, what is the product of 482 x 2.5?

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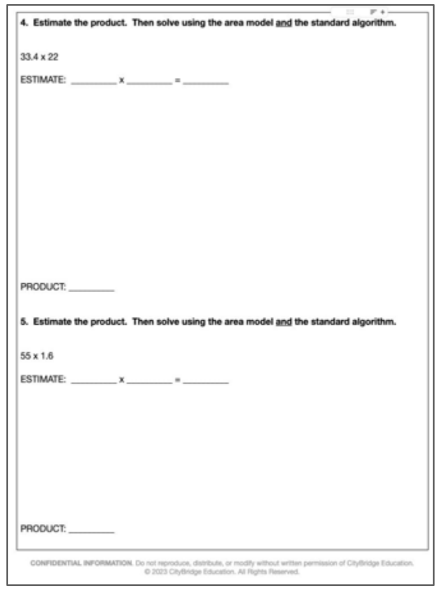
4. Estimate the product. Then solve using the area model and the standard algorithm.

33.4 x 22

ESTIMATE: _______ x _______ = _______

PRODUCT: _______

5. Estimate the product. Then solve using the area model and the standard algorithm.

55 x 1.6

ESTIMATE: _______ x _______ = _______

PRODUCT: _______

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Name: ____ G5 U2 Lesson 8 - Let's Try It

1. Use an area model to find 47 x 26. Then find the product using the standard algorithm.

2. Now, think about 47 x 2.6.
   a. Round each factor to estimate the product.

   b. Will the actual product be greater than or less than your estimate? Explain.

   ____

   ____

   c. Write 2.6 as just tenths.

   2.6 = _____ tenths

   d. Now revisit your product from #1. How can 47 x 26 help us think about the product of 47 x 26 tenths? Explain and include the exact product.

   ____

   ____

   ____

   ____

   ____

3. Consider the equation 14.5 x 41 = ?.
   a. Estimate the product by rounding each factor.

b. Use an area model or the standard algorithm to determine the product. (HINT: Be extra careful when placing the decimal in the product!)

c. Is your answer reasonable?

4. Find the product of 17.6 x 74. Then explain why your answer is reasonable.

1. If the product of 8 x 6 is 48, what is the product of 8 x 0.6?

   A. 0.48
   B. 4.8
   C. 8.4
   D. 48.0

2 If the product of 19 x 38 is 722, what is the product of 1.9 x 38?

3. If the product of 482 x 25 is 12,050, what is the product of 482 x 2.5?

4. Estimate the product. Then solve using the area model <u>and</u> the standard algorithm.

33.4 x 22

ESTIMATE: __________ x __________ = __________

PRODUCT: ___________

5. Estimate the product. Then solve using the area model <u>and</u> the standard algorithm.

55 x 1.6

ESTIMATE: ___________ x ___________ = ___________

PRODUCT: ___________

Name: KEY

G5 U2 Lesson 8 - Let's Try It

1. Use an area model to find 47 x 26. Then find the product using the standard algorithm.

	40	7
6	240	42
20	800	140

$$\begin{array}{r} 282 \\ +\ 940 \\ \hline 1{,}222 \end{array}$$

$$\begin{array}{r} 47 \\ \times\ 26 \\ \hline 282 \\ +\ 940 \\ \hline 1{,}222 \end{array}$$

2. Now, think about 47 x 2.6.

a. Round each factor to estimate the product.

47 ≈ 50

2.6 ≈ 3

50 × 3 = 150

b. Will the actual product be greater than or less than your estimate? Explain.

It will be less since I rounded each factor up.

c. Write 2.6 as just tenths.

2.6 = 26 tenths

d. Now revisit your product from #1. How can 47 x 26 help us think about the product of 47 x 26 tenths? Explain and include the exact product.

47 × 26 is 1,222. So, I know 47 × 26 tenths is 1,222 tenths. The product is 122.2.

3. **Consider the equation 14.5 x 41 = ?.**

a. Estimate the product by rounding each factor.

15 × 40 = ? ≈ 600

b. Use an area model or the standard algorithm to determine the product. (HINT: Be extra careful when placing the decimal in the product!)

```
   1 4 5
 ×   4 1
 -------
   1 4 5
+5 8 0 0
 -------
 5 9 4 5
```

145 tenths × 41 = 5945 tenths

594.5

c. Is your answer reasonable?

Yes. 594.5 is close to 600.

4. **Find the product of 17.6 x 74. Then explain why your answer is reasonable.**

$\boxed{\text{EST.}}$

18 × 70

(10×70) + (8×70)

700 + 560

1260

```
     1 7 6
   ×   7 4
   -------
     7 0 4
+1 2 3 2 0
 ---------
 1 3 0 2 4
```

176 tenths × 74 = 13024 tenths

$\boxed{1,302.4}$

My product is close to my estimate of 1,260.

Name: KEY

1. **If the product of 8 x 6 is 48, what is the product of 8 x 0.6?**

A. 0.48
B. 4.8
C. 8.4
D. 48.0

8 x 6 tenths = 48 tenths

2 **If the product of 19 x 38 is 722, what is the product of 1.9 x 38?**

19 tenths x 38 = 722 tenths

72.2

3. **If the product of 482 x 25 is 12,050, what is the product of 482 x 2.5?**

482 x 25 tenths = 12050 tenths

1205.0

OR

1,205

4. **Estimate the product. Then solve using the area model and the standard algorithm.**

33.4 x 22

ESTIMATE: 30 x 20 = 600

	30	3	0.4
20	600	60	8
2	60	6	0.8

$$\begin{array}{r} 668 \\ +\ 66.8 \\ \hline 734.8 \end{array}$$

$$\begin{array}{rl} 334 & \text{tenths} \\ \times\ 22 & \\ \hline 668 & \\ +\ 6680 & \\ \hline 7348 & \text{tenths} \end{array}$$

↓

734.8

PRODUCT: 734.8

5. **Estimate the product. Then solve using the area model and the standard algorithm.**

55 x 1.6

ESTIMATE: 60 x 2 = 120

	50	5
1	50	5
0.6	30	3

$$\begin{array}{r} 55 \\ +\ 33 \\ \hline 88 \end{array}$$

$$\begin{array}{rl} 55 & \\ \times\ 16 & \text{tenths} \\ \hline 330 & \\ +\ 550 & \\ \hline 880 & \text{tenths} \end{array}$$

↓

88.0

PRODUCT: 88

G5 U2 Lesson 9

Multiply decimal fractions by multi-digit whole numbers through conversion to a whole number problem

G5 U2 Lesson 9 - Students will multiply decimal fractions by multi-digit whole numbers through conversion to a whole number problem and reasoning about the placement of the decimal

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): In our previous lesson we started to learn about what happens when we're multiplying, but one of our factors is a decimal in the tenths place (*write 12.7 x 18 as an example*). We noticed how we can multiply our factors as if they were both whole numbers, and then we could reason about the factor in the tenths once we finished multiplying. Today, we're going to see problems where one factor is in the hundredths (*write 1.27 x 18 as an example*). Before we see an example, what do you predict might be the same or different about multiplying with decimal factors in the hundredths place? Possible Student Answers, Key Points:

12.7×18

1.27×18

- We might still multiply the numbers like they were whole numbers.
- Maybe our answer will be in the hundredths place.
- Maybe the work looks same.

Let's find out if any of your predictions come true!

Let's Talk (Slide 3): Imagine you and your friend are at the store. Your friend wants to buy some pens, and says this (*read from slide*): "I want to buy 3 pens that each cost $1.02. I multiplied 3 x 1.02 and got 306. Yikes! The pens cost $306?" What is your initial reaction to your friend? Possible Student Answers, Key Points:

- That does seem pretty expensive. Maybe their math is wrong.
- I think they forgot about the decimal. Their place value is incorrect in the product.

Could an estimate help your friend think about the total cost of the pens? How could you estimate the product? Possible Student Answers, Key Points:

- $1.02 is really close to $1, so they can think about the easier fact of 1 x 3. The total for the pens should be close to $3. $306 is nowhere near $3.

$$\begin{array}{r} 102 \text{ hundredths} \\ \times \quad 3 \\ \hline \end{array}$$

Let's use vertical form to think about $1.02 x 3. Kind of similar to the previous lesson with tenths, I'm going to think of $1.02 as 102 hundredths times 3. This way I can multiply like I normally do, and then worry about the place value later. (*write 102 hundredths x 3 in vertical form*)

$$\begin{array}{r} 102 \text{ hundredths} \\ \times \quad 3 \\ \hline 306 \end{array}$$

When we multiply, (*fill in product below the line as you explain, one digit at a time*) 2 x 3 is 6, 0 x 3 is 0, and 1 x 3 is 3. 102 x 3 = 306. But what is important to remember at this point? (the place value of 102, or hundredths) Right, I can't forget about the fact that we were multiplying by hundredths.

$$\begin{array}{r} 102 \text{ hundredths} \\ \times \quad 3 \\ \hline 3.06 \end{array}$$

So if 102 x 3 = 306, then I know 102 hundredths x 3 = 306 hundredths. I can write that as 306 in the hundredths place, or 3.06. (*highlight or circle the word hundredths, and dramatically insert a decimal into the product*)

The correct product of $3.06 not only makes sense in terms of the cost of pens, but it also is more in line with the estimate we made a few moments ago.

Let's Think (Slide 4): Let's look at one more problem before we get a chance to practice some together. This problem wants us to estimate 301.44 x 23, and then find the actual product. We'll want to pay close attention to the place value of our factors and our product so that we end up with a reasonable answer.

$301.44 \approx 300$

$23 \approx 20$

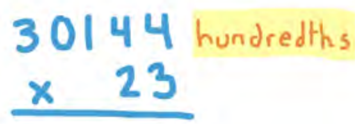
$300 \times 20 = 6000$

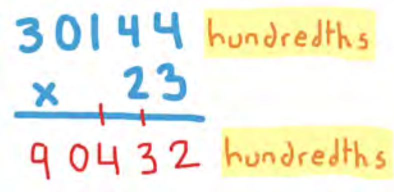
Let's start by estimating. We've done a lot of estimating, so I'll let you help me out. How would you estimate the product of 301.44 x 23? (*write as student shares, supporting as needed*) Possible Student Answers, Key Points:

- 301.44 is really close to 300. 23 is in between 20 and 30, but it's closer to 20. I can estimate by thinking about 300 x 20. A reasonable product should be about 6,000.

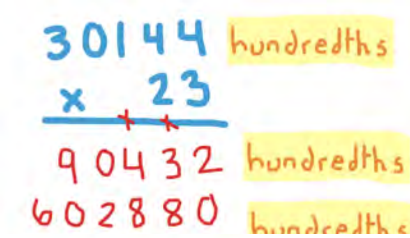
I'll keep that in the back of my head for when I arrive at the actual product. Our actual product should be about 6,000.

Now let's multiply. I can use an area model or the standard algorithm, depending on what I find more efficient in the moment. I'm going to stack my numbers vertically and use the algorithm for this problem. (*write 30144 x 23 in vertical form)* What do you notice I did with the first factor? (You removed the decimal and wrote it as a whole number) Great! But simply removing the decimal will change the value of the number, which I certainly don't want to do. I'm going to write hundredths off to the side, so I know this 30,144 actually means 30,144 hundredths. (*write hundredths next to 30,144)* Let's start multiplying. I'm going to start by finding 30,144 hundredths times 3.

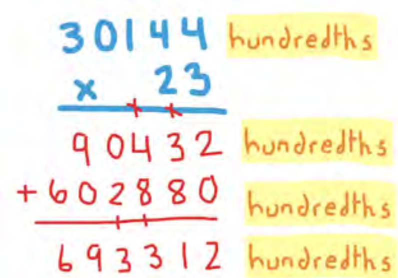




(*write each digit in the partial product below the line as you explain)* 4 x 3 is 12, so I will write a 2 in the ones place and regroup 1 ten on the line. 4 tens x 3 is 12 tens, plus 1 ten makes 13 tens. I'll write 3 in the tens place and regroup 1 hundred on the line. 1 hundred x 3 is 3 hundreds, plus 1 hundred makes 4 hundreds. 0 thousands x 3 makes 0 thousands. 3 ten thousands x 3 makes 9 ten thousands. So, 30,144 times 3 is equal to 90,432. We were actually multiplying 30,144 hundredths times 3, so I'm going to make sure I note that this partial product is actually 90,432 hundredths. (*write hundredths to the side*)

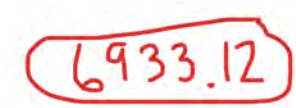


Now we can multiply 30,144 x 20. (*write each digit in the partial product below the first partial product as you explain)* 4 x 2 tens is 8 tens. I'll write an 8 in the tens place and 0 in the ones place. 4 tens x 2 tens is 8 hundreds. 1 hundred x 2 tens is 2 thousand. 0 thousands x 2 tens is 0 ten thousands. 3 ten thousands x 2 tens is 6 hundred thousands. Let's remember to label this partial product as hundredths since we were multiplying 30,144 hundredths by 20. (*label hundredths)*



Take a moment to add the partial products. Let me know what you get. *(wait and validate or support as needed)* When I add 90,432 and 602,880, I get 693,312. Why would that not be a reasonable product? Possible Student Answers, Key Points:

- When we estimated, we noted that our answer should be about 6,000. 693,312 is far too big to be a reasonable product.
- We didn't factor in the fact that our product should end in the hundredths place.



If 30,144 x 23 = 693,312, then I know 30,144 hundredths x 23 = 693,312 hundredths. 693,312 hundredths would be the same digits, ending in the hundredths place. Our final product is 6,933.12, (*write it)* which is much more reasonable given our estimate.

Let's Try it (Slides 5 - 6): Now let's work together to multiply decimal fractions by multi-digit whole numbers through conversion to a whole number problem. We know from our previous lesson and today's lesson that multiplying with decimal factors has a lot in common with multiplying with whole numbers. We will want to make an estimate before we multiply and carefully keep track of the place value of factors so that the final product is reasonable for the given factors.

WARM WELCOME

Today we will multiply decimal fractions by multi-digit whole numbers through conversion to a whole number problem and reasoning about the placement of the decimal

Let's Talk:

I want to buy 3 pens that each cost $1.02.

I multiplied 3 x 1.02 and got 306.

Yikes! The pens cost $306?

I think I know what's going on here…

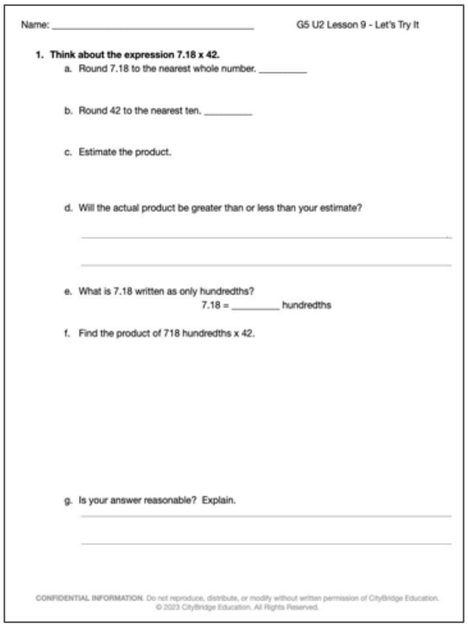
Let's Think:

What is 301.44 x 23?

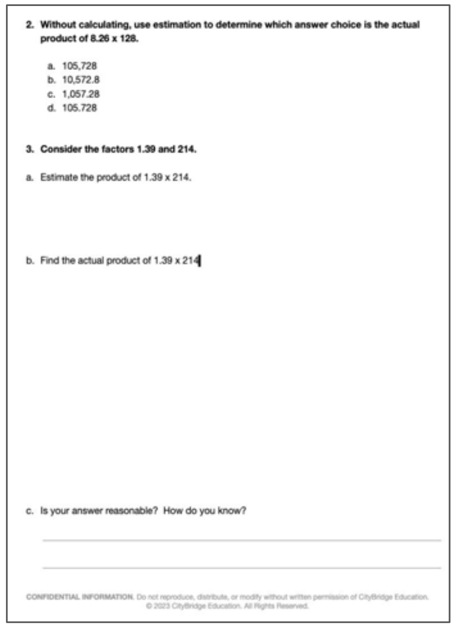
ESTIMATE

Let's Try It:

Let's explore multiplying decimal fractions by multi-digit whole numbers together.


Name: ______________________ G5 U2 Lesson 9 - Let's Try It

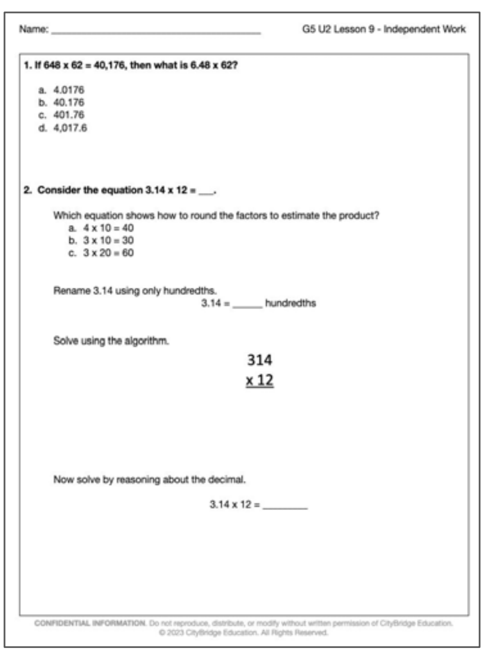
1. **Think about the expression 7.18 x 42.**
   a. Round 7.18 to the nearest whole number. ________
   b. Round 42 to the nearest ten. ________
   c. Estimate the product.
   d. Will the actual product be greater than or less than your estimate?
   e. What is 7.18 written as only hundredths?
      7.18 = ________ hundredths
   f. Find the product of 718 hundredths x 42.
   g. Is your answer reasonable? Explain.


2. **Without calculating, use estimation to determine which answer choice is the actual product of 8.26 x 128.**
   a. 105,728
   b. 10,572.8
   c. 1,057.28
   d. 105.728

3. **Consider the factors 1.39 and 214.**
   a. Estimate the product of 1.39 x 214.
   b. Find the actual product of 1.39 x 214
   c. Is your answer reasonable? How do you know?

On your Own:

Now it's time to multiply decimal fractions by multi-digit whole numbers on your own.


Name: ______________________ G5 U2 Lesson 9 - Independent Work

1. If 648 x 62 = 40,176, then what is 6.48 x 62?
   a. 4.0176
   b. 40.176
   c. 401.76
   d. 4,017.6

2. Consider the equation 3.14 x 12 = ___.

Which equation shows how to round the factors to estimate the product?
   a. 4 x 10 = 40
   b. 3 x 10 = 30
   c. 3 x 20 = 60

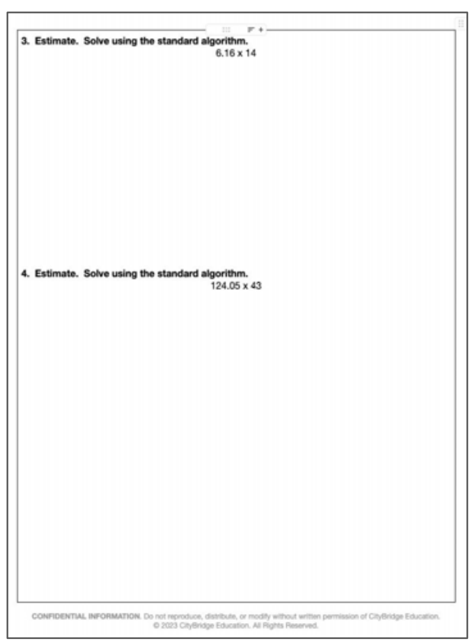
Rename 3.14 using only hundredths.
3.14 = _____ hundredths

Solve using the algorithm.

314
x 12

Now solve by reasoning about the decimal.

3.14 x 12 = _______


3. **Estimate. Solve using the standard algorithm.**
6.16 x 14

4. **Estimate. Solve using the standard algorithm.**
124.05 x 43

1. Think about the expression 7.18 x 42.
   a. Round 7.18 to the nearest whole number. __________
   b. Round 42 to the nearest ten. __________
   c. Estimate the product.
   d. Will the actual product be greater than or less than your estimate?

      ____

      ____

   e. What is 7.18 written as only hundredths?

      7.18 = __________ hundredths

   f. Find the product of 718 hundredths x 42.
   g. Is your answer reasonable? Explain.

      ____

      ____

2. Without calculating, use estimation to determine which answer choice is the actual product of 8.26 x 128.

   a. 105,728
   b. 10,572.8
   c. 1,057.28
   d. 105.728

3. Consider the factors 1.39 and 214.

a. Estimate the product of 1.39 x 214.

b. Find the actual product of 1.39 x 214.

c. Is your answer reasonable? How do you know?

1. If 648 x 62 = 40,176, then what is 6.48 x 62?

   a. 4.0176
   b. 40.176
   c. 401.76
   d. 4,017.6

2. Consider the equation 3.14 x 12 = ____.

   Which equation shows how to round the factors to estimate the product?
   a. 4 x 10 = 40
   b. 3 x 10 = 30
   c. 3 x 20 = 60

   Rename 3.14 using only hundredths.

   3.14 = _______ hundredths

   Solve using the algorithm.

   $$\begin{array}{r} 314 \\ \underline{\times\ 12} \end{array}$$

   Now solve by reasoning about the decimal.

   3.14 x 12 = __________

3. Estimate. Solve using the standard algorithm.

   6.16 x 14

4. Estimate. Solve using the standard algorithm.

124.05 x 43

Name: KEY

1. **Think about the expression 7.18 x 42.**
   a. Round 7.18 to the nearest whole number. 7

      $7.18 \approx 7$

   b. Round 42 to the nearest ten. 40

      $42 \approx 40$

   c. Estimate the product.

      $7 \times 40 = 280$

   d. Will the actual product be greater than or less than your estimate?

      I rounded to smaller numbers, so I can expect the actual product to be greater.

   e. What is 7.18 written as only hundredths?

      7.18 = 718 hundredths

   f. Find the product of 718 hundredths x 42.

$$\begin{array}{r} 718 \text{ hundredths} \\ \times \quad 42 \\ \hline 1436 \\ +\ 28720 \\ \hline 30156 \text{ hundredths} \end{array}$$

301.56

   g. Is your answer reasonable? Explain. Yes, my answer is a bit more than 280.

2. Without calculating, use estimation to determine which answer choice is the actual product of 8.26 x 128.

$8 \times 100 = 800$

- ~~a.~~ 105,728
- ~~b.~~ 10,572.8
- c. 1,057.28 ← a little more than 800
- ~~d.~~ 105.728

3. Consider the factors 1.39 and 214.

a. Estimate the product of 1.39 x 214.

$1 \times 200 = 200$

b. Find the actual product of 1.39 x 214.

139 hundredths

$$\begin{array}{r} 139 \\ \times\ 214 \\ \hline 556 \\ 1390 \\ +\ 27800 \\ \hline 29746 \end{array}$$

29746 hundredths

297.46

c. Is your answer reasonable? How do you know?

Yes, my answer is a little more than 200.

Name: KEY

1. If 648 x 62 = 40,176, then what is 6.48 x 62?

a. 4.0176
b. 40.176
c. 401.76
d. 4,017.6

648 hundredths x 62 = 40176 hundredths

2. Consider the equation 3.14 x 12 = ___.

Which equation shows how to round the factors to estimate the product?

a. 4 x 10 = 40
b. 3 x 10 = 30
c. 3 x 20 = 60

≈3 ≈10

Rename 3.14 using only hundredths.

3.14 = 314 hundredths

Solve using the algorithm.

$$\begin{array}{r} 314 \\ \underline{\times\ 12} \\ 628 \\ \underline{3140} \\ 3768 \end{array}$$

Now solve by reasoning about the decimal.

3.14 x 12 = 37.68

314 hundredths x 12 = 3768 hundredths

3. Estimate. Solve using the standard algorithm.

6.16 x 14

EST

6 x 10 = 60

616 hundredths

$$\begin{array}{r} 616 \\ \times\ 14 \\ \hline 2464 \\ +\ 6160 \\ \hline 8624 \end{array}$$

8624 hundredths

86.24

4. Estimate. Solve using the standard algorithm.

124.05 x 43

EST

100 x 40 = 4,000

12405 hundredths

$$\begin{array}{r} 12405 \\ \times\ 43 \\ \hline 37215 \\ +\ 496200 \\ \hline 533415 \end{array}$$

533415 hundredths

5,334.15

G5 U2 Lesson 10

Reason about the product of a whole number and a decimal with hundredths

CITYTUTOR DC

G5 U2 Lesson 10 - Students will reason about the product of a whole number and a decimal with hundredths using place value understanding and estimation

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): In our previous lesson we used what we know about multiplying with whole numbers to help us multiply with decimals. We multiplied decimal factors as if they were whole numbers, and then carefully reasoned about the placement of the decimal in each product. We used estimation and unit form to help us. Today, we're going to practice a lot of similar thinking and apply what we know in story problems. Let's get started!

Let's Talk (Slide 3): Read this problem with me. We're not going to solve this right away (*read problem*). In your own words, retell the story. What is happening? Possible Student Answers, Key Points:

- He is eating oranges for three weeks to get Vitamin C. We are trying to figure out how much Vitamin C he gets over that time.

Before we dive into solving this problem, take a look at the three possible estimates. Take a second to think and reason, but don't calculate anything precisely. Which estimate makes the most sense based on the story, and what makes you think that? Possible Student Answers, Key Points:

- 1.4 grams is closer to what he'd consume in 2 or 3 days, not 21 days.
- 140 is way too much. He's eating less than 1 gram each day, so the answer should be less than 21 grams.
- Three weeks is about 20 days. 0.65 grams is about 0.7 or 7 tenths. So 20 x 7 tenths is 140 tenths.

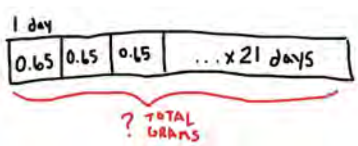
Nice thinking! We can use what we know about operations, estimation, and place value to help us solve real-world story problems involving multiplication with decimals. Reasoning about a story and using estimation before solving the problem is a really helpful way to process what is happening in a given story, and it helps make sure our final answer makes sense.

Now that we have an idea of where we're headed, let's actually work to solve this problem.

Let's Think (Slide 4): What information from the story is important in order for us to find how many grams of Vitamin C Seth consumes? Possible Student Answers, Key Points:

- Each serving is 0.65 grams of Vitamin C. He eats one serving every day, and he does this for 3 weeks.
- 3 weeks is 21 days, because every week has 7 days.

Let's picture what is happening. You told me we're trying to find all the Vitamin C Seth consumes over a 3 week period. Let's draw a big rectangle to represent that whole amount (*draw rectangle)*. You also told me that every day, Seth gets 0.65 grams of Vitamin C from his serving of oranges (*partition one small rectangle, write 0.65 inside, and label it with 1 day at the top)*.



We're not trying to find just 1 day though, we want to find the total after 21 days, or 3 weeks. It would take a long time to show all 21 days in our tape diagram, so I'll draw a couple more days and then make a note that we're finding 21 days (*partition and label two or three more boxes, then write …x 21 days in the portion)*. And since we were trying to find the total grams, I'll use a bracket and a question mark to show that on our diagram (*draw and label bracket)*.

Now, looking at our tape diagram, what might we do to approach finding the total number of grams of Vitamin C that Seth consumes? Possible Student Answers, Key Points:

- We could add 0.65 over and over until we find 21 days worth of Vitamin C. That might take a while…
- I see we're trying to find 21 equal groups of 0.65 grams. We can multiply 21 x 0.65 to find the total.

$$0.65 \times 21 = ?$$

Let's use a multiplication strategy. We can use the equation 0.65 x 21 = ? to find the total number of grams of Vitamin C Seth gets over 21 days (*write equation).*

65 hundredths x 21 will require some careful calculation. Let's estimate first. What can we round our factors to that would be easier to think about? Possible Student Answers, Key Points:

- 0.65 is pretty close to 0.7. We can think of it as 7 tenths, which would be pretty easy to consider.
- 21 is really close to 20.

$0.7 \times 20 = ?$

7 tenths × 20 = 140 tenths = 14.0 grams

Great, let's think of 0.65 as being about 0.7. Let's think of 21 days as being about 20 days (*write equation*). If we think of our factors in unit form, we can do this math in our heads (*write 7 tenths x 20 = ____*). What is 7 tenths x 20 equal to in unit form (140 tenths). So, we know our answer is close to 140 tenths or 14.0. Let's calculate the exact product, keeping our estimate in mind.

We are multiplying 0.65, or 65 hundredths, by 21. What strategies have we learned to multiply decimals? Possible Student Answers, Key Points:

- We can use an area model. We can use vertical form. We can multiply the numbers like they're whole numbers, but use unit form to keep track of the place value.

65 hundredths
x 21

Let's think of our decimals in unit form, and then use vertical form to help us multiply. What is 0.65 in unit form? (65 hundredths) Let's set up our multiplication in vertical form (*write 65 hundredths x 21 in vertical form).* Now we can multiply as if we're dealing with whole numbers, and we'll worry about the place value once we arrive at the product of 65 and 21.

65 hundredths
x 21
65 ← 65 × 1

Let's find our first partial product. What is 65 x 1? (65) Let's write that below the line (*write it, label 65 x 1 next to it).*

65 hundredths
x 21
65 ← 65 × 1
1300 ← 65 × 20
1365

Now, what is 65 x 20? If it helps, we can think about 5 x 20 and 60 x 20 in parts. (65 x 20 is 1,300) Let's write 1,300 as our other partial product (*write partial product and label with 65 x 20).* What is the sum of the two partial products we found? (1,365) Excellent, but we know that 1,365 cannot be the exact product, because we estimated that our answer should be about 14 grams.

How can we use place value reasoning and unit form to make sure our answer is correct? Possible Student Answers, Key Points:

- We found 65 x 21 is 1,365. If we use unit form, we can think of 65 *hundredths* x 21, so our answer will just be 1,365 *hundredths*. That's 13.65.
- 1,365 is way too big. If our estimate was that our answer should be close to 14, it makes sense to put the decimal in between the 3 and 6 in our product. 13.65 is close to 14.

65 hundredths
x 21
65 ← 65 × 1
1300 ← 65 × 20
1365 hundredths
13.65

Great thinking. 65 hundredths times 21 is 1,365 hundredths. We can think of that as 13.65, which is in line with our estimate from earlier (*write hundredths next to 1,365, then write 13.65).* Seth consumed 13.65 grams of Vitamin C over the course of 3 weeks.

We reasoned about the story by retelling what is happening and drawing a tape diagram to help us consider a solution pathway, we estimated a product by rounding each factor, and we used what we know about place value reasoning to arrive at an exact answer.

Before we practice applying what we know, let's look at two student work samples and give them some feedback. These two students are both on the student council at their school, and they want to buy notebooks for everyone in their grade. They need to buy 305 notebooks, and each one costs $2.44. How might you go about solving this? Possible Student Answers, Key Points:

- We could multiply 305 by $2.44. We could use an area model or vertical form to carefully multiply with the decimal value.

Can you think of a reasonable estimate for the total amount of money the student council would spend? Possible Student Answers, Key Points:

- 305 notebooks is about 300 notebooks. And each notebook costs between 2 and 3 dollars. I know 300 x 2 would be $600. I know 300 x 3 would be $900. So the total amount should be between 600 and 900 dollars, most likely.

Interesting! Let's look at their work and see how the two students went about it (*click to next slide).*

Let's Think (Slide 5): Here we see how two students attempted to multiply 305 x 2.44. Take a second to look at the work, and when you're ready share with me what you notice each student doing (*pause to allow think time*). Possible Student Answers, Key Points:

- The student writing in blue used vertical form and thought of the numbers as if they were whole numbers. They found two partial products and added them together.
- The student writing in green drew an area model. They found six partial products and added them together. They didn't convert 2.44 to a whole number though, they just wrote it in expanded form along the area model.

Excellent things to notice. The first student used vertical form, kind of like we did earlier. The second student still multiplied in parts, but they used an area model. We've seen that before in previous lessons. Both strategies can work to find a product.

You probably noticed that they have different answers. Take a second and think about which student's work shows an error. Once you spot it, share out and tell me how you might go about correcting it. Possible Student Answers, Key Points:

- The first work sample is incorrect. A lot of the multiplication is correct in terms of digits, but the student ignored place value altogether.
- I would think of 2.44 as 244 hundredths. We could multiply 244 by 305, and get 74,420 just like they did in the example. Except, I would want to remember that 244 was actually 244 *hundredths*, so my answer would be 74,420 *hundredths*. The actual product is 744.20, which is much closer to our estimate.

We know many strategies that we can use to help us multiply carefully with decimals. Whether we use vertical form or area models, we have to keep the place value of our factors in mind. The place value of our factors impacts the place value of the final product.

Let's Try it (Slides 6 - 7): Now let's work together to reason about the product of a whole number and a decimal with hundredths using place value understanding and estimation. Rounding each factor will help make sure the product we end up with is reasonable. We will use what we know about multiplying whole numbers to help us, and we will want to carefully keep track of the place value in each factor so that the placement of digits in our product makes sense.

WARM WELCOME

Today we will reason about the product of a whole number and a decimal with hundredths using place value understanding and estimation

Let's Talk:

Seth eats a serving of oranges every day for 3 weeks to get Vitamin C. If each serving contains 0.65 grams of Vitamin C, how many grams does Seth consume over 3 weeks?

Without calculating, which estimate seems most appropriate? Why?

about 1.4 grams

about 14 grams

about 140 grams

Let's Think:

Seth eats a serving of oranges every day for 3 weeks to get Vitamin C. If each serving contains 0.65 grams of Vitamin C, how many grams does Seth consume over 3 weeks?

<u>ESTIMATE</u>

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Let's Think:

Two students worked to find the product of 2.44 and 305. Explain the steps each student takes and help correct the work shows an error.

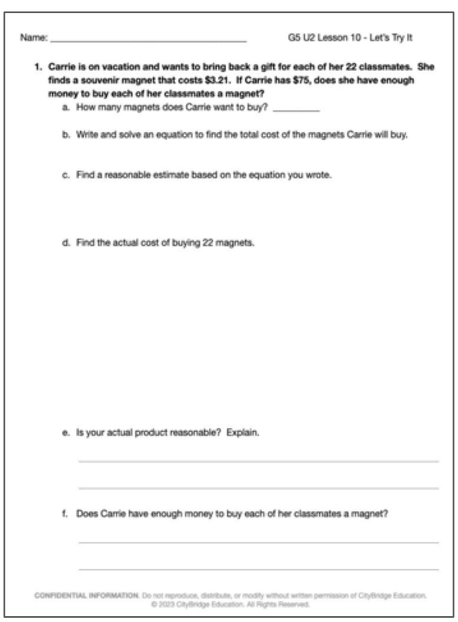
$$
\begin{array}{r}
2.44 \\
\times\ 305 \\
\hline
1220 \\
+\ 73200 \\
\hline
74420
\end{array}
$$

	2	0.4	0.04
300	600	120	12
5	10	2	0.2

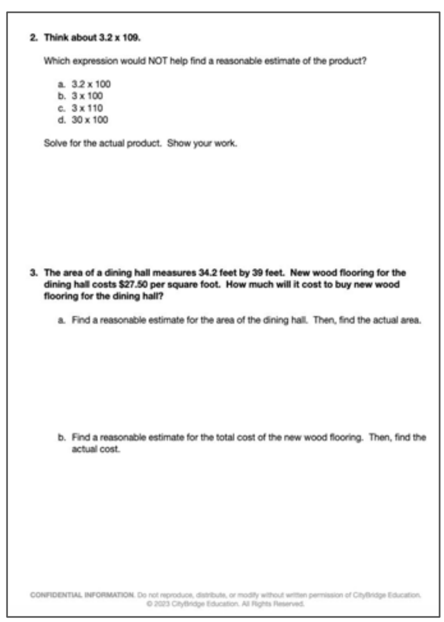
$$
\begin{array}{r}
732 \\
+\ 12.2 \\
\hline
744.2
\end{array}
$$

Let's Try It:

Let's reason about the product of a whole number and a decimal with hundredths using place value understanding and estimation.


Name: ______________________ G5 U2 Lesson 10 - Let's Try It

1. **Carrie is on vacation and wants to bring back a gift for each of her 22 classmates. She finds a souvenir magnet that costs $3.21. If Carrie has $75, does she have enough money to buy each of her classmates a magnet?**
   a. How many magnets does Carrie want to buy? ________
   b. Write and solve an equation to find the total cost of the magnets Carrie will buy.
   c. Find a reasonable estimate based on the equation you wrote.
   d. Find the actual cost of buying 22 magnets.
   e. Is your actual product reasonable? Explain.
   f. Does Carrie have enough money to buy each of her classmates a magnet?


2. **Think about 3.2 x 109.**

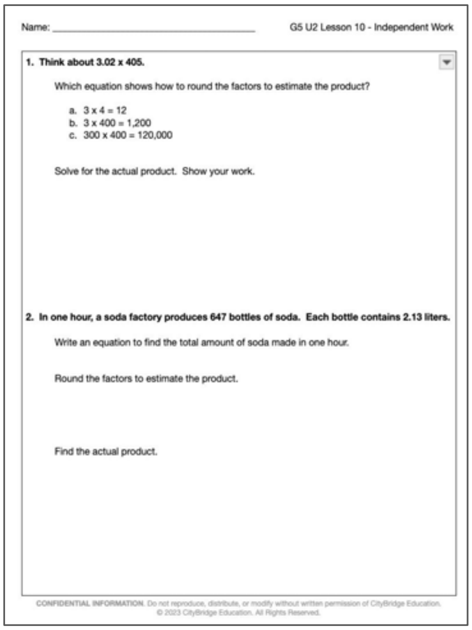
   Which expression would NOT help find a reasonable estimate of the product?
   a. 3.2 x 100
   b. 3 x 100
   c. 3 x 110
   d. 30 x 100

   Solve for the actual product. Show your work.

3. **The area of a dining hall measures 34.2 feet by 39 feet. New wood flooring for the dining hall costs $27.50 per square foot. How much will it cost to buy new wood flooring for the dining hall?**
   a. Find a reasonable estimate for the area of the dining hall. Then, find the actual area.
   b. Find a reasonable estimate for the total cost of the new wood flooring. Then, find the actual cost.

On your Own:

Now it’s time to multiply decimal fractions by multi-digit whole numbers on your own.


Name: ______________________ G5 U2 Lesson 10 - Independent Work

1. Think about 3.02 x 405.

Which equation shows how to round the factors to estimate the product?

a. 3 x 4 = 12
b. 3 x 400 = 1,200
c. 300 x 400 = 120,000

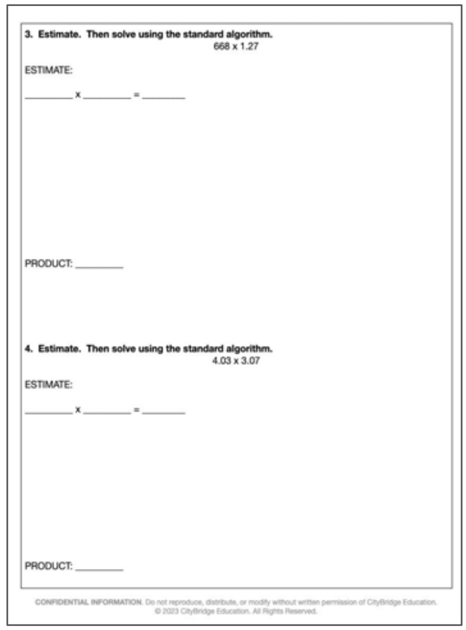
Solve for the actual product. Show your work.

2. In one hour, a soda factory produces 647 bottles of soda. Each bottle contains 2.13 liters.

Write an equation to find the total amount of soda made in one hour.

Round the factors to estimate the product.

Find the actual product.


3. Estimate. Then solve using the standard algorithm.
668 x 1.27

ESTIMATE:

_______ x _______ = _______

PRODUCT: _______

4. Estimate. Then solve using the standard algorithm.
4.03 x 3.07

ESTIMATE:

_______ x _______ = _______

PRODUCT: _______

1. Carrie is on vacation and wants to bring back a gift for each of her 22 classmates. She finds a souvenir magnet that costs $3.21. If Carrie has $75, does she have enough money to buy each of her classmates a magnet?
   a. How many magnets does Carrie want to buy? __________

   b. Write an equation that can be used to find the total cost of the magnets Carrie will buy.

   c. Find a reasonable estimate based on the equation you wrote.

   d. Find the actual cost of buying 22 magnets.

   e. Is your actual product reasonable? Explain.

   ____

   ____

   f. Does Carrie have enough money to buy each of her classmates a magnet?

   ____

   ____

2. Think about 3.2 x 109.

   Which expression would NOT help find a reasonable estimate of the product?

   a. 3.2 x 100
   b. 3 x 100
   c. 3 x 110
   d. 30 x 100

Solve for the actual product. Show your work.

3. The area of a dining hall measures 34.2 feet by 39 feet. New wood flooring for the dining hall costs $27.50 per square foot. How much will it cost to buy new wood flooring for the dining hall?

    a. Find a reasonable estimate for the area of the dining hall. Then, find the actual area.

    b. Find a reasonable estimate for the total cost of the new wood flooring. Then, find the actual cost.

1. Think about 3.02 x 405.

   Which equation shows how to round the factors to estimate the product?

   a. 3 x 4 = 12
   b. 3 x 400 = 1,200
   c. 300 x 400 = 120,000

   Solve for the actual product. Show your work.

2. In one hour, a soda factory produces 647 bottles of soda. Each bottle contains 2.13 liters.

   Write an equation to find the total amount of soda made in one hour.

   Round the factors to estimate the product.

   Find the actual product.

3. Estimate. Then solve using the standard algorithm.

668 x 1.27

ESTIMATE:

__________ x __________ = __________

PRODUCT: ___________

4. Estimate. Then solve using the standard algorithm.

4.03 x 3.07

ESTIMATE:

___________ x ___________ = __________

PRODUCT: ___________

Name: KEY

1. **Carrie is on vacation and wants to bring back a gift for each of her 22 classmates. She finds a souvenir magnet that costs \$3.21. If Carrie has \$75, does she have enough money to buy each of her classmates a magnet?**
   a. How many magnets does Carrie want to buy? 22

   b. Write ~~and solve~~ an equation to find the total cost of the magnets Carrie will buy.

   $22 \times 3.21 = ?$

   c. Find a reasonable estimate based on the equation you wrote.

   $20 \times 3 = 60$

   d. Find the actual cost of buying 22 magnets.

   321 hundredths

   $$\begin{array}{r} 321 \\ \times\ 22 \\ \hline 642 \\ +\ 6420 \\ \hline 7062 \end{array}$$

   7062 hundredths

   $\boxed{\$70.62}$

   e. Is your actual product reasonable? Explain.

   My estimate is 60 and my actual product is 70.62, so they are pretty close. Yes!

   f. Does Carrie have enough money to buy each of her classmates a magnet?

   Yes! She has \$75 and only needs \$70.62

2. **Think about 3.2 x 109.**

Which expression would NOT help find a reasonable estimate of the product?

✓ a. 3.2 x 100
✓ b. 3 x 100
✓ c. 3 x 110
d. 30 x 100 ← neither factor is close to 30 in the problem

Solve for the actual product. Show your work.

$$\begin{array}{r} 109 \\ \times\ 32 \text{ tenths} \\ \hline 218 \\ +\ 3270 \\ \hline 3488 \text{ tenths} \end{array} \rightarrow 348.8$$

3. **The area of a dining hall measures 34.2 feet by 39 feet. New wood flooring for the dining hall costs \$27.50 per square foot. How much will it cost to buy new wood flooring for the dining hall?**

a. Find a reasonable estimate for the area of the dining hall. Then, find the actual area.

A = L x W
A ≈ 30 x 40
≈ 1200 sq. ft
estimate

$$\begin{array}{r} 342 \text{ tenths} \\ \times\ 39 \\ \hline 3078 \\ +\ 10260 \\ \hline 13338 \text{ tenths} \end{array} \rightarrow 1,333.8 \text{ sq. ft}$$

b. Find a reasonable estimate for the total cost of the new wood flooring. Then, find the actual cost.

1,333.8 x 27.5 = cost
1000 x 28 ≈ cost
28,000 ≈ cost
estimate

$$\begin{array}{r} 13338 \text{ tenths} \\ \times\ 275 \text{ tenths} \\ \hline 66690 \\ 933660 \\ +\ 2667600 \\ \hline 3667950 \text{ hundredths} \end{array}$$

$\boxed{\$36,679.50}$

Name: KEY

1. Think about 3.02 x 405.

Which equation shows how to round the factors to estimate the product?

~~a.~~ $3 \times \cancel{4} = 12$
b. $3 \times 400 = 1{,}200$
c. $\cancel{300} \times 400 = 120{,}000$

Solve for the actual product. Show your work.

$$
\begin{array}{r}
302 \\
\times\ 405 \\
\hline
1510 \\
+\ 120800 \\
\hline
122310
\end{array}
$$

302 hundredths

122310 hundredths

1,223.1

2. In one hour, a soda factory produces 647 bottles of soda. Each bottle contains 2.13 liters.

Write an equation to find the total amount of soda made in one hour.

$647 \times 2.13 = ?$

Round the factors to estimate the product.

$600 \times 2 = 1{,}200$ L

Find the actual product.

$$
\begin{array}{r}
647 \\
\times\ 213 \\
\hline
1941 \\
6470 \\
+\ 129400 \\
\hline
137811
\end{array}
$$

213 hundredths

137811 hundredths

1,378.11 L

3. Estimate. Then solve using the standard algorithm.

668 x 1.27

ESTIMATE:

700 x 1 = 700

$$\begin{array}{r} 668 \\ \times\ 127 \\ \hline 4676 \\ 13360 \\ +\ 66800 \\ \hline 84836 \end{array}$$

hundredths

hundredths

PRODUCT: 848.36

4. Estimate. Then solve using the standard algorithm.

4.03 x 3.07

ESTIMATE:

4 x 3 = 12

$$\begin{array}{r} 403 \\ \times\ 307 \\ \hline 2821 \\ +\ 120900 \\ \hline 123721 \end{array}$$

hundredths

hundredths

ten thousandths

PRODUCT: 12.3721

G5 U2 Lesson 11

Use whole number multiplication to express equivalent measurements

CITYTUTOR DC

G5 U2 Lesson 11 - Students will use whole number multiplication to express equivalent measurements

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): We've been working on multiplication skills, particularly involving decimals, for the past several lessons. Today, we get a chance to apply those skills to convert measurements. Conversions are everywhere in our lives if you think about it. You might need to convert pints into cups when you're cooking. You might need to convert dollars to euros when you're traveling and need money. You might need to convert yards to inches when you're renovating your house. Let's give it a try, and we'll see how our multiplication skills come in handy!

Let's Talk (Slide 3): Take a second and look at these pairings (*pause*). What do you notice? What do you wonder? Possible Student Answers, Key Points:

- I notice some pairs are time units and some pairs are length units. I notice each one has a "1" in it somewhere.
- I wonder if each pair is equal, since I know 1 hour is 60 minutes. I wonder if there are other pairs I could come up with.

Interesting ideas. Each pairing here shows a larger unit and an equivalent amount of a smaller unit. For example, 1 hour is the same as 60 minutes; minutes are smaller units of time than hours. 1 week is equivalent to 7 days; days are just a smaller unit. 1 meter is the same as 100 centimeters, and 1 foot is the same as 12 inches. Today, we're going to convert from a larger unit, like hours, to a smaller unit, like minutes.

Let's Think (Slide 4): This first problem wants us to think about how many grams are in 7 kilograms. What do you know or notice about the relationship between grams and kilograms? Possible Student Answers, Key Points:

- I know kilograms and grams are weight units. I know kilograms are heavier than grams. I know they are metric units.
- The problem notes that 1 kilogram is equal to 1,000 grams.

7 kilograms = _____ grams

Good. 1 kilogram is the same as 1,000 grams, or we can say that there are 1,000 grams in 1 kilogram. We are trying to find how many grams are in 7 kilograms. We can write that as an equation (*write 7 kilograms = ____ grams).* If it helps you be efficient, you can use the abbreviations for units instead of writing the entire word. In this case, the abbreviation for kilograms is kg, and the abbreviation for grams is g.

$7\text{ kg} = 7 \times (1\text{ kg})$

Now let's think (*write 7 kg = 7 x (1 kg)).* Think about this equation, and tell me why it's true. Possible Student Answers, Key Points:

- 7 kilograms is the same as 7 units of 1 kilogram. 7 kilograms is like 7 groups of 1 kilogram, or 7 x 1 kg.

$7\text{ kg} = 7 \times (1\text{ kg})$
$= 7 \times (1000\text{ g})$

So if I know 7 kilograms can be thought of as 7 x (1 kg), I can use what I know about 1 kilogram to help me convert. You named that 1 kilogram is equal to 1,000 grams. So I'm going to rewrite the equation, but I'll write 1,000 grams where we wrote 1 kg (*write it, and highlight 1 kg and 1,000 g).* I can replace 1 kg with 1,000 g, because we know they are the same amount. Now, all we have to do is multiply 7 x 1,000 grams. What is 7 x 1,000 grams? (7,000 grams) Correct! So we know 7 kilograms is equal to 7,000 grams (*write answer).*

7 kilograms = 7000 grams

To convert from a larger unit to a smaller unit, we thought about how many groups of 1 larger unit we had. We replaced that larger unit with the equivalent amount of smaller units. Then, we were able to use multiplication to find how many smaller units were equivalent to the larger unit we started with.

Let's try one more using similar thinking.

Let's Think (Slide 5): What do you notice is the same and different about this problem compared to the one we just worked on? Possible Student Answers, Key Points:

- This problem has a decimal value.
- This problem isn't about kilograms and grams; it's about pounds and ounces.

Even though this problem has some differences on the surface, we'll notice that the big ideas and strategies we use remain constant. Let's start by writing an equation to represent what we are trying to figure out. In this case, we want to know how many ounces are

9.5 pounds (lb) = ____ ounces (oz)

9.5 lbs = 9.5 × (1 lb)

equivalent to 9.5 pounds (*write 9.5 pounds = ____ ounces)*. The abbreviation for pounds is lb (*note that above pounds)*, and the abbreviation for ounces is oz (*note that above ounces).*

I know 9.5 pounds is the same as 9.5 groups of 1 pound. I can write that as 9.5 pounds = 9.5 x (1 pound) *(write as you say the equation)*.

9.5 lbs = 9.5 × (1 lb)
= 9.5 × (16 oz)

Since I'm trying to convert pounds into ounces, I can replace 1 pound with what I know about a pound's relationship to ounces. What can I replace "1 lb" with in my equation? (16 ounces) Correct, let's substitute 16 ounces in place of 1 pound since we know they are the same (*write new equation and highlight 1 lb and 16 oz)*.

At this point in our previous problem, we were able to use mental math to quickly find how many grams were in 7 kilograms. In this problem, we have factors that might require us to perform calculations. That's okay! We've been practicing multiplying with whole numbers and decimals for several lessons, so we're prepared. Let's multiply 9.5 x 16. We can use an area model or vertical form to do this. Let's use vertical form this time, and we'll think about our decimal factor in unit form to help us. What is 9.5 in unit form? (95 tenths) Let's write 95 tenths x 16 vertically (*write it)*.

95 tenths
× 16

95 tenths
× 16
570 ← 95 × 6
+950 ← 95 × 10

Let's find the partial products. Take a second to think and calculate. What is 95 x 6? (570) *(write 570 with an arrow to show that it is the product of 95 x 6)* What is 95 x 10? (950) (*write 950 and an arrow to show that it is the product of 95 x 10)* When we multiply 95 x 16, the two partial products are 570 and 950. We have to remember that we weren't actually multiplying with 95; we were multiplying with 95 tenths. Take a moment to find the sum of the partial products. What is the product of 95 tenths x 16, and how do you know? Possible Student Answers, Key Points:

- When I add the partial products of 570 and 950, I get 1520. Since 95 x 16 is 1,520, I know that 95 *tenths* x 16 is 1,520 *tenths*. I can write that as 152.0 or 152.

9.5 pounds (lb) = 152 ounces (oz)

Excellent. So we know that 9.5 pounds is equivalent to 152 ounces (*fill in 152 ounces in blank)*.

Even though this problem involved different units and decimals, what did you notice? Possible Student Answers, Key Points:

- The process we used didn't really change. We could still write an equation thinking of how many groups of the larger unit, and replace the larger unit with the equivalent amount of smaller units.
- When dealing with a decimal factor, the math might take a little bit longer since we might not be able to do all the calculation in our head. We want to keep careful track of the place value when we multiply with decimals.

Nice work!

Let's Try it (Slides 6 - 7): Now let's work together to use whole number multiplication to find equivalent measurements . As we work, we'll want to play close attention to how many smaller units are equivalent to the larger unit we are given. We can use that equivalence and the associative property to write a multiplication expression that can take us from a larger unit to an equivalent amount of a smaller unit.

WARM WELCOME

Today we will use whole number multiplication to express equivalent measurements.

Let's Talk:

1 hour

60 minutes

1 meter

100 centimeters

7 days

1 week

12 inches

1 foot

Let's Think:

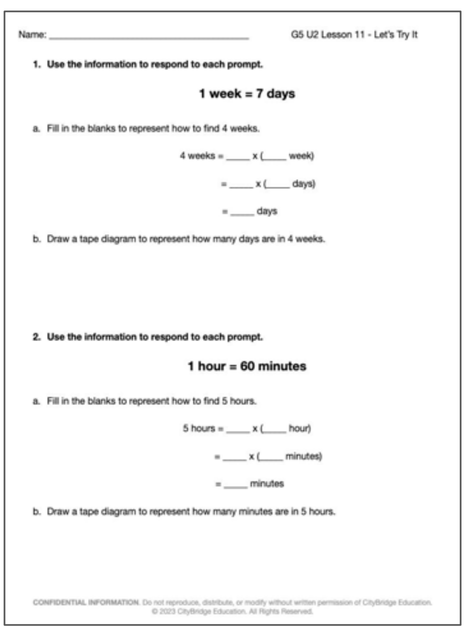
How many grams are in 7 kilograms?
(1 kilogram = 1,000 grams)

Let’s Think:

9.5 pounds is equivalent to how many ounces?
(1 pound = 16 ounces)

Let’s Try It:

Let’s explore using whole number multiplication to express equivalent measurements together.


Name: ______________________ G5 U2 Lesson 11 - Let’s Try It

1. **Use the information to respond to each prompt.**

1 week = 7 days

a. Fill in the blanks to represent how to find 4 weeks.

4 weeks = ____ x (____ week)

= ____ x (____ days)

= ____ days

b. Draw a tape diagram to represent how many days are in 4 weeks.

2. **Use the information to respond to each prompt.**

1 hour = 60 minutes

a. Fill in the blanks to represent how to find 5 hours.

5 hours = ____ x (____ hour)

= ____ x (____ minutes)

= ____ minutes

b. Draw a tape diagram to represent how many minutes are in 5 hours.

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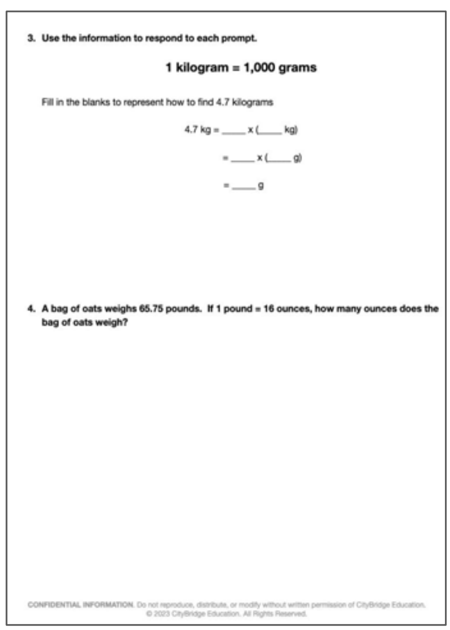
3. **Use the information to respond to each prompt.**

1 kilogram = 1,000 grams

Fill in the blanks to represent how to find 4.7 kilograms

4.7 kg = ____ x (____ kg)

= ____ x (____ g)

= ____ g

4. **A bag of oats weighs 65.75 pounds. If 1 pound = 16 ounces, how many ounces does the bag of oats weigh?**

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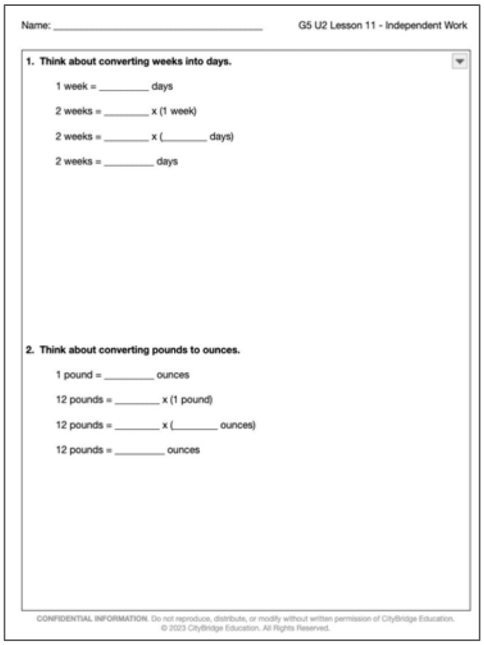
On your Own:

Now it's time to use whole number multiplication to express equivalent measurements on your own.


Name: ________________________ G5 U2 Lesson 11 - Independent Work

1. Think about converting weeks into days.

1 week = ________ days

2 weeks = ________ x (1 week)

2 weeks = ________ x (________ days)

2 weeks = ________ days

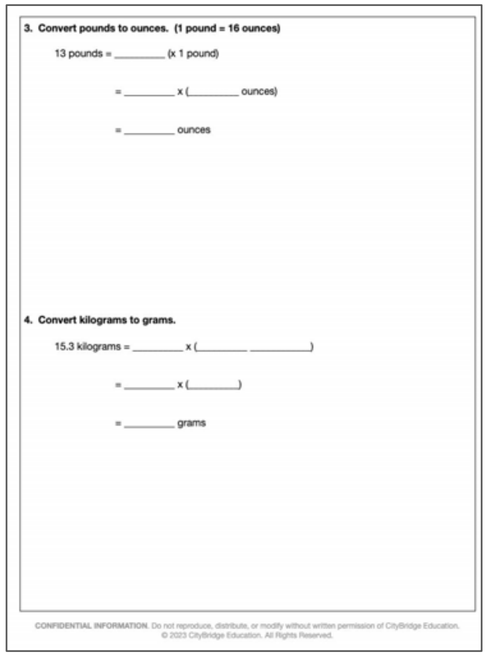
2. Think about converting pounds to ounces.

1 pound = ________ ounces

12 pounds = ________ x (1 pound)

12 pounds = ________ x (________ ounces)

12 pounds = ________ ounces


3. Convert pounds to ounces. (1 pound = 16 ounces)

13 pounds = ________ (x 1 pound)

= ________ x (________ ounces)

= ________ ounces

4. Convert kilograms to grams.

15.3 kilograms = ________ x (________ ________)

= ________ x (________)

= ________ grams

1. Use the information to respond to each prompt.

1 week = 7 days

a. Fill in the blanks to represent how to find 4 weeks.

4 weeks = ______ x (______ week)

= ______ x (______ days)

= ______ days

b. Draw a tape diagram to represent how many days are in 4 weeks.

2. Use the information to respond to each prompt.

1 hour = 60 minutes

a. Fill in the blanks to represent how to find 5 hours.

5 hours = ______ x (______ hour)

= ______ x (______ minutes)

= ______ minutes

b. Draw a tape diagram to represent how many minutes are in 5 hours.

3. Use the information to respond to each prompt.

1 kilogram = 1,000 grams

Fill in the blanks to represent how to find 4.7 kilograms

$4.7 \text{ kg} = \_\_\_\_\_ \times (\_\_\_\_\_ \text{ kg})$

$= \_\_\_\_\_ \times (\_\_\_\_\_ \text{ g})$

$= \_\_\_\_\_ \text{ g}$

4. A bag of oats weighs 65.75 pounds. If 1 pound = 16 ounces, how many ounces does the bag of oats weigh?

1. Think about converting weeks into days.

   1 week = ___________ days

   2 weeks = __________ x (1 week)

   2 weeks = __________ x (__________ days)

   2 weeks = ___________ days

2. Think about converting pounds to ounces.

   1 pound = ___________ ounces

   12 pounds = __________ x (1 pound)

   12 pounds = __________ x (__________ ounces)

   12 pounds = ___________ ounces

3. Convert pounds to ounces. (1 pound = 16 ounces)

   13 pounds = ___________ (x 1 pound)

   = ___________ x (___________ ounces)

= __________ ounces

4. Convert kilograms to grams.

15.3 kilograms = __________ x (__________ ____________)

= __________ x (__________)

= __________ grams

Name: KEY

1. Use the information to respond to each prompt.

1 week = 7 days

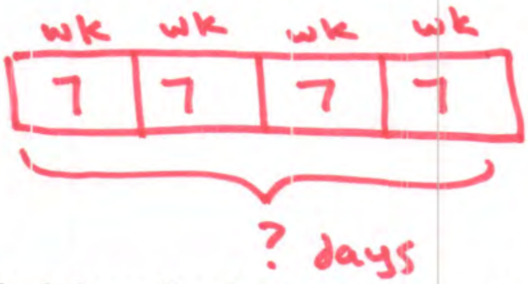
a. Fill in the blanks to represent how to find 4 weeks.

4 weeks = 4 x (1 week)

= 4 x (7 days)

= 28 days

b. Draw a tape diagram to represent how many days are in 4 weeks.



2. Use the information to respond to each prompt.

1 hour = 60 minutes

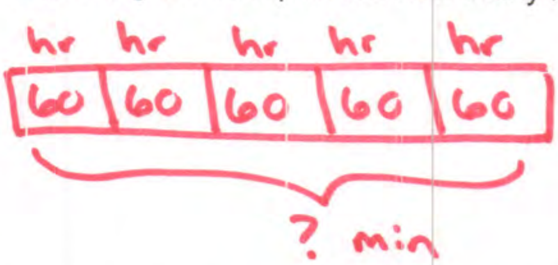
a. Fill in the blanks to represent how to find 5 hours.

5 hours = 5 x (1 hour)

= 5 x (60 minutes)

= 300 minutes

b. Draw a tape diagram to represent how many minutes are in 5 hours.



3. **Use the information to respond to each prompt.**

1 kilogram = 1,000 grams

Fill in the blanks to represent how to find 4.7 kilograms

4.7 kg = 4.7 x (1 kg)

= 4.7 x (1000 g)

= 4,700 g
or
4,700.0

47 tenths x 1000 = 47,000 tenths

4. **A bag of oats weighs 65.75 pounds. If 1 pound = 16 ounces, how many ounces does the bag of oats weigh?**

EST.
70 x 20 = 1400

65.75 lbs = 65.75 x (1 lb)
65.75 x (16 oz)

6575 hundredths
x 16
39450
+ 65750
105200 hundredths

1,052.00
or
1,052 oz

Name: KEY

1. **Think about converting weeks into days.**

1 week = 7 days

2 weeks = 2 x (1 week)

2 weeks = 2 x (7 days)

2 weeks = 14 days

2. **Think about converting pounds to ounces.**

1 pound = 16 ounces

12 pounds = 12 x (1 pound)

12 pounds = 12 x (16 ounces)

12 pounds = 192 ounces

$$\begin{array}{r} 12 \\ \times\ 16 \\ \hline 72 \\ +\ 120 \\ \hline 192 \end{array}$$

3. Convert pounds to ounces. (1 pound = 16 ounces)

13 pounds = 13 (x 1 pound)

= 13 x (16 ounces)

= 208 ounces

$$\begin{array}{r} 13 \\ \times\ 16 \\ \hline 78 \\ +\ 130 \\ \hline 208 \end{array}$$

4. Convert kilograms to grams.

15.3 kilograms = 15.3 x (1 kg)

= 15.3 x (1000 g)

= 15,300 grams

153 tenths x 1000 = 153,000 tenths

G5 U2 Lesson 12

Use fraction and decimal multiplication to express equivalent measurements

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G5 U2 Lesson 12 - Students will use fraction and decimal multiplication to express equivalent measurements

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): In our previous lesson we converted from a larger unit to a smaller unit using what we know about multiplication. For example, we could use multiplication to help us figure out how many days are in 3 weeks. Or we could figure out how many meters are equivalent 78 kilometers. Our work today will be related to our previous lesson, except we'll be converting from a smaller unit to a larger unit. Instead of converting weeks into days, we'll convert days into weeks. Or instead of figuring out how many meters are equivalent to a given number of kilometers, we'll figure out how many kilometers are equivalent to a given number of meters. Let's get started!

Let's Talk (Slide 3): I wanted to share a problem my friend ran into recently, but before I do that, I want you to take a second and look at the information here. What do you notice? What do you wonder? Possible Student Answers, Key Points:

- I notice fabric costs $5 per yard. A person needs 24 feet of fabric.
- I wonder why the fabric is sold in yards, but the person needs 24 feet. Yards are different than feet.
- I wonder why they need the fabric.
- I wonder how much it will cost them to buy the fabric.

Great thinking! The other day, my friend was at the fabric store and needed to buy some fabric. But she noticed that the fabric store sold fabric by the yard, but she needed 24 feet of fabric. She called me to help her figure out how much her 24 feet of fabric would cost, even though the store sells by the yard. What ideas do you have that could potentially help her solve her problem? Possible Student Answers, Key Points:

- We know 1 yard is equal to 3 feet. We can use that relationship to help us.
- Maybe we can use multiplication to help us like we did in the last lesson.

Let's use what we did in the previous lesson to help us figure out how many yards are equivalent to 24 feet.

Let's Think (Slide 4): You named that 3 feet is equivalent to 1 yard.

(ft) (yd)
24 feet = ____ yards

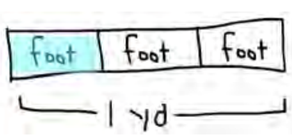
$24 \text{ ft} = 24 \times (1 \text{ ft})$

Let's keep that in mind as we figure out how many yards are equivalent to 24 feet (*write 24 feet = ______ yards)*. We can use the abbreviations of ft and yd if that's helpful (*write abbreviations over corresponding unit*).

We know from our last lesson that we can think of 24 feet as 24 groups of 1 foot. How can I write that as a multiplication equation? (We can write 24 feet = 24 x (1 foot)) Let's write that (*write it*).

Now here is where we have to pause and think for a second. If this were our previous lesson, we'd be converting yards into feet, so we could substitute 1 yard for 3 feet and multiply. Now, we have to think about how many yards are equivalent to 1 foot. What do you notice, or what is different about that? Possible Student Answers, Key Points:

- A foot is smaller than a yard. A yard is bigger than a foot.
- A yard can't fit into a foot, because it's a bigger unit.



If there are 3 feet in one yard, (*draw rectangle partitioned into 3 equal sections, labeling the sections as feet and the whole as 1 yard)* then we can say 1 foot is equal to a fraction of yard (*shade 1 foot)*. What fraction of a yard is 1 foot equal to? ($\frac{1}{3}$)

$24 \text{ ft} = 24 \times (1 \text{ ft})$

$= 24 \times (\frac{1}{3} \text{ yd})$

Just like yesterday, we can replace our known unit with the equivalent of the other unit. We can replace 1 foot with $\frac{1}{3}$ yard. Let's do that in our equation. (*rewrite equation substituting $\frac{1}{3}$ yd in place of 1 foot, highlight each to point out equivalence)* 1 foot is the same as $\frac{1}{3}$ yard, so we rewrote the equation. Now we can multiply. What is 24 x $\frac{1}{3}$? (24/3 or 8 wholes)

$= \frac{24}{3} \text{ yd}$

8 yd

24 feet is equal to 24/3 yards or 8 yards. (*write 24/3 yd and 8 yd)* Even though we were converting from a smaller unit, feet, to a larger unit, yards, we still used multiplication to help us convert. Our conversion factor, $\frac{1}{3}$ in this case, was a fraction. This makes sense because a smaller unit will always be a fraction or a part of a larger unit. Let's try another one.

Let's Think (Slide 5): This problem wants us to convert 678 milliliters into liters. What do you notice is the same or different about this problem? Possible Student Answers, Key Points:

- The units are different. This one involves milliliters and liters.
- It's similar because we're converting a smaller unit into a larger unit. Milliliters are smaller than liters.

(mL) (L)
678 milliliters = ___ liters

Let's use what we know to help us. What is the relationship between milliliters and liters? (1 liter is the same as 1,000 milliliters) Right, we know 1 liter is the same as 1,000 milliliters. We're trying to find out how many liters is the same as 678 milliliters. Let's write that as an equation. *(write 678 milliliters = _____ liters)* We can use the abbreviations of mL and L if we want. *(write abbreviations over corresponding units)*

$$678 \text{ mL} = 678 \times (1 \text{ mL})$$
$$= 678 \times (0.001 \text{ L})$$

We can think of 678 milliliters as 678 groups of 1 milliliter. *(write 678 mL = 678 x (1 mL))* Now, we have to think about how many liters is equivalent to 1 milliliter. We know a milliliter is smaller than a liter, so our conversion factor will be a fraction or part of a liter. One milliliter is equal to what fraction of a liter? (1 thousandth of a liter) How do we write 1 thousandth in decimal form? (0.001) We can replace 1 mL with 0.001 L, or 1 thousandth of a liter. *(substitute 1 mL with 0.001 L and highlight 1 mL and 0.001 L to highlight equivalence)*

678 thousandths
0.678 L

We can multiply 678 x 0.001 L in many ways, but thinking about unit form can be helpful and efficient. What is 0.001 in unit form? (1 thousandth) I know 678 x 1 is 678. So I know 678 x 1 thousandth is 678 thousandths *(write it)*, or 0.678 *(write it and label with L)*. 678 milliliters is equivalent to 0.678 liters. We wrote an equation, substituted the given unit with a conversion factor based on the relationship between milliliters and liters, and then multiplied to find th equivalent number of liters. Well done!

What was different about this problem compared to one we did before this? Possible Student Answers, Key Points:

- This problem involved metric units of volume. The last one involved customary units of length.
- This problem involved multiplying by a decimal, because the conversion factor was a power of 10. The other problem involved multiplying by a decimal, because the conversion factor was ⅓which is probably easier to think about as a fraction than a decimal.

Let's Try it (Slides 6 - 7): Now let's work together to use fraction and decimal multiplication to express equivalent measurements. When we convert from smaller units to larger units, our conversion factor is a decimal or a fraction. We can use that decimal or fraction and what we know about properties of multiplication to write equations to find equivalent measurements. Depending on the relationship between units, it may be easier to use a fraction in some problems and a decimal in others.

WARM WELCOME

Today we will use use fraction and decimal multiplication to express equivalent measurements.

Let's Talk:

$5 per YARD

But…I need **24 <u>feet</u>** of fabric…

Let's Think:

How many yards is equivalent to 24 feet of fabric?

(1 yard = 3 feet)

Let's Think:

678 milliliters is equivalent to how many liters?

(1 liter = 1,000 milliliters)

Let's Try It:

Let's explore using decimal and fraction multiplication to express equivalent measurements together.

Name: ______________________ G5 U2 Lesson 12 - Let's Try It

1. Let's convert 16 cups into pints. (1 pint = 2 cups)

a. Draw and label a tape diagram to show the relationship between cups and pints.

b. One cup is what fraction of a pint?

1 cup = _____ pint

c. Fill in the blanks.

16 cups = _____ x (_____ cup)

= _____ x (_____ pints)

= _____ pints

2. Let's convert 185 centimeters to meters. Remember, 1 cm = 0.01 m.

a. One centimeter is what fraction of a meter?

1 centimeter = _____ meter

b. What is the fraction in decimal form?

1 centimeter = _____ meter

c. Fill in the blanks.

185 cm = _____ x (_____ cm)

= _____ x (_____ m)

= _____ meters

3. Determine how many weeks are in 63 days.

63 days = _____ x (_____ day)

= _____ x (_____ week)

= _____ weeks

Why does it make more sense to use a fraction to help convert rather than a decimal in this problem?

4. Determine how many gallons are equivalent to 24 quarts. (1 gallon = 4 quarts)

24 quarts = _____ x (_____ quart)

= _____ x (_____ gallons)

= _____ gallons

5. Determine how many meters are equivalent to 820 centimeters.

On your Own:

Now it's time to use whole number multiplication to express equivalent measurements on your own.

Name: ______________________________ G5 U2 Lesson 12 - Independent Work

1. Complete the equation to convert quarts to gallons.

14 quarts = ________ x 1 quart

= ________ x (¼ gallon)

= ________ gallons

2. Convert days to weeks.

49 days = ________ x 1 day

= 49 x (________ week)

= ________ weeks

3. Convert grams to kilograms. (1 gram = 0.001 kilogram)

1,946 grams = ________ kilograms

3. Convert days to weeks.

63 days = ________ weeks

1. Let's convert 16 cups into pints. (1 pint = 2 cups)

   a. Draw and label a tape diagram to show the relationship between cups and pints.

   b. One cup is what fraction of a pint?

   1 cup = _______ pint

   c. Fill in the blanks.

   16 cups = ______ x (______ cup)

   = ______ x (______ pints)

   = ______ pints

2. Let's convert 185 centimeters to meters. Remember, 1 cm = 0.01 m.

   a. One centimeter is what fraction of a meter?

   1 centimeter = _______ meter

   b. What is the fraction in decimal form?

   1 centimeter = _______ meter

   c. Fill in the blanks.

   185 cm = ______ x (______ cm)

   = ______ x (______ m)

   = ______ meters

3. Determine how many weeks are in 63 days.

   63 days = ______ x (______ day)

   = ______ x (______ week)

= ______ weeks

Why does it make more sense to use a fraction to help convert rather than a decimal in this problem?

4. Determine how many gallons are equivalent to 24 quarts. (1 gallon = 4 quarts)

24 quarts = ______ x (______ quart)

= ______ x (______ gallons)

= ______ gallons

5. Determine how many meters are equivalent to 820 centimeters.

1. Complete the equation to convert quarts to gallons.

   14 quarts = ___________ x 1 quart

   = ___________ x (¼ gallon)

   = ___________ gallons

2. Convert days to weeks.

   49 days = ___________ x 1 day

   = 49 x (___________ week)

   = ___________ weeks

3. Convert grams to kilograms. (1 gram = 0.001 kilogram)

   1,946 grams = ___________ kilograms

4. Convert days to weeks.

   63 days = ___________ weeks

Name: KEY

1. Let's convert 16 cups into pints. (1 pint = 2 cups)

a. Draw and label a tape diagram to show the relationship between cups and pints.

b. One cup is what fraction of a pint?

1 cup = $\frac{1}{2}$ pint

c. Fill in the blanks.

16 cups = 16 x (1 cup)

= 16 x ($\frac{1}{2}$ pints) → $\frac{16}{2} = 8$

= 8 pints

2. Let's convert 185 centimeters to meters. Remember, 1 cm = 0.01 m.

a. One centimeter is what fraction of a meter?

1 centimeter = $\frac{1}{100}$ meter

b. What is the fraction in decimal form?

1 centimeter = ~~$\frac{1}{100}$~~ 0.01 meter

c. Fill in the blanks.

185 cm = 185 x (1 cm)

= 185 x (0.01 m) 185 x 1 hundredth = ?

= 1.85 meters

185 hundredths

3. **Determine how many weeks are in 63 days.**

63 days = 63 x (1 day)

= 63 x ($\frac{1}{7}$ week) $\frac{63}{7} = 9$

= 9 weeks

Why does it make more sense to use a fraction to help convert rather than a decimal in this problem?

A day is $\frac{1}{7}$ of a week. I'm not sure what $\frac{1}{7}$ is as a decimal, so leaving it as a fraction is ideal here.

4. **Determine how many gallons are equivalent to 24 quarts. (1 gallon = 4 quarts)**

24 quarts = 24 x (1 quart)

= 24 x ($\frac{1}{4}$ gallons) $\frac{24}{4} = 6$

= 6 gallons

5. **Determine how many meters are equivalent to 820 centimeters.**

820 cm = 820 x (1 cm)

820 x (0.01 m)

820 x 1 hundredth

820 hundredths

8.20 or 8.2 m

Name: KEY

1. Complete the equation to convert quarts to gallons.

14 quarts = 14 x 1 quart

= 14 x (¼ gallon)

= $3\frac{2}{4}$ gallons

$3\frac{1}{2}$

$\frac{14}{4} = 3\frac{2}{4}$

2. Convert days to weeks.

49 days = 49 x 1 day

= 49 x ($\frac{1}{7}$ week)

= 7 weeks

$\frac{49}{7} = 7$

3. Convert grams to kilograms. (1 gram = 0.001 kilogram)

1,946 grams = 1.946 kilograms

1946 g = 1946 x (1 g)

1946 x (0.001 kg)

1946 x 1 thousandth

1946 thousandths

4. Convert days to weeks.

63 days = 9 weeks

63 days = 63 x (1 day)

63 x ($\frac{1}{7}$ wk)

$\frac{63}{7} = 9$

G5 U2 Lesson 13

Use basic facts to approximate quotients with two-digit divisors

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G5 U2 Lesson 13 - Students will use basic facts to approximate quotients with two-digit divisors

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): We've spent several lessons working on multiplication. On many occasions we've used estimation when we've multiplied by rounding one or both of our factors to friendly numbers. Why is estimation helpful when multiplying? Possible Student Answers, Key Points:

- It helps us efficiently determine what the actual factor is close to.
- It can help us make sure the actual product is reasonable after we calculate

Today, we are going to switch gears and focus on division. Just like we used estimation to get a quick idea of products when we multiplied, we will use estimation to help us think about division answers. We will use basic, friendly facts to approximate quotients, or the answer to a division problem, when we divide with two-digit divisors. Let's get started.

Let's Talk (Slide 3): Take a look here. What do you notice about the scene? What do you wonder? Possible Student Answers, Key Points:

- I notice there are six identical cans of soup and a receipt. I notice the receipt is torn, so I can't see the price of each can. I notice the total is \$11.88 in all. I notice the total is about \$12.
- I wonder how the receipt got torn. I wonder how much each can of soup costs.

Good thinking. We know the total for six cans of soup is \$11.88, but because the receipt is ripped, we don't know the what this person paid for each can of soup. If this person didn't have a calculator or pen/paper nearby, could they use estimation to help them get a sense of about how much they spent on each can of soup? Possible Student Answers, Key Points:

- They could guess and check. For example, \$5 for each can would be too high. \$1 per can would be too low.
- The total amount is about \$12. \$11.88 is tricky to divide by 6, but \$12 divided by 6 is easy to do in my head.

The total is about \$12, which is easy to think about if we have 6 cans of soup because 12 is divisible by 6. So since 12 divided by 6 is 2, we know this person spent *about* \$2 per can of soup. We rounded to find friendly numbers that were easy to divide with. Let's keep this story in mind as we try a couple more problems.

Let's Think (Slide 4): This problem wants us to estimate the quotient of 607 divided by 22. We are just going to estimate today, not find the exact answer. Would this problem be easy to do in our head as is? Why or why not? Possible Student Answers, Key Points:

- Probably not. I don't know many multiples of 22, and 607 is a pretty big total. I'm not even sure if 22 goes into 607 evenly.

TOTAL DIVISOR
607 ÷ 22 =

Since this problem isn't particularly friendly, let's estimate so we can use mental math to get an idea of the quotient. Which number is the total, and which number is the divisor in this problem? (607 is the total, and 22 is the divisor) (*write 607 ÷ 22, and label each)*

TOTAL DIVISOR
607 ÷ 22 =
↓
20

Let's start by rounding our divisor first. What is 22 rounded to the nearest ten? *(20)* We'll think of the divisor as being about 20. That's easier to think about than 22. *(write 20 underneath 22)* If we were to stop here, our equation would be 607 ÷ 20, which still seems tricky to work with.

TOTAL DIVISOR
607 ÷ 22 =
↓ ↓
600 ÷ 20 =

Given that, we need to round the total to a number that can be easily divided by 20. Let's use 600, since we can use mental math to divide 600 by 20. *(write 600 under 607)* Now we have an equation that is much easier to think about.

60 ÷ 2 = 30
tens tens

What is 600 divided by 20? (30) You may use facts and patterns you know to help you find the estimated quotient. If you weren't sure about 600 divided by 20, it can help to think of it in unit form too. *(write as you talk)* 600 is 60 tens. 20 is 2 tens. So 60 divided by 2 is 30.

We know the quotient of 607 and 22 should be about 30. We rounded our divisor to a simpler multiple of ten, then we rounded the total to a number that we knew would be divisible by our rounded divisor. This made an easier problem that we could use mental math to think about. Let's try another one!

Let's Think (Slide 5): This problem wants us to divide 483 by 66.

TOTAL DIVISOR

$483 \div 66 =$

(write equation and label "total" above 483 and "divisor" above 66) Neither of these numbers is particularly easy to think about, so let's find easier numbers to work with. Start with the divisor. What is 66 rounded to the nearest ten? (70)

70
140
210
280
350
420
490

If we think of the divisor as being about 70, we now need to round the total to a number that is easily divisible by 70. If we're not sure, we can list out some multiples like this. *(list a few multiples of 70)* I see 420 and 490 are close to 483. Let's use 490, since it's a little closer to 483 than the other multiples of 70.

$490 \div 70 = 7$

$49 \text{ tens} \div 7 \text{ tens} = 7$

(write new equation with rounded numbers) What is 490 divided by 70? (7) If it helps, you can think of it as 49 tens divided by 7 tens. *(write equation in unit form as shown)*

Our estimated quotient is 7. That means that 483 divided by 66 will be about 7 if we took the time to calculate the exact quotient.

TOTAL DIVISOR

$483 \div 66 =$

$\downarrow \quad \downarrow$

$480 \div 60 = 8$

Another student I know, estimated their quotient to this problem a bit differently. This is what they did. Take a look, and tell me what you notice is the same and different about their approach. *(write 483 divided by 66 again, showing estimated values of 480 and 60 and an estimated quotient of 8)*

Possible Student Answers, Key Points:

- They used different values when they estimated, and they got a different estimated quotient.
- Even though they used different numbers, the estimated quotient is only one away from our estimated quotient.
- Maybe these numbers were easier for them to think about then the ones we used. They are still reasonable.

There is not one right way to estimate. Of course we want to be as precise as possible, so we want to use numbers that are *close* to the actual numbers. Keep that in mind as you work and think about the "friendly" numbers you'll use to help you tackle today's approximations.

Nice work with these problems! We've just approximated the quotients of problems involving two-digit divisors. If you were to describe the thinking we've used to a student who was new to this, what would you say? Possible Student Answers, Key Points:

- You can round the divisor to an easy number to think about, then round the total to a number that is compatible with that divisor. Rounding the numbers means we can efficiently approximate the quotient without having to calculate an exact answer.

Let's Try it (Slides 6 - 7): Now let's work together to use facts we know to approximate quotients with two-digit divisors. As we've seen, it's helpful to round the divisor first, and then use skip-counting, mental math, or multiplication to help us find a total that can be easily divided by the divisor. Let's keep in mind that there are often many ways to think about estimation, and your pathway will depend on how you consider the numbers in the problem and the ways in which you round them. As long as the numbers we use are reasonable in the given problem, our estimate will be accurate and therefore useful.

WARM WELCOME

Today we will use basic facts to approximate quotients with two-digit divisors

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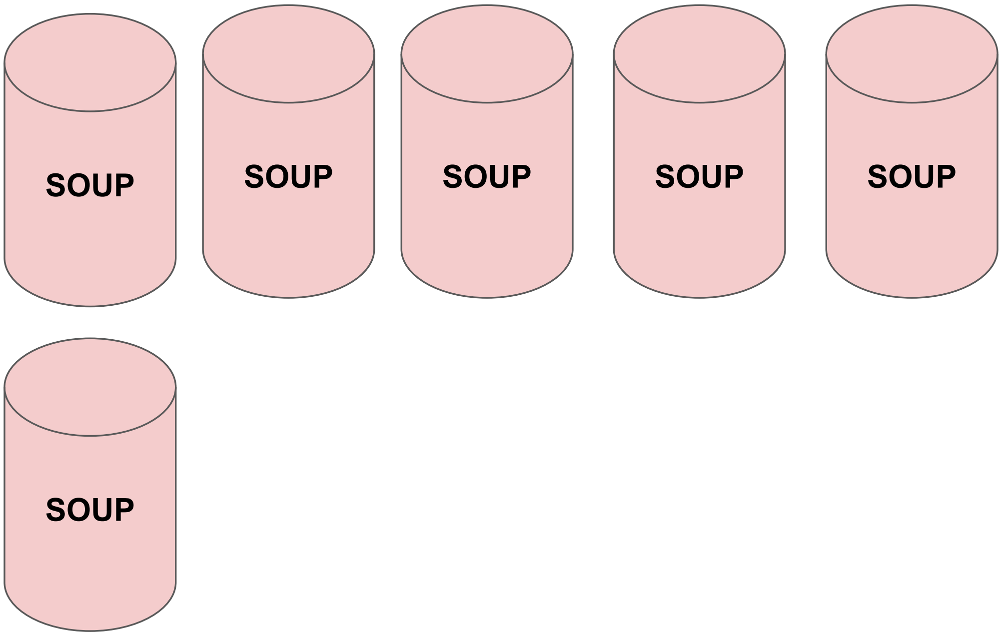
Let’s Talk:



Let’s Think:

Estimate the quotient.

607 ➗ 22

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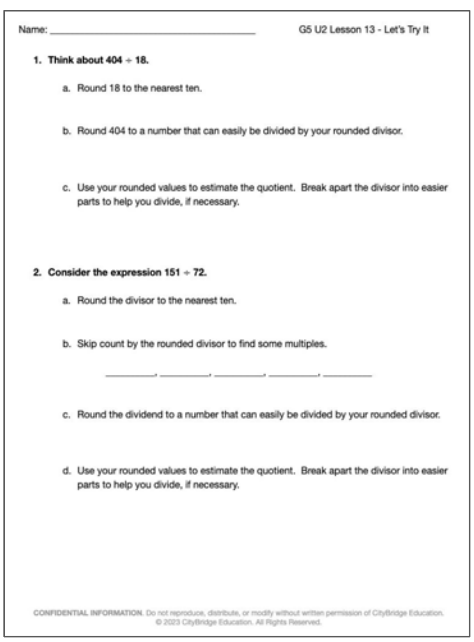
Let's Think:

Estimate the quotient.

$483 \div 66$

Let's Try It:

Let's explore using basic facts to approximate quotients with two-digit divisors together.



Name: ____________________ G5 U2 Lesson 13 - Let's Try It

1. Think about $404 \div 18$.

a. Round 18 to the nearest ten.

b. Round 404 to a number that can easily be divided by your rounded divisor.

c. Use your rounded values to estimate the quotient. Break apart the divisor into easier parts to help you divide, if necessary.

2. Consider the expression $151 \div 72$.

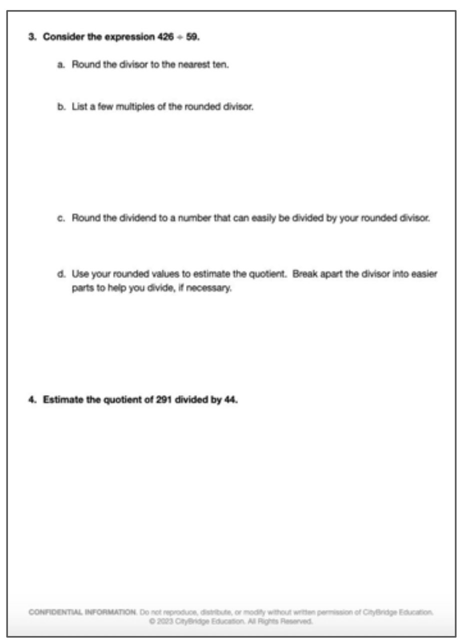
a. Round the divisor to the nearest ten.

b. Skip count by the rounded divisor to find some multiples.

______, ______, ______, ______, ______

c. Round the dividend to a number that can easily be divided by your rounded divisor.

d. Use your rounded values to estimate the quotient. Break apart the divisor into easier parts to help you divide, if necessary.



3. Consider the expression $426 \div 59$.

a. Round the divisor to the nearest ten.

b. List a few multiples of the rounded divisor.

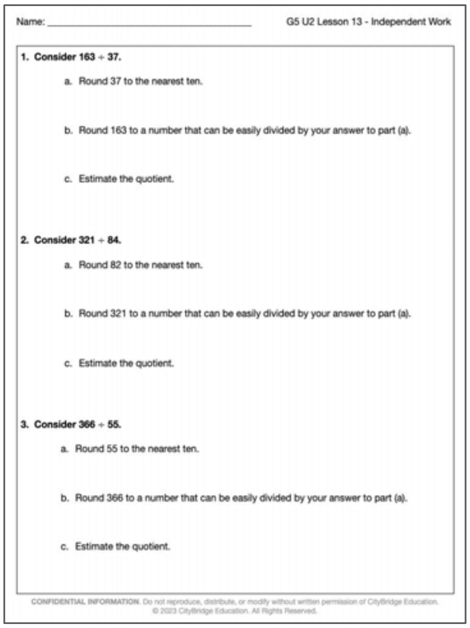
c. Round the dividend to a number that can easily be divided by your rounded divisor.

d. Use your rounded values to estimate the quotient. Break apart the divisor into easier parts to help you divide, if necessary.

4. Estimate the quotient of 291 divided by 44.

On your Own:

Now it's time to use basic facts to approximate quotients of two-digit divisors on your own.



Name: ______________________ G5 U2 Lesson 13 - Independent Work

1. Consider 163 ÷ 37.

a. Round 37 to the nearest ten.

b. Round 163 to a number that can be easily divided by your answer to part (a).

c. Estimate the quotient.

2. Consider 321 ÷ 84.

a. Round 82 to the nearest ten.

b. Round 321 to a number that can be easily divided by your answer to part (a).

c. Estimate the quotient.

3. Consider 366 ÷ 55.

a. Round 55 to the nearest ten.

b. Round 366 to a number that can be easily divided by your answer to part (a).

c. Estimate the quotient.

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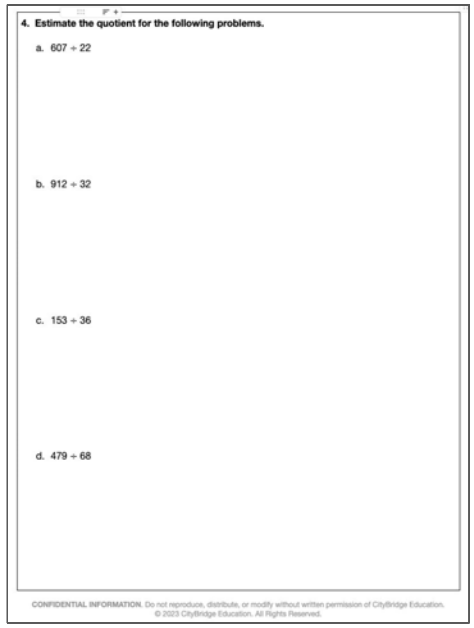

4. Estimate the quotient for the following problems.

a. 607 ÷ 22

b. 912 ÷ 32

c. 153 ÷ 36

d. 479 ÷ 68

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1. Think about $404 \div 18$.

    a. Round 18 to the nearest ten.

    b. Round 404 to a number that can easily be divided by your rounded divisor.

    c. Use your rounded values to estimate the quotient. Break apart the divisor into easier parts to help you divide, if necessary.

2. Consider the expression $151 \div 72$.

    a. Round the divisor to the nearest ten.

    b. Skip count by the rounded divisor to find some multiples.

    __________, __________, __________, __________, __________

    c. Round the dividend to a number that can easily be divided by your rounded divisor.

    d. Use your rounded values to estimate the quotient. Break apart the divisor into easier parts to help you divide, if necessary.

3. Consider the expression $426 \div 59$.

    a. Round the divisor to the nearest ten.

    b. List a few multiples of the rounded divisor.

c. Round the dividend to a number that can easily be divided by your rounded divisor.

d. Use your rounded values to estimate the quotient. Break apart the divisor into easier parts to help you divide, if necessary.

4. Estimate the quotient of 291 divided by 44.

1. Consider $163 \div 37$.
   a. Round 37 to the nearest ten.

   b. Round 163 to a number that can be easily divided by your answer to part (a).

   c. Estimate the quotient.

2. Consider $321 \div 84$.
   a. Round 82 to the nearest ten.

   b. Round 321 to a number that can be easily divided by your answer to part (a).

   c. Estimate the quotient.

3. Consider $366 \div 55$.
   a. Round 55 to the nearest ten.

   b. Round 366 to a number that can be easily divided by your answer to part (a).

   c. Estimate the quotient.

4. Estimate the quotient for the following problems.
   a. $607 \div 22$

b. $912 \div 32$

c. $153 \div 36$

d. $479 \div 68$

Name: KEY

1. **Think about 404 ÷ 18.**

   a. Round 18 to the nearest ten.

   $18 \approx 20$

   b. Round 404 to a number that can easily be divided by your rounded divisor.

   $404 \approx 400$

   c. Use your rounded values to estimate the quotient. Break apart the divisor into easier parts to help you divide, if necessary.

   40 tens ÷ 2 tens = 20

2. **Consider the expression 151 ÷ 72.**

   a. Round the divisor to the nearest ten.

   $72 \approx 70$

   b. Skip count by the rounded divisor to find some multiples.

   70, 140, 210, 280, 350

   c. Round the dividend to a number that can easily be divided by your rounded divisor.

   $151 \approx 140$

   d. Use your rounded values to estimate the quotient. Break apart the divisor into easier parts to help you divide, if necessary.

   $140 \div 70 = 2$

3. **Consider the expression 426 ÷ 59.**

a. Round the divisor to the nearest ten.

$59 \approx 60$

close!

b. List a few multiples of the rounded divisor.

60, 120, 180, 240, 300, 360, $\boxed{420}$

c. Round the dividend to a number that can easily be divided by your rounded divisor.

$420 \div 60 = ?$

d. Use your rounded values to estimate the quotient. Break apart the divisor into easier parts to help you divide, if necessary.

$\underset{\text{tens}}{42} \div \underset{\text{tens}}{6} = 7$

4. **Estimate the quotient of 291 divided by 44.**

$44 \approx 40$

$291 \approx 280$

$280 \div 40 = ?$

$\underset{\text{tens}}{28} \div \underset{\text{tens}}{4} = 7$

Name: KEY

1. Consider 163 ÷ 37.

a. Round 37 to the nearest ten.

$37 \approx 40$

b. Round 163 to a number that can be easily divided by your answer to part (a).

$163 \approx 160$

c. Estimate the quotient.

16 tens ÷ 4 tens = 4

2. Consider 321 ÷ 84.

a. Round 82 to the nearest ten.

$82 \approx 80$

b. Round 321 to a number that can be easily divided by your answer to part (a).

$321 \approx 320$

c. Estimate the quotient.

32 tens ÷ 8 tens = 4

3. Consider 366 ÷ 55.

a. Round 55 to the nearest ten.

$55 \approx 60$

b. Round 366 to a number that can be easily divided by your answer to part (a).

$366 \approx 360$

c. Estimate the quotient.

36 tens ÷ 6 tens = 6

4. Estimate the quotient for the following problems.

a. $607 \div 22$

$22 \approx 20$

$607 \approx 600$

$600 \div 20 = ?$

60 tens $\div$ 2 tens = 30

b. $912 \div 32$

$32 \approx 30$

$912 \approx 900$

$900 \div 30 = ?$

90 tens $\div$ 3 tens = 30

c. $153 \div 36$

$36 \approx 40$

$153 \approx 160$

$160 \div 40 = ?$

16 tens $\div$ 4 tens = 4

d. $479 \div 68$

$68 \approx 70$

$479 \approx 490$

$490 \div 70 = ?$

49 tens $\div$ 7 tens = 7

G5 U2 Lesson 14

Divide two- and three-digit dividends by multiples of 10 with single-digit quotients

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G5 U2 Lesson 14 - Students will divide two- and three-digit dividends by multiples of 10 with single digit quotients, and make connections to a written method

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): In our previous lesson, we spent some time estimating quotients by rounding numbers in a division problem. We rounded the divisor, and then found a number close to the total that we knew was divisible by the divisor. Today, we'll use those same estimation skills while also using what we know to calculate the actual quotient. Let's get going!

Let's Talk (Slide 3): Today, we'll be dividing by multiples of 10. Before we get into that, let's reflect on some things we already know about division. Take a look at this student's work. They correctly divided 73 by 8. What do you notice and wonder about this work sample? Possible Student Answers, Key Points:

- I notice they showed their work in vertical form.
- I notice the quotient is 9, because I see that at the top. I notice there is a remainder of 1 at the bottom.
- I notice they checked their work by multiplying 8 x 9, then adding the remainder of 1.

Very observant. *(point as you describe)* This student used vertical form to show their division using a division bar with their total underneath. The divisor of 8 is on the left. I see the student knew 9 groups of 8 make 72, so they wrote 9 as part of their quotient. They subtracted out the 72 they had distributed and were left with a remainder of 1. 73 divided by 8 is 9 with a remainder of 1.

They checked their work by multiplying 9 x 8 to confirm that 9 groups of 8 is 72. Once they added the remainder of 1, they were back at the original total of 73. So, they knew their answer was correct.

Let's see how this type of work can help us think about dividing two- and three-digit numbers by multiples of 10.

Let's Think (Slide 4): This problem is asking us to divide 72 by 30. All of today's problems will involve dividing by a multiple of 10. In this case, 30 is the multiple of 10 that we are dividing by. Before we calculate, let's think about an estimate so we can make sure our actual quotient is reasonable. Thinking back to our previous lesson, how could we use estimation to help us find the approximate quotient? Possible Student Answers, Key Points:

- We usually round the divisor first, but our divisor is already 30. We can just round the total to estimate.
- I can skip-count or use mental math to think of multiples of 30 that are close to 72. We can use 60 or 90.

$$60 \div 30 = 2$$
$$90 \div 30 = 3$$

Either 60 or 90 would be good estimates to use as our total. Let's use both! *(write 60 ÷ 3 = and 90 ÷ 3 =, and fill in answers as student shares)* What is 60 divided by 30? (2) What is 90 divided by 30? (3) So, no matter how we chose to estimate, we know our actual quotient should be around 2 or 3. Let's solve and see if we're correct.

$$30\overline{)72}$$

We can start by writing our division problem in vertical form. We write the total inside our division bar, and the divisor goes on the outside. *(set up vertical form)* I can now think about how many groups of 30 can go into the total of 72. If I'm not sure, my estimated quotient can give me a good starting point. What do you think? Possible Student Answers, Key Points:

- I know 2 groups of 30 is 60, so we can put 2 in our quotient.
- If I used 3 groups of 30, that's 90. 90 is bigger than the total, so that won't help us.

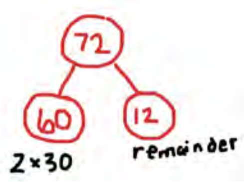
$$\begin{array}{r} 2 \\ 30\overline{)72} \\ -60 \\ \hline 12 \end{array}$$

Okay, let's use 2. *(write 2 above the 2 in 72)* 2 groups of 30 is 60, so we can take that out of the total. *(write -60 under the 72, and then write 12 as the remaining total)* We now only have 12 left in the total. What do you notice? Possible Student Answers, Key Points:

- 12 is less than 30. We can't take any more groups of 30 out of the total.
- 12 is our remainder, because we can't take 30 out of 12.

$$2 \times 30 = 60$$
$$60 + 12 = 72 \checkmark$$

Excellent, so the quotient is 2 with a remainder of 12. Does our answer seem reasonable? (Yes, it's close to both our estimates) Just to be safe, let's check our work like the student did in the problem at the beginning of our lesson. *(write as you narrate)* I know 2 x 30 is 60. If I add the remainder of 12, 60 + 12 = 72.



This makes sense. *(draw number bond as you narrate)* We started with a total of 72. We made 2 groups of 30, which is 60. Then we had 12 leftover as a remainder. We just estimated, found an exact quotient using vertical form, and checked our work. Well done! Let's look at another example.

Let's Think (Slide 5): Now we're dividing 574 by 90. These numbers are a little bigger, but we're still dividing by a multiple of 10, so let's lean on the same thinking we just used. What should we always do before we start calculating a quotient? (We should find an estimated or approximate quotient) Sure, let's find an estimate. We don't need to round our divisor, since it's already 90. Let's think of a total that would be divisible by 90 and close to 574. If you're not sure, you can always list out or skip-count by 90. *(wait for student to work)*

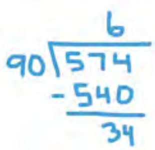
When I thought about multiples of 90, I found 540 and 630 were the closest to our total. Which one makes the most sense in this case, and why? Possible Student Answers, Key Points:

- 540 makes the most sense. It's way closer 574 than 630 is.
- It's okay to have a higher estimate like 630, but in this case, 630 is too far off from our total to be the best choice.

$540 \div 90 = 6$

Great idea, we'll use 540 as our estimated total. *(write as you narrate)* What is 540 divided by 90? (6) Our actual quotient should be about 6. Let's use vertical form to calculate the exact quotient and see if we're close to 6. How should I set up vertical form for this problem? Possible Student Answers, Key Points:

- The total goes inside the division bar symbol, and the divisor goes to the left. We'll put the quotient above the line as we work.



(set up vertical form) How many groups of 90 can go into 574? (6) Right! When we were estimating, we figured out that 6 groups of 90 is 540. *(write 6 in quotient, then continue filling in vertical form as you narrate)* That means we can subtract 540 from our total, leaving us with 34. Looking at our vertical form now, what does this tell us? Possible Student Answers, Key Points:

- he quotient is 6; we see that at the top.
- here is a remainder of 34, because we can't take any more groups of 90 from a total of 34. We can think of the actual quotient as 6 with a remainder of 34.

A quotient of 6 with a remainder of 34 makes sense with our original estimate. Nice work!

$6 \times 90 = 540$

$540 + 34 = 574$ ✓

Let's double-check by using multiplication. How could we do that? *(write as student explains)* Possible Student Answers, Key Points:

- We know 6 groups of 90 is 540. We can write 6 x 90 = 540. Then we add the remainder of 34. 540 + 34 = 574. Our equal groups and the remainder total back up to 574, so our work checks out.

(draw the number bond shown here) How does this number bond represent our quotient? Possible Student Answers, Key Points:

- The number bond shows the total is 574.
- The 540 represents the 6 groups of 90 that we found. The 34 is the leftover part, or the reminder.

Once again, we found the quotient of a two- or three-digit total divided by a multiple of ten. We estimated first, used vertical form to calculate the exact quotient, and then checked our work using multiplication.

Let's Try it (Slides 6 - 7): Now let's work together to divide by multiples of ten. With most problems, we'll want to think about an estimated quotient first, then solve for the actual quotient, and then check our answer. We also saw how we can represent quotients and remainders using a number bond, so keep that in mind as we think through some more problems.

WARM WELCOME

Today we will divide two- and three-digit dividends by multiples of ten with single digit quotients and make connections to a written method

Let's Talk:

$73 \div 8$

$$\begin{array}{r} 9 \\ 8\overline{)73} \\ -72 \\ \hline 1 \end{array}$$

CHECK

$8 \times 9 = 72$

$72 + 1 = 73$ ✓

Let's Think:

72 ÷ 30 = ?

ESTIMATE

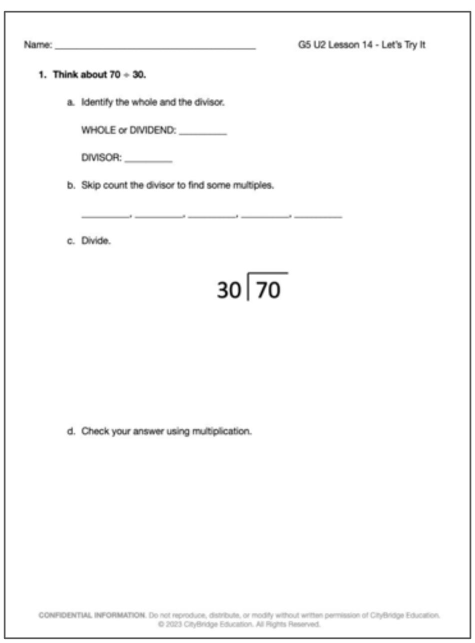
Let's Think:

574 ÷ 90 = ?

ESTIMATE

Let's Try It:

Let's explore dividing by multiples of ten together.



Name: ______________________ G5 U2 Lesson 14 - Let's Try It

1. Think about 70 ÷ 30.

a. Identify the whole and the divisor.

WHOLE or DIVIDEND: ________

DIVISOR: ________

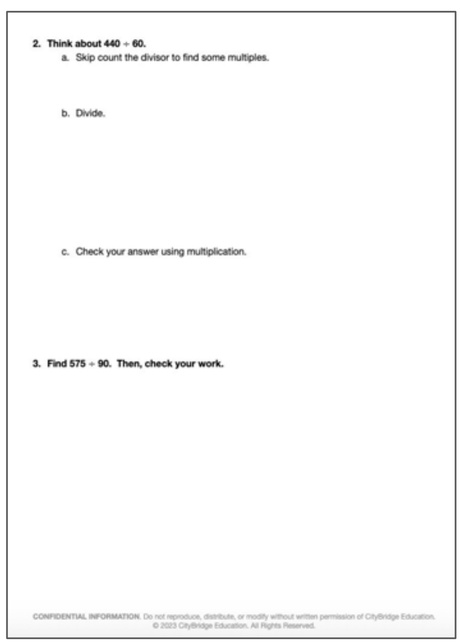
b. Skip count the divisor to find some multiples.

________, ________, ________, ________, ________

c. Divide.

$30\overline{)70}$

d. Check your answer using multiplication.



2. Think about 440 ÷ 60.

a. Skip count the divisor to find some multiples.

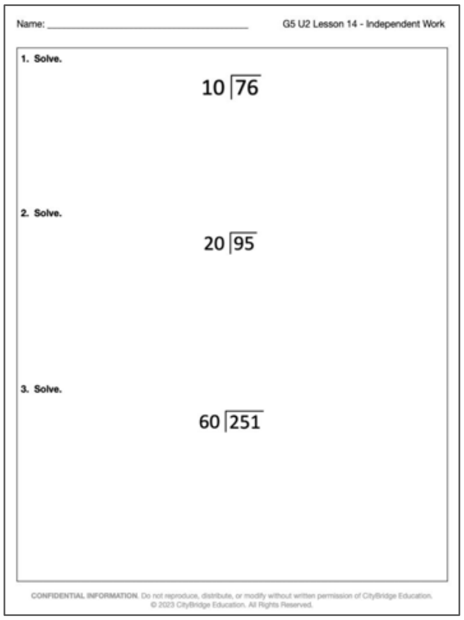
b. Divide.

c. Check your answer using multiplication.

3. Find 575 ÷ 90. Then, check your work.

On your Own:

Now it’s time to divide by multiples of ten on your own.


Name: ______________________ G5 U2 Lesson 14 - Independent Work

1. Solve.

$10 \overline{)76}$

2. Solve.

$20 \overline{)95}$

3. Solve.

$60 \overline{)251}$


4. Divide. Then check using multiplication.

$72 \div 20$

5. Divide. Then check using multiplication.

$295 \div 30$

1. Think about 70 ÷ 30.

   a. Identify the whole and the divisor.

      WHOLE or DIVIDEND: ___________

      DIVISOR: ___________

   b. Skip count the divisor to find some multiples.

      ___________, ___________, ___________, ___________, ___________

   c. Divide.

$$30\overline{)\,70}$$

   d. Check your answer using multiplication.

2. Think about 440 ÷ 60.

   a. Skip count the divisor to find some multiples.

   b. Divide.

c. Check your answer using multiplication.

3. Find 575 ÷ 90. Then, check your work.

1. Solve.

$$10 \overline{)76}$$

2. Solve.

$$20 \overline{)95}$$

3. Solve.

$$60 \overline{)251}$$

4. Divide. Then check using multiplication.

$72 \div 20$

5. Divide. Then check using multiplication.

$$295 \div 30$$

Name: KEY

1. **Think about 70 ÷ 30.**

   a. Identify the whole and the divisor.

   WHOLE or DIVIDEND: 70

   DIVISOR: 30

   b. Skip count the divisor to find some multiples.

   30, *60, *90, 120, 150

   c. Divide.

$$\begin{array}{r} 2 \\ 30\overline{)70} \\ -60 \\ \hline 10 \end{array}$$

   QUOTIENT: 2
   REMAINDER: 10

   d. Check your answer using multiplication.

$(2 \times 30) + 10$

$60 + 10$

70 ✓

2. **Think about 440 ÷ 60.**

a. Skip count the divisor to find some multiples.

60, 120, 180, 240, 300, 360, *420, *480

b. Divide.

$$60 \overline{)440}$$

7

−420

20

Q: 7
R: 20

c. Check your answer using multiplication.

$(60 \times 7) + 20$

$420 + 20$

440 ✓

3. **Find 575 ÷ 90. Then, check your work.**

90, 180, 270, 360, 450, *540, *630

$$90 \overline{)575}$$

6

−540

35

Q: 6
R: 35

$(6 \times 90) + 35$

$540 + 35$

575 ✓

Name: KEY

1. Solve.

$$\begin{array}{r} 7 \\ 10\overline{)76} \\ -70 \\ \hline 6 \end{array}$$

Q: 7
R: 6

2. Solve.

$$\begin{array}{r} 4 \\ 20\overline{)95} \\ -80 \\ \hline 15 \end{array}$$

Q: 4
R: 15

3. Solve.

$$\begin{array}{r} 4 \\ 60\overline{)251} \\ -240 \\ \hline 11 \end{array}$$

Q: 4
R: 11

4. Divide. Then check using multiplication.

72 ÷ 20

$$20\overline{)72}$$ 3

-60

12

$\boxed{\text{Q: 3} \quad \text{R: 12}}$

$(3 \times 20) + 12$

$60 + 12$

72 ✓

5. Divide. Then check using multiplication.

295 ÷ 30

$$30\overline{)295}$$ 9

-270

25

$\boxed{\text{Q: 9} \quad \text{R: 25}}$

$(9 \times 30) + 25$

$270 + 25$

295 ✓

G5 U2 Lesson 15

Divide two- and three-digit dividends by two-digit divisors with single-digit quotients

CITYTUTOR DC

G5 U2 Lesson 15 - Students will divide two- and three-digit dividends by two-digit divisors with single digit quotients, and make connections to a written method

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): Last time we worked together, we divided with multi-digit numbers. Each division problem involved dividing by a divisor that was a multiple of 10, like 20 or 30 or 40. Today, we'll use similar thinking, but you'll notice our divisors won't always be multiples of ten. We will work to divide by two-digit divisors with single-digit quotients and make connections to a written method.

Let's Talk (Slide 3): Take a look at these two equations. What do you notice? What do you wonder? Possible Student Answers, Key Points:

- I notice they are both division. I notice they both have a total of 194. I notice they are different colors. I notice their divisors are different, but close to each other.
- I wonder what the quotients are. I wonder if the quotients are the same. I wonder if one is an equation to help estimate the other.

$$\begin{array}{r} 4 \\ 40\overline{)194} \\ -160 \\ \hline 34 \end{array}$$

Those are excellent noticings and wonderings. These two equations both have a total of 194. The first one is being divided by a multiple of ten, 40. That is similar to the problems we saw in our last lesson. How would you go about finding the quotient of 194 divided by 40? Feel free to write anything down if that helps. *(write 194 divided by 40 in vertical form as student shares out, if student does not use vertical form)* Possible Student Answers, Key Points:

- I know 4 groups of 40 go into 194, because 4 x 40 = 160. So the quotient would be 4. Since 4 x 40 is 160, that leaves us with 34 in our total. I can't take another group of 40 from 34, so the quotient is 4 with a remainder of 34.

Excellent work. Now, look at the second equation that shows 194 divided by 43. How could you use your work from the first equation to help you think about the second equation? Possible Student Answers, Key Points:

- 43 is very close to 40, so I imagine the quotient would be pretty close.
- Maybe I can use the first equation to help me think about how many groups of 43 can go into 194, since 40 is easier to think about than 43.

You'll see in a moment that the work we do with divisors that are multiples of ten is not too different from the work we'll do when our divisors are *not* multiples of 10. Keep this problem in mind. We'll come back to it!

Let's Think (Slide 4): Let's find the quotient of 73 divided by 23. You'll notice 23 is not a multiple of ten. What is the total in this problem? (73) Let's start by estimating a quotient. What multiple of ten is closest to our divisor of 23? (20) Since our total is 73, we can find the approximate quotient a couple ways. *(write 60 ÷ 20 and 80 ÷ 20).* Which estimate would you choose, and why? Possible Student Answers, Key Points:

$60 \div 20$

$80 \div 20$

- I would choose 60 divided by 20, because 80 divided by 20 is too big. I don't want to go over the total.
- I would choose 80 divided by 20, because 72 is closer to 80 than it is to 60.

Either estimate would be close to the actual quotient, but let's go with 60 divided by 20. This will help us think about how many groups of 23 can go into 73 without going over the total. When we divide, we can't take out more groups than the total allows. What is 60 divided by 20? *(3)* The actual quotient should be about 3. This also tells us that there should be about 3 groups of 23 in 73. Let's calculate and see for ourselves.

$$23\overline{)73}$$

Let's set up our problem in vertical form. *(write in vertical form)* The total goes underneath the division bar, and the divisor goes outside the division bar. We'll leave room above to write the quotient, and we'll leave room below to subtract from the total.

$$\begin{array}{r} 3 \\ 23\overline{)73} \\ -69 \\ \hline 4 \end{array}$$

We said, based on the estimate, that about 3 groups of 23 go into 73. What is 23 x 3? (69) That works! *(write as you narrate)* 3 groups of 23 go into 73. You named that 23 x 3 is 69, so we can subtract and see that we have 4 left in the total. Is 4 enough to make another group of 23? (No.) No, so we know the quotient is 3 with a remainder of 4.

CHECK
$23 \times 3 = 69$
$69 + 4 = 73$ ✓

Think back to our previous lesson. What can we do to check our work? *(write as student shares if student does not write out their thinking)* Possible Student Answers, Key Points:

- I notice they are both division. I notice they both have a total of 94. I notice they are different colors. I notice their divisors are different, but close to each other.

We can use multiplication to check our work. 3 groups of 23, or 3 x 23, is 69. When we add the remaining 4, we end up with the original total of 73. Excellent thinking.

Let's Think (Slide 5): Let's do one more. This problem wants us to divide 59 by 34. Note that the divisor is once again not a multiple of 10.

Let's start by making an estimate. This will help make sure the actual quotient is reasonable, and it will help us start our calculation by considering how many groups of our divisor go into the total. How would you estimate with these numbers? Possible Student Answers, Key Points:

- 34 is close to 30, and 59 is close to 60. So 60 divided by 30, means the quotient should be close to 2.

$60 \div 30 = 2$

Yes, 34 is closest to 30 if we think about multiples of ten. 59 is really close to 60. So an easy estimated quotient to think about would be 60 divided by 30. *(write 60 ÷ 30 = 2)* The answer we get when we calculate in vertical form should be close to 2.

$34\overline{)59}$

Now, we'll calculate the exact quotient. Start by writing the problem in vertical form. *(write 59 inside a division bar with 34 on the outside)* How many groups of 34 go into 59? Possible Student Answers, Key Points:

- Our estimate makes me think 2 groups of 34 should go into 59, but that won't work.
- 2 groups of 34 would be too big, so it's just 1 group.

$$\begin{array}{r} 1 \\ 34\overline{)59} \\ -34 \\ \hline \end{array}$$

Yes, two groups of 34 would be 68. That's too much. So we can only take 1 group of 34 out of 59. That's okay. Sometimes the estimated quotient will be too high, which means we might have to think carefully about how many groups of the divisor can go into the total. *(write 1 in quotient and subtract 34 from 59)* What is the quotient of 59 divided by 34? (The quotient is 1 with a remainder of 25)

CHECK
$1 \times 34 = 34$
$34 + 25 = 59$ ✓

We can use multiplication to check the answer we got. *(write as you narrate)* I know 1 group of 34, or 1 x 34, is 34. I add the remainder of 25, and 34 + 25 = 59. Our answer checks out, because we ended up back at the original total.

Now, think back to the original equations we looked at. *(return to Slide 3, if helpful)* You already solved the red equation, 194 divided by 40. Now that we've practiced some, how would you go about determining the quotient of the blue equation, 194 divided by 43? Possible Student Answers, Key Points:

- Since I know 40 goes into 94 four times, I can see if 43 also goes into 94 four times. 43 x 4 is 172, so it does. The quotient would also be 4, just with a different remainder. 194 minus 172 is 22. The quotient is 4 with 22 remaining.

Well done!

Let's Try it (Slides 6 - 7): Now let's work together to divide by two-digit divisors. With most problems, we'll want to estimate the quotient first, then solve for the actual quotient, and then check our answer. Our estimation and checking our work with multiplication help us make sure we are dividing accurately. Let's go for it!

WARM WELCOME

Today we will divide two- and three-digit dividends by two-digit divisors with single-digit quotients, and make connections to a written method

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Let's Talk:

$194 \div 40 = ?$

$194 \div 43 = ?$

Let's Think:

$73 \div 23 = ?$

<u>ESTIMATE</u>

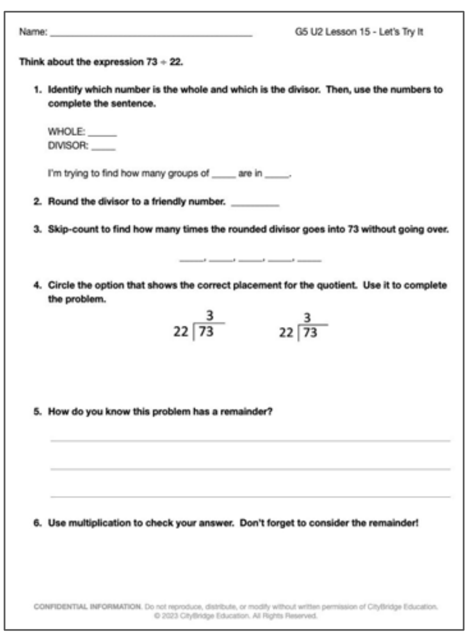
Let's Think:

$59 \div 34 = ?$

ESTIMATE

Let's Try It:

Let's explore dividing by two-digit divisors with single-digit quotients together.



Name: ______________________ G5 U2 Lesson 15 - Let's Try It

Think about the expression 73 ÷ 22.

1. **Identify which number is the whole and which is the divisor. Then, use the numbers to complete the sentence.**

   WHOLE: _____
   DIVISOR: _____

   I'm trying to find how many groups of _____ are in _____.

2. **Round the divisor to a friendly number.** ________

3. **Skip-count to find how many times the rounded divisor goes into 73 without going over.**

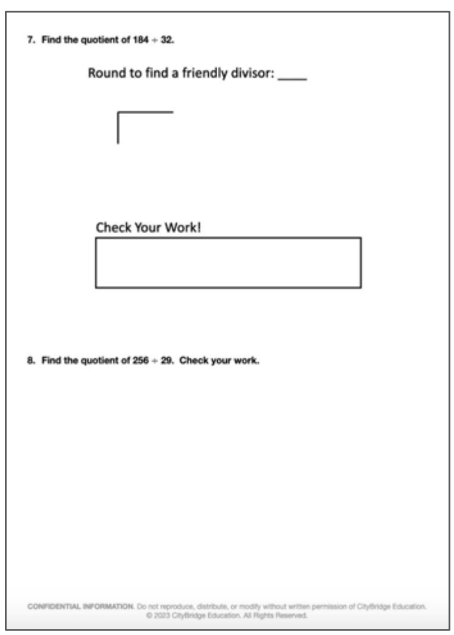
   ____, ____, ____, ____, ____

4. **Circle the option that shows the correct placement for the quotient. Use it to complete the problem.**

   $\begin{array}{r} 3 \\ 22\overline{)73} \end{array}$ $\begin{array}{r} 3 \\ 22\overline{)73} \end{array}$

5. **How do you know this problem has a remainder?**

6. **Use multiplication to check your answer. Don't forget to consider the remainder!**



7. **Find the quotient of 184 ÷ 32.**

   Round to find a friendly divisor: ____

   Check Your Work!

8. **Find the quotient of 256 ÷ 29. Check your work.**

On your Own:

Now it’s time to divide by two-digit divisors with single-digit quotients on your own.

Name: ______________________ G5 U2 Lesson 15 - Independent Work

1. Solve.

$$23\overline{)59}$$

2. Solve.

$$27\overline{)84}$$

3. Solve.

$$45\overline{)59}$$

4. Divide. Then check with multiplication.

a. 181 ÷ 23

b. 689 ÷ 79

Think about the expression $73 \div 22$.

1. Identify which number is the whole and which is the divisor. Then, use the numbers to complete the sentence.

   WHOLE: _______
   DIVISOR: ______

   I'm trying to find how many groups of ______ are in ______.

2. Round the divisor to a friendly number. ___________

3. Skip-count to find how many times the rounded divisor goes into 73 without going over.

   ______, ______, ______, ______, ______

4. Circle the option that shows the correct placement for the quotient. Use it to complete the problem.

$$22\overline{)\,73}\ \text{with } 3 \text{ above the } 3 \qquad\qquad 22\overline{)\,73}\ \text{with } 3 \text{ above the } 7$$

5. How do you know this problem has a remainder?

   ____

   ____

   ____

6. Use multiplication to check your answer. Don't forget to consider the remainder!

7. Find the quotient of $184 \div 32$.

Round to find a friendly divisor: ____

Check Your Work!

8. Find the quotient of $256 \div 29$. Check your work.

1. Solve.

$$23 \overline{)\,59}$$

2. Solve.

$$27 \overline{)\,84}$$

3. Solve.

$$45 \overline{)\,59}$$

4. Divide. Then check with multiplication.

a. $181 \div 23$

b. $689 \div 79$

Name: KEY

Think about the expression 73 ÷ 22.

1. **Identify which number is the whole and which is the divisor. Then, use the numbers to complete the sentence.**

   WHOLE: 73
   DIVISOR: 22

   I'm trying to find how many groups of 22 are in 73.

2. **Round the divisor to a friendly number.** 20

3. **Skip-count to find how many times the rounded divisor goes into 73 without going over.**

   20, 40, *60, *80, 100

4. **Circle the option that shows the correct placement for the quotient. Use it to complete the problem.**

$$22 \times 3 = 66$$

$$\begin{array}{r} 3 \\ 22\overline{)73} \\ -66 \\ \hline 7 \end{array} \qquad \cancel{\begin{array}{r} 3 \\ 22\overline{)73} \end{array}}$$

5. **How do you know this problem has a remainder?**

   There is 7 left in the total. I can't make another group of 22 from 7.

6. **Use multiplication to check your answer. Don't forget to consider the remainder!**

$$(3 \times 22) + 7$$
$$66 + 7$$
$$73$$

7. **Find the quotient of 184 ÷ 32.**

30, 60, 90, 120, 150, 180 ✓

Round to find a friendly divisor: 30

$$\require{cancel}\cancel{32\overline{)184}}$$

← cannot subtract

$$\begin{array}{r} 5 \\ 32\overline{)184} \\ -160 \\ \hline 24 \end{array}$$

$$\begin{array}{r} 32 \\ \times\ 5 \\ \hline 160 \end{array}$$

Check Your Work!

(5 × 32) + 24
160 + 24
184 ✓

8. **Find the quotient of 256 ÷ 29. Check your work.**

29 ≈ 30

30 × 8 = 240

$$\begin{array}{r} 29 \\ \times\ 8 \\ \hline 232 \end{array}$$

$$\begin{array}{r} 8 \\ 29\overline{)256} \\ -232 \\ \hline 24 \end{array}$$

(29 × 8) + 24
232 + 24
256 ✓

Name: KEY

1. Solve.

$$\begin{array}{r|l} & 2 \\ \hline 23 & 59 \\ & -46 \\ \hline & 13 \end{array}$$

2. Solve.

$27 \approx 30$

$$\begin{array}{r} 27 \\ \times\ 3 \\ \hline 81 \end{array}$$

$$\begin{array}{r|l} & 3 \\ \hline 27 & 84 \\ & -81 \\ \hline & 3 \end{array}$$

3. **Solve.**

$$45 \overline{)59}$$

1
-45
14

4. **Divide. Then check with multiplication.**

a. 181 ÷ 23

23 ≈ 20

23 × 9 = 207 too big

23 × 8 = 184 too big

23 × 7 = 161

7
23 ⟌ 181
-161
20

(7×23)+20
161+20
181 ✓

b. 689 ÷ 79

79 ≈ 80
80× 8 = 640

79 × 8 = 632

8
79 ⟌ 689
-632
57

(8×79)+57
632+57
689 ✓

G5 U2 Lesson 16

Divide decimal dividends by multiples of 10, reasoning about the placement of the decimal point

G5 U2 Lesson 16 - Students will divide decimal dividends by multiples of 10, reasoning about the placement of the decimal point and making connections to a written method

Warm Welcome (Slide 1): Tutor choice

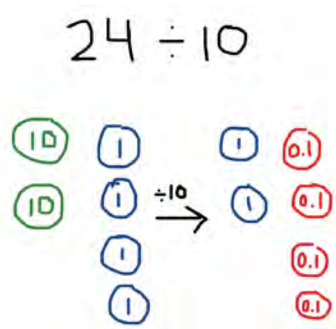
Frame the Learning/Connect to Prior Learning (Slide 2): Last time we worked together, we divided with multi-digit numbers. Each division problem involved dividing by a divisor that was a multiple of 10, like 20 or 30 or 40. Today, we'll use similar thinking, but you'll notice our divisors won't always be multiples of ten. We will work to divide by two-digit divisors with single-digit quotients and make connections to a written method.

Let's Talk (Slide 3): Take a second and look at these equations. What is the same and what is different about each? Possible Student Answers, Key Points:

- They all involve division. They all use the fact 12 divided by 6 in some way. They all have a divisor of 2.
- They each have a different total and a different answer. Some have decimal numbers and some do not. Each quotient has a 6 in a different place value.

I noticed that there are similar digits in each problem. I see 12, 6 and 2 in each one, but the place value of the digits is different depending on the equation. The place patterns we see here will show up in some of our work today. We can use what we know about whole number division, place value units, and patterns to help us divide with decimal dividends. Let's work on some problems, and I'll show you what I mean.

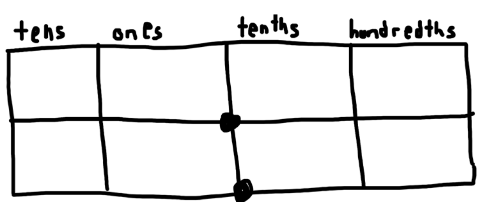
Let's Think (Slide 4): This problem wants us to find three quotients. Let's start by thinking about 24 divided by 10. *(write 24 ÷ 10 horizontally)*



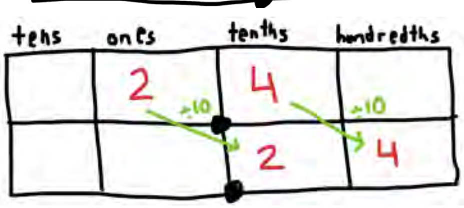
We'll solve this one by thinking about place value disks. I'm going to draw 2 tens and 4 ones to represent 24. *(draw 2 tens and 4 ones)* We are going to divide this value by 10. *(draw an arrow labeled ÷ 10)* If I think about 1 ten, what is 1 ten divided by 10? (1) So, I know 2 tens divided by 10 would be 2 ones. *(draw 2 ones on the other side of the arrow)* If I think about 1 one, what is 1 one divided by 10? (1 tenth or 0.1 or 1/10) So, 4 ones divided by 10 would be 4 tenths. *(draw 4 tenths next to the 2 ones)* Based on the place value disks we drew, we can see that 24 divided by 10 is 2 ones and 4 tenths, which is 2.4.

Look at the next equation we are asked to solve. What do you notice? Possible Student Answers, Key Points:

- It has a different total, but we're still dividing by 10. Instead of 24 it's 24 tenths.
- I see the same digits, but in different place values in the total.



We can think about this one in a similar way. We could model 2 ones and 4 tenths using disks and divide that by 10. Another way we can show this thinking is with a place value chart. *(sketch a place value chart as shown, labeling tens, ones, tenths, and hundredths)*

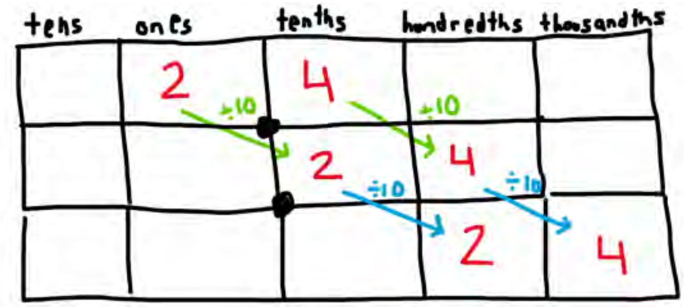


Our total, or dividend, in this equation is 2 ones and 4 tenths. *(write 2 in ones and 4 in tenths in the first row)* If I divide 1 one by 10, I get 1 tenth. What is 2 ones divided by 10? (2 tenths) *(write 2 tenths in the bottom row and draw an arrow labeled ÷ 10)* If I divide 1 tenth by 10, I get 1 hundredth. What is 4 tenths divided by 10? (4 hundredths) *(write 4 hundredths in the bottom row and draw an arrow labeled ÷ 10)* Our place value chart shows us that 2.4 divided by 10 is equal to 0.24. How is this strategy the alike or different compared to using place value disks? Possible Student Answers, Key Points:

- Both strategies show dividing by 10. Both strategies show dividing by each unit separately.
- The place value disks require more drawing/writing, since you have to draw all the disks both times. The place value chart seems a little more efficient.

Both methods work, but let's keep using the place value chart to find this last quotient. The last equation wants us to divide 0.24 by 10. Let's add a row and a column to our place value chart so we have room to work. *(draw an additional row along the bottom of the place value chart and draw/label a thousandths column)* We already have 0.24 in the second row of the chart. How can I show that I am dividing that value by 10 in our updated place value chart? *(draw arrows and digits as student shares)* Possible Student Answers, Key Points:

- 2 tenths divided by 10 would be 2 hundredths. We can draw an arrow and write 2 in the hundredths place. 4 hundredths divided by 10 would be 4 thousandths. We can draw another arrow and write 4 in the thousandths place.



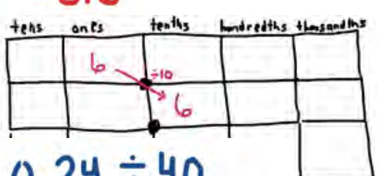
Nice work! So 0.24 divided by 10 is 0.024, or 24 thousandths. What patterns do you notice as we divided 24, 2.4, and 0.24 by 10? Possible Student Answers, Key Points:

- We used the same digits, they just were in different place values.
- Each time we divided by 10, our digits shifted to the right. Each larger place value unit can be broken into 10 of a smaller unit.

Let's Think (Slide 5): Let's try a few more. This time, you'll notice the divisor isn't ten. Instead, it's a multiple of 10. As we work, think about what is similar and what is different compared to the work we just did.

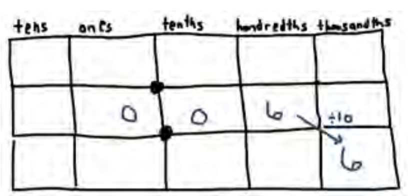
$24 \div 40$
$= 24 \div 4 \div 10$
$= 6 \div 10$
$= 0.6$

The first equation is asking us to divide 24 by 40. *(write equation horizontally)* Instead of dividing by 40 all at once, let's divide by 4…then divide by 10. *(write 24 ÷ 4 ÷ 10)* What is 24 divided by 4? (6) Now all we have to think about is 6 divided by 10. Use disks or a place value chart. What is 6 divided by 10? (6 tenths, or 0.6) *(show 6 divided by 10 in a place value chart, as needed)* We divided 24 by 40 in parts, dividing by 4 first, and then 10. We see that 24 divided by 40 is 0.6.



$0.24 \div 40$
$= 0.24 \div 4 \div 10$
$= 0.06 \div 10$
$= 0.006$

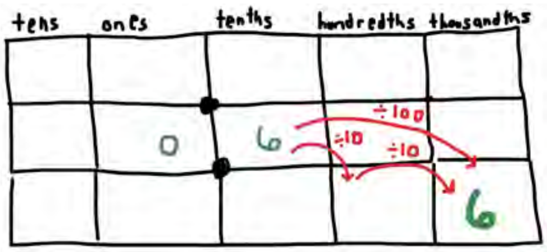
The second equation wants us to divide 0.24 by 40. *(write equation horizontally)* Dividing by 40 all at once could be confusing, so we'll break it into pieces. We'll divide by 4 and then by 10. *(write 0.24 ÷ 4 ÷ 10)* What is 24 hundredths divided by 4? (6 hundredths or 0.06) Now all we have to think about is 0.06 divided by 10. Use disks or a place value chart. What is 0.06 divided by 10? *(write equation)* (0.006 or 6 thousandths)



(show 0.06 divided by 10 in a place value chart, as needed) We divided 24 hundredths by 4, then by 10. We see that 0.24 divided by 40 is 0.006.

Let's wrap this up with the last equation. What do you see that is a bit different here? (We're dividing by 400 instead of just 40) Not to worry, we can still divide in parts. Instead of dividing by 400 all at once, we can divide by 4 then 100. Or if you'd prefer, we can divide by 4, then 10, then 10 again. Either option will work. *(write 2.4 divided by 400 horizontally, then write 2.4 ÷ 4 ÷ 100 underneath it)* What is 2.4, or 24 tenths, divided by 4? (6 tenths or 0.6) *(write 0.6 divided by 100 underneath)*

$2.4 \div 400$
$= 2.4 \div 4 \div 100$
$= 0.6 \div 100$
$= 0.006$



Now, we just have to divide 0.6 by 100. Each place value unit is 10 times as much as the next smallest unit, so if we are dividing by 10, we can shift our digit one place value. In this case, we're dividing by 100, so we will shift the 6 two place values. *(write 0.6 in a place value chart, draw an arrow labeled with ÷100, and another 6 in the thousandths place in the row below like shown)* If dividing by 100 all at once seems like a lot, we can think of dividing 0.6 by 10, to get 0.06, then by 10 again to get 0.006. *(show this with two labeled arrows as shown)*

So 2.4 divided by 400 is what? (0.006) Correct!

Think back to the first set of colorful equations we looked at. *(show slide 2 again)* Now that we know what we know about dividing with decimal dividends, how would you explain what we see in these equations? Possible Student Answers, Key Points:

- I could explain what is happening in these equations by using unit form. Each shows 12 of a unit divided by 2. The first equation shows 12 hundreds divided by 2, which is 6 hundreds. 12 tens divided by 2 is 6 tens. 12 ones divided by 2 is 6 ones. 12 tenths divided by 2 is 6 tenths. 12 hundredths divided by 2 is 6 hundredths. We can think of the fact 12 ÷ 6, just with different place value units.

Let's Try it (Slides 6 - 7): Now let's work together to divide decimal dividends by multiples of 10. We can use place value disks or place value charts to help us think about dividing by 10. If we're dividing by a multiple of 10 other than ten, we can decompose and divide in parts to help us make sense of the problem and keep track of our units. Let's give it a try with some more problems.

WARM WELCOME

Today we will divide decimal dividends by multiples of 10, reasoning about the placement of the decimal point and making connections to a written method

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Let's Talk:

$1{,}200 \div 2 = 600$

$120 \div 2 = 60$

$12 \div 2 = 6$

$1.2 \div 2 = 0.6$

$0.12 \div 2 = 0.06$

Let's Think:

Find each quotient.

$24 \div 10 = ?$

$2.4 \div 10 = ?$

$0.24 \div 10 = ?$

Let's Think:

Find each quotient.

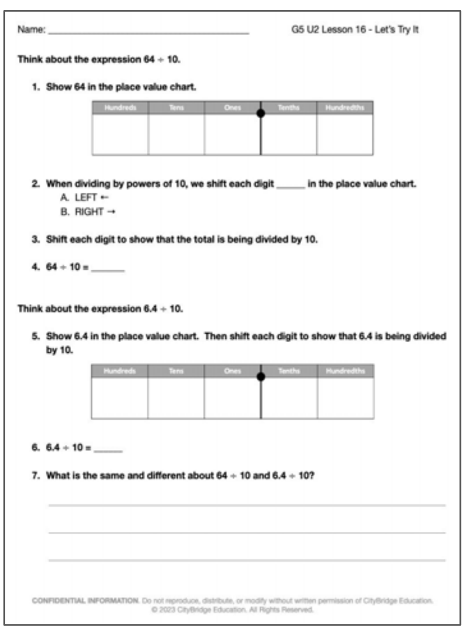
$24 \div 40 = ?$

$0.24 \div 40 = ?$

$2.4 \div 400 = ?$

Let's Try It:

Let's explore dividing decimal dividends by multiples of 10 together.



Name: ______________________ G5 U2 Lesson 16 - Let's Try It

Think about the expression $64 \div 10$.

1. Show 64 in the place value chart.

Hundreds	Tens	Ones	Tenths	Hundredths

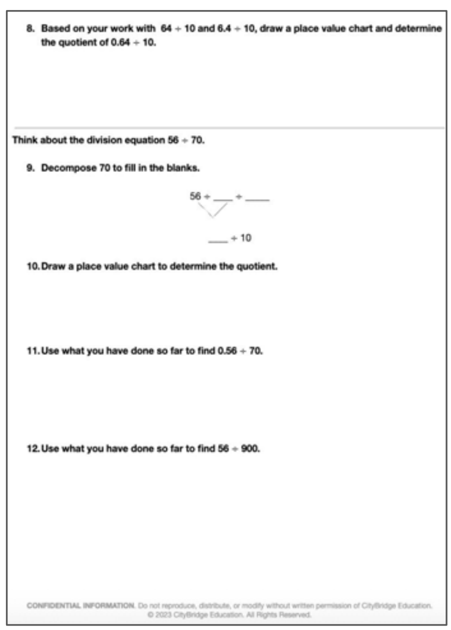
2. When dividing by powers of 10, we shift each digit _____ in the place value chart.
   A. LEFT ←
   B. RIGHT →
3. Shift each digit to show that the total is being divided by 10.
4. $64 \div 10 =$ _____

Think about the expression $6.4 \div 10$.

5. Show 6.4 in the place value chart. Then shift each digit to show that 6.4 is being divided by 10.

Hundreds	Tens	Ones	Tenths	Hundredths

6. $6.4 \div 10 =$ _____
7. What is the same and different about $64 \div 10$ and $6.4 \div 10$?



8. Based on your work with $64 \div 10$ and $6.4 \div 10$, draw a place value chart and determine the quotient of $0.64 \div 10$.

Think about the division equation $56 \div 70$.

9. Decompose 70 to fill in the blanks.

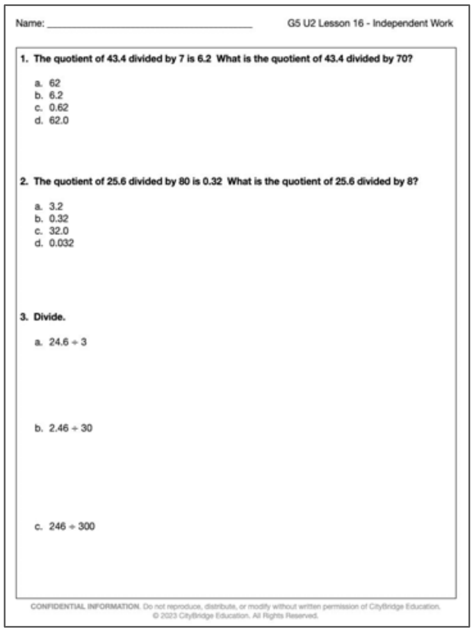
$56 \div$ ___ $\div$ ___

___ $\div 10$

10. Draw a place value chart to determine the quotient.
11. Use what you have done so far to find $0.56 \div 70$.
12. Use what you have done so far to find $56 \div 900$.

On your Own:

Now it's time to divide decimal dividends by multiples of 10 on your own.


Name: ______________________ G5 U2 Lesson 16 - Independent Work

1. The quotient of 43.4 divided by 7 is 6.2 What is the quotient of 43.4 divided by 70?

a. 62
b. 6.2
c. 0.62
d. 62.0

2. The quotient of 25.6 divided by 80 is 0.32 What is the quotient of 25.6 divided by 8?

a. 3.2
b. 0.32
c. 32.0
d. 0.032

3. Divide.

a. 24.6 ÷ 3

b. 2.46 ÷ 30

c. 246 ÷ 300


4. If 7.38 ÷ 9 = 0.82, then what is the quotient of 7.38 ÷ 90? Explain.

Think about the expression 64 ÷ 10.

1. Show 64 in the place value chart.

Hundreds	Tens	Ones	Tenths	Hundredths

2. When dividing by powers of 10, we shift each digit _______ in the place value chart.
   A. LEFT ←
   B. RIGHT →

3. Shift each digit to show that the total is being divided by 10.

4. 64 ÷ 10 = ________

Think about the expression 6.4 ÷ 10.

5. Show 6.4 in the place value chart. Then shift each digit to show that 6.4 is being divided by 10.

Hundreds	Tens	Ones	Tenths	Hundredths

6. 6.4 ÷ 10 = _______

7. What is the same and different about 64 ÷ 10 and 6.4 ÷ 10?

____

____

____

8. Based on your work with 64 ÷ 10 and 6.4 ÷ 10, draw a place value chart and determine the quotient of 0.64 ÷ 10.

Think about the division equation 56 ÷ 70.

9. Decompose 70 to fill in the blanks.

$$\underbrace{56 \div \_\_\_\_}_{\_\_\_\_ \div 10} \div \_\_\_\_$$

10. Draw a place value chart to determine the quotient.

11. Use what you have done so far to find 0.56 ÷ 70.

12. Use what you have done so far to find 56 ÷ 700.

1. The quotient of 43.4 divided by 7 is 6.2 What is the quotient of 43.4 divided by 70?

    a. 62
    b. 6.2
    c. 0.62
    d. 62.0

2. The quotient of 25.6 divided by 80 is 0.32 What is the quotient of 25.6 divided by 8?

    a. 3.2
    b. 0.32
    c. 32.0
    d. 0.032

3. Divide.

    a. $24.6 \div 3$

    b. $2.46 \div 30$

    c. $246 \div 300$

4. If $7.38 \div 9 = 0.82$, then what is the quotient of $7.38 \div 90$? Explain.

Name: KEY

Think about the expression 64 ÷ 10.

1. **Show 64 in the place value chart.**

Hundreds	Tens	Ones	Tenths	Hundredths
	6	4 6	4	

2. **When dividing by powers of 10, we shift each digit ______ in the place value chart.**
   A. LEFT ←
   B. RIGHT →

3. **Shift each digit to show that the total is being divided by 10.**

4. **64 ÷ 10 =** 6.4

Think about the expression 6.4 ÷ 10.

5. **Show 6.4 in the place value chart. Then shift each digit to show that 6.4 is being divided by 10.**

Hundreds	Tens	Ones	Tenths	Hundredths
		6	÷10 4 6	÷10 4

6. **6.4 ÷ 10 =** 0.64

7. **What is the same and different about 64 ÷ 10 and 6.4 ÷ 10?**

They both use the same digits and divide by 10. The place value of the digits in each quotient are different.

8. Based on your work with 64 ÷ 10 and 6.4 ÷ 10, draw a place value chart and determine the quotient of 0.64 ÷ 10.

1	0.1	0.01	0.001
0.	6	4	
0	0	6	4

0.064

Think about the division equation 56 ÷ 70.

9. Decompose 70 to fill in the blanks.

56 ÷ 7 ÷ 10

8 ÷ 10

10. Draw a place value chart to determine the quotient.

ones	tenths
8	÷10
	8

0.8

11. Use what you have done so far to find 0.56 ÷ 70.

0.56 ÷ 7 ÷ 10

0.08 ÷ 10

0.008

12. Use what you have done so far to find 56 ÷ ~~900.~~ 700

56 ÷ 7 ÷ 10 ÷ 10

8 ÷ 10 ÷ 10

0.8 ÷ 10

0.08

Name: KEY

1. The quotient of 43.4 divided by 7 is 6.2 What is the quotient of 43.4 divided by 70?

a. 62
b. 6.2
c. 0.62
d. 62.0

$43.4 \div 7 \div 10$
$6.2 \div 10$
0.62

2. The quotient of 25.6 divided by 80 is 0.32 What is the quotient of 25.6 divided by 8?

a. 3.2
~~b. 0.32~~
c. 32.0
d. 0.032

these digits are one place value farther right

3. Divide.

a. 24.6 ÷ 3

$24 \div 3 = 8$
$0.6 \div 3 = 0.2$ → 8.2

b. 2.46 ÷ 30

$2.46 \div 30$
$2.46 \div 3 \div 10$
$0.82 \div 10$
0.082

c. 246 ÷ 300

$246 \div 3 \div 100$
$82 \div 100$
0.82

4. **If 7.38 ÷ 9 = 0.82, then what is the quotient of 7.38 ÷ 90? Explain.**

$7.38 \div 9 \div 10$

$0.82 \div 10$

$\boxed{0.082}$

I can decompose 90 into factors of 9 and 10.
I already know 7.38 ÷ 9 = 0.82, so I can just divide that by 10. I can shift each digit in 0.82 to the right.

G5 U2 Lesson 17

Use basic facts to approximate decimal quotients with two-digit divisors

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G5 U2 Lesson 17 - Students will use basic facts to approximate decimal quotients with two-digit divisors, reasoning about the placement of the decimal point

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): We've spent time in previous lessons thinking about division. One thing we know can help us when dividing is estimation. For example, if I'm trying to find the quotient of 85 divided by 22 *(write 85 ÷ 12)*, I can first estimate by thinking about 80 divided by 20 *(write that equation underneath)*. This tells me that the quotient should be about 4. Estimating a quotient helps make sure our answer is reasonable, and it helps us think about the relationship between the divisor and the total, or the dividend. Today, we'll use estimation to help us think about decimal quotients specifically.

$85 \div 22 = ?$

$80 \div 20 = 4$

Let's Talk (Slide 3): Take a second and look at the work in the green box on the left. What do you notice this student doing? Possible Student Answers, Key Points:

- It looks like they're estimating the quotient of 635 divided by 23.
- They rounded 23 to 20. They rounded 635 to 640, so it was easy to think about with a divisor of 20. Their quotient should be about 32.

This student rounded their divisor to something a bit easier to think about than 23. They then rounded their divisor to be a number close to 635 that they know 20 goes into neatly. This helped them see that their actual quotient should be something around 32.

Now look at the incomplete work in the red box on the right. How do you think the work shown in the green box could help this student estimate the quotient of 63.5 divided by 23? Possible Student Answers, Key Points:

- I notice they're the same digits, but the total's digits are in different place value positions. Maybe the estimate would still be 4, but in a different place value.
- They can probably still round the divisor to 20. They'd need to round the dividend to something different, though, since 63.5 isn't close to 640; it's close to 64.

Interesting thoughts! Keep all that in mind, because we'll circle back to this question in a few minutes.

Let's Think (Slide 4): This problem wants us to estimate the quotient of 39.1 divided by 17. *(write expression horizontally)* Neither of these numbers is particularly easy to work with using mental math, so estimation makes a lot of sense here.

$39.1 \div 17$

$\downarrow \quad \downarrow$

$40 \div 20 = 2$

We'll start by rounding the divisor. What is 17 rounded to the nearest ten? (20) *(write 20 underneath 17)* Now we need to round the total, or the dividend, to a number that can be easily divided by 20. What do you recommend? (40) Sure, 40 will work well. *(write 40 underneath 39.1)* From here, we can reason that the quotient of 39.1 divided by 17 should be about 2, since 40 divided by 20 is 2.

Estimating with decimal dividends doesn't feel all that different from estimating with whole number dividends, does it? Let's take this one step further. What if I told you that our total was 3.91 instead of 39.1? *(write 3.91 ÷ 17 next to the original equation)*

$3.91 \div 17$

$\downarrow \quad \downarrow$

$4 \div 20$

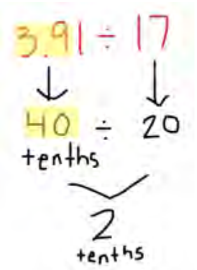
$4 \div 2 \div 10$

$2 \div 10$

0.2

We can still think of 17 as being close to 20. *(write 20 underneath 17)* I can't round 3.91 to 40 though, since 3.91 isn't really close to 40. We can think of it as being about 4, though. *(write 4 underneath 3.91)*

4 divided by 20 maybe isn't a mental math fact we know, because 20 is bigger than 4. That's okay, we can divide in parts. I know we can divide 4 by 2 quickly, and then we can divide that by 10. *(write each step underneath the previous as you narrate)* What is 4 divided by 2? (2) What is 2 divided by 10? (0.2 or 2 tenths) Right, 1 divided by 10 is 1 tenth, so 2 divided by ten is 2 tenths. We can see now that the estimated quotient of 3.91 divided by 17 would be about 2 tenths, or 0.2



We can also think about this same estimation by thinking about unit form. Let me show you what I mean. *(rewrite 3.91 ÷ 17 with an arrow from 17 to 20 underneath it)* Instead of rounding 3.91 to 4 wholes, since dividing 4 by 20 might feel tricky, I can think of 3.91 as being close to 40 tenths, since 3.91 has 39 tenths. 40 tenths is really close to 39 tenths. *(write 40 tenths underneath 3.91)* What is 40 *tenths* divided by 20? (2 tenths) Correct, 40 tenths divided by 20 is 2 tenths or 0.2! *(write it)* Renaming numbers in unit form can make them easier to think about when dividing.

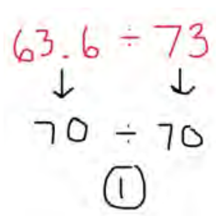
How are the two ways we divided 3.91 by 17 the same or different? Possible Student Answers, Key Points:

- We rounded the divisor to 20 both times. We got 0.2 or 2 tenths as our estimated answer both times.
- The first way, we divided by 20 in pieces that were easy to think about. The second way, we renamed the estimated total in unit form so we could use mental math to divide all at once.

After we round the divisor to something easy to work with, we can use either strategy to think about the dividend and help us find the estimated quotient.

Let's Think (Slide 5): Let's try one more set, so we can be even more confident in our understanding. We'll start by estimating the quotient of 63.6 divided by 73. How would you round these numbers to help us divide and why? Possible Student Answers, Key Points:

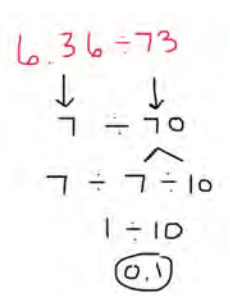
- 73 is really close to 70. 63.6 is really close to 60, but I think 70 will be a better estimate since it works well with the estimated divisor.



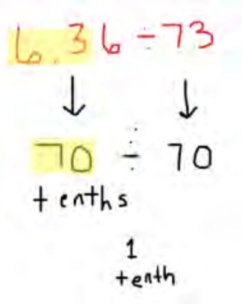
Let's round the divisor to 70. In this case, 63.6 could round to 60, but rounding to 70 will be more efficient in terms of using mental math. *(write 70 ÷ 70 underneath the original equation)* What is 70 divided by 70? (1) The estimated quotient of 63.6 divided by 73 is 1. *(write and circle 1)* Now let's use this problem to help us do one that is a little similar and a little different.

Look at the problem on the right. This wants us to now find the estimated quotient of 6.36 divided by 73. How do you think this estimated quotient will be similar or different compared to the estimated quotient we just found? Possible Student Answers, Key Points:

- It should be smaller since our total is smaller. 6.36 is less than 63.6.
- It will probably have the same digit, 1, but in a different place value. The digits in this problem are the same digits as in the previous problem.



Let's work on it. I'll still round 73 to 70. What compatible or friendly whole number can we round 6.36 to? (7) *(write 7 ÷ 70 underneath original equation)* 7 divided by 70 can be tricky to think about, since 70 is bigger than 7. Let's divide in parts. I can divide 7 by 7 and then by 10 instead of dividing by 70 all at once. What is 7 divided by 7? (1) And 1 divided by 10 is what? (1 tenth or 0.1) The estimated quotient of 6.36 divided by 73 is 0.1. That aligns with some of what you predicted. It's the same estimate we got in our first problem on this slide, just in a different place value.



Before we close out this part, let's think about this problem using the unit form strategy. *(write 6.36 ÷ 73 with an arrow rounding 73 to 70 underneath)* We'll still think of 73 as being about 70, but now let's rename the dividend using unit form in a way that will help us estimate efficiently. Looking at just the ones place isn't super helpful, since we're dividing by 70 and 6.36 only has 6 ones. Let's think about 6.36 in terms of tenths. It has 63 tenths in the number, which is really close to 70 tenths. 70 tenths is easily divisible by 70. *(write 70 tenths ÷ 70 underneath)* What is 70 tenths divided by 70? (1 tenth or 0.1) So by using unit form, we see another way to arrive at the same estimated quotient.

We can consider both strategies as we work more today.

Think back to the work we saw from earlier in the red box on the right. *(return to Slide 3)* Now that we know what we know, how could you help this student use the work they already did to arrive at an estimate for 63.5 divided by 24? Possible Student Answers, Key Points:

- They can use the same steps they used in the green box, with the decimal numbers. They'd just have to be more careful about the place value of their digits when working with decimals.
- If I know 640 divided by 20 gives me an estimate of 32 wholes, then I know 640 tenths divided by 20 gives me an estimate of 320 tenths or 3.2 The answer will have the same digits in a smaller place value.

Let's Try it (Slides 6 - 7): Now let's practice finding approximate decimal quotients. As we've seen, the work we do to estimate decimal quotients is similar to the work we do to estimate whole number quotients. We'll reason about a friendly divisor to work with, then do the same with the dividend in each problem. From there, we just have to carefully divide with decimals by thinking about unit form or dividing in parts. Let's go for it.

WARM WELCOME

Today we will use basic facts to approximate decimal quotients with two-digit divisors, reasoning about the placement of the decimal point

Let's Talk:

$635 \div 23$

$23 \approx 20$

$635 \approx 640$

$640 \div 20 = 32$

$63.5 \div 23$

???

Let's Think:

Estimate the quotient.

$$39.1 \div 17 = ?$$

Let's Think:

Estimate each quotient.

$63.6 \div 73 = ?$	$6.36 \div 73 = ?$

Let's Try It:

Let's explore approximating decimal quotients with two-digit divisors together.

Name: ______________________________ G5 U2 Lesson 17 - Let's Try It

Think about the expression 38.2 ÷ 18.

1. Round the divisor to the nearest ten.
2. Round 38.2 so it is easy to divide by your rounded divisor.
3. Estimate the quotient based on how you rounded each number.

Think about the expression 3.82 ÷ 18.

4. Round the divisor to the nearest ten.
5. Since 3.82 is not easily divisible by the rounded divisor, we can use unit form to help us. What is the rounded divisor in unit form?
6. Round 3.82 so it is easy to divide by your rounded divisor. Decompose the divisor to help.

   3.82 ÷ 18 ≈ ____ ÷ ____

   ____ ÷ ____ ÷ ____

7. How is finding a reasonable estimate for 38.2 ÷ 18 similar to finding a reasonable estimate for 3.82 ÷ 18?

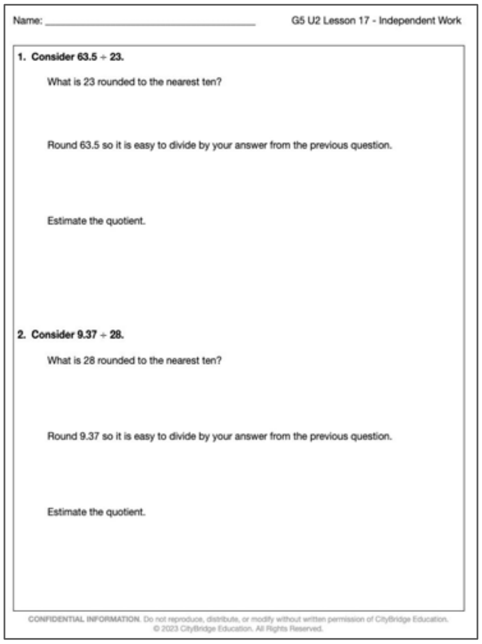
At a bakery, 62.7 pounds of chocolate chips were put into 74 bags. The baker wants to know about how many pounds of chocolate chips were in each bag.

8. Draw a tape diagram to represent what is happening in the story.
9. About how many pounds were in each bag?
   - A. Less than 1 pound
   - B. Exactly 1 pound
   - C. More than 1 pound
10. Round the divisor to the nearest ten. Write it in standard and unit form.
11. Round 62.7 to a number that is easily divisible by the rounded divisor.
12. Find an estimated quotient.
13. Use the previous work to find 6.27 ÷ 74

14. Estimate the quotient of 11.73 ÷ 41.

On your Own:

Now it’s time to approximate decimal quotients with two-digit divisors on your own.


Name: ______________________________ G5 U2 Lesson 17 - Independent Work

1. Consider 63.5 ÷ 23.

What is 23 rounded to the nearest ten?

Round 63.5 so it is easy to divide by your answer from the previous question.

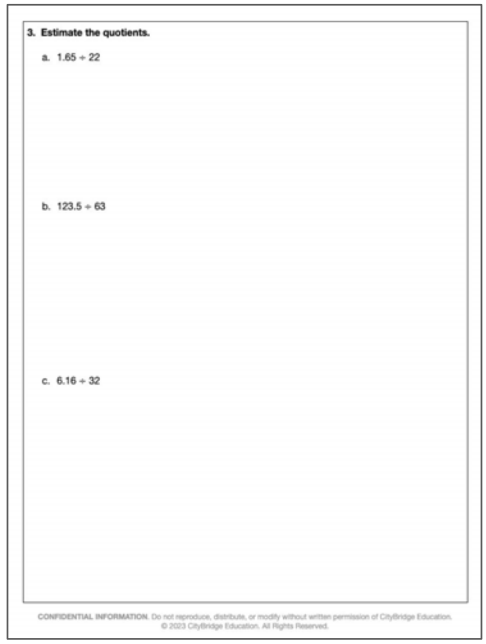
Estimate the quotient.

2. Consider 9.37 ÷ 28.

What is 28 rounded to the nearest ten?

Round 9.37 so it is easy to divide by your answer from the previous question.

Estimate the quotient.


3. Estimate the quotients.

a. 1.65 ÷ 22

b. 123.5 ÷ 63

c. 6.16 ÷ 32

Think about the expression $38.2 \div 18$.

1. Round the divisor to the nearest ten.

2. Round 38.2 so it is easy to divide by your rounded divisor.

3. Estimate the quotient based on how you rounded each number.

Think about the expression $3.82 \div 18$.

4. Round the divisor to the nearest ten.

5. Since 3.82 is not easily divisible by the rounded divisor, we can use unit form to help us. What is the rounded divisor in unit form?

6. Round 3.82 so it is easy to divide by your rounded divisor. Decompose the divisor to help.

   $3.82 \div 18 \approx$ _____ $\div$ _____

   _____ $\div$ _____ $\div$ _____

7. How is finding a reasonable estimate for $38.2 \div 18$ similar to finding a reasonable estimate for $3.82 \div 18$?

   ____

   ____

At a bakery, 62.7 pounds of chocolate chips were put into 74 bags. The baker wants to know about how many pounds of chocolate chips were in each bag.

8. Draw a tape diagram to represent what is happening in the story.

9. About how many pounds were in each bag?
    A. Less than 1 pound
    B. Exactly 1 pound
    C. More than 1 pound

10. Round the divisor to the nearest ten. Write it in standard and unit form.

11. Round 62.7 to a number that is easily divisible by the rounded divisor.

12. Find an estimated quotient.

13. Use the previous work to find $6.27 \div 74$

14. Estimate the quotient of $11.73 \div 41$.

1. Consider $63.5 \div 23$.

   What is 23 rounded to the nearest ten?

   Round 63.5 so it is easy to divide by your answer from the previous question.

   Estimate the quotient.

2. Consider $9.37 \div 28$.

   What is 28 rounded to the nearest ten?

   Round 9.37 so it is easy to divide by your answer from the previous question.

   Estimate the quotient.

3. Estimate the quotients.

   a. $1.65 \div 22$

b. 123.5 ÷ 63

c. 6.16 ÷ 32

Name: KEY

G5 U2 Lesson 17 - Let's Try It

Think about the expression 38.2 ÷ 18.

1. Round the divisor to the nearest ten.

$18 \approx 20$

2. Round 38.2 so it is easy to divide by your rounded divisor.

$38.2 \approx 40$

3. Estimate the quotient based on how you rounded each number.

$40 \div 20 \approx 2$

Think about the expression 3.82 ÷ 18.

4. Round the divisor to the nearest ten.

$18 \approx 20$

5. Since 3.82 is not easily divisible by the rounded divisor, we can use unit form to help us. What is the rounded divisor in unit form?

20 = 2 tens

6. Round 3.82 so it is easy to divide by your rounded divisor. Decompose the divisor to help.

$3.82 \div 18 \approx$ 4 ÷ 20

4 ÷ 2 ÷ 10

$2 \div 10 = \boxed{0.2}$

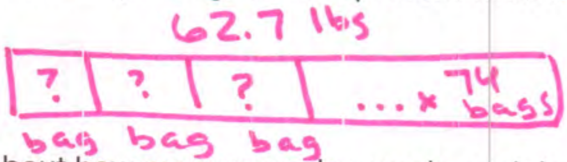
7. How is finding a reasonable estimate for 38.2 ÷ 18 similar to finding a reasonable estimate for 3.82 ÷ 18?

I could still round 18 to 20. The place value of digits in the dividend would be different.

$38.2 \approx 40$

At a bakery, 62.7 pounds of chocolate chips were put into 74 bags. The baker wants to know about how many pounds of chocolate chips were in each bag.

8. Draw a tape diagram to represent what is happening in the story.



9. About how many pounds were in each bag?
   A. Less than 1 pound
   B. Exactly 1 pound
   C. More than 1 pound

$62.7 \div 74$ bags

10. Round the divisor to the nearest ten. Write it in standard and unit form.

$74 \approx 80$ or 8 tens

11. Round 62.7 to a number that is easily divisible by the rounded divisor.

$62.7 \approx 64$

12. Find an estimated quotient.

$64 \div 80$

$64 \div 8 \div 10$

$8 \div 10$

0.8

13. Use the previous work to find $6.27 \div 74$

$6.27 \approx 6.4$

$6.4 \div 8 \div 10$

$0.8 \div 10$

0.08

---

14. Estimate the quotient of $11.73 \div 41$.

$41 \approx 40$

$11.73 \approx 12$

$12 \div 4 \div 10$

$3 \div 10$

0.3

Name: KEY

1. Consider 63.5 ÷ 23.

What is 23 rounded to the nearest ten?

$23 \approx 20$

Round 63.5 so it is easy to divide by your answer from the previous question.

$63.5 \approx 60$

Estimate the quotient.

$60 \div 20 = 3$

2. Consider 9.37 ÷ 28.

What is 28 rounded to the nearest ten?

$28 \approx 30$

Round 9.37 so it is easy to divide by your answer from the previous question.

$9.37 \approx 9$

Estimate the quotient.

$9 \div 30$

$9 \div 3 \div 10$

$3 \div 10 \rightarrow 0.3$

3. Estimate the quotients.

a. 1.65 ÷ 22

$22 \approx 20$

$1.65 \approx 2$

$2 \div 20$

$2 \div 2 \div 10$

$1 \div 10$

0.1

b. 123.5 ÷ 63

$63 \approx 60$

$123.5 \approx 120$

$120 \div 60$

2

c. 6.16 ÷ 32

$32 \approx 30$

$6.16 \approx 6$

$6 \div 30$

$6 \div 3 \div 10$

$2 \div 10$

0.2

G5 U2 Lesson 18

Divide decimal dividends by two-digit divisors

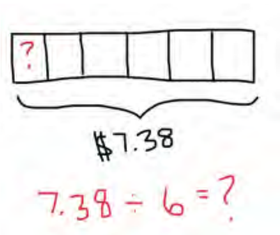
G5 U2 Lesson 18 - Students will divide decimal dividends by two-digit divisors, estimate quotients, reasoning about the placement of the decimal point, and making connections to a written method

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): We have spent the last several lessons thinking about division. More recently, we've been thinking about division with decimal dividends. In our previous lesson, we reasoned about the dividend and divisor to find an approximate quotient. Today, we'll use that same thinking to estimate, but we'll also calculate to find the exact quotient.

Let's Talk (Slide 3): The other day I saw a sign at the store that said 6 apples cost $7.38. They looked delicious! I wanted to try them, but there was no way I could eat 6 apples. I wanted to buy just one, but I wasn't immediately sure how much 1 would cost. What do you think I could do to find the cost of 1 apple? Possible Student Answers, Key Points:

- You could use division. You could divide the total by 6.
- You could estimate to get an idea of the cost. I know if 6 apples cost $1 each, the total would be $6. So, each apple in this case is going to cost a little more than $1 since $7.38 is a little more than $6.



Great thinking. I know 6 apples *(draw a rectangle partitioned into 6 parts)* cost $7.38 in all. *(draw a bracket and label the entire rectangle $7.38)* If I wanted to find the cost of just 1 apple *(write ? in one of the partitioned rectangles)*, I could use division to help me figure that out. I can take the total cost, $7.38, and divide it by 6 apples. *(write $7.38 ÷ 6)* Estimation could help us get a close idea of what the price would be, but if I wanted to find the exact cost, I would have to calculate it. That's what we're going to be doing today!

Let's Think (Slide 4): This first problem wants us to divide 834.6 by 26. Let's estimate a quotient. What numbers could we round the divisor and dividend to to give us an idea of the quotient? Possible Student Answers, Key Points:

- 26 is close to 30. We can think of the divisor as 30.
- 834.6 is close to 900, so we can think of the dividend as 900.

$900 \div 30 = 30$

$\underset{\text{tens}}{90} \div \underset{\text{tens}}{3} = 30$

If we think of the divisor as being close to 30, and the dividend as being close to 900, we can find a reasonable estimate of the quotient. *(write 900 ÷ 30 and 90 tens ÷ 3 tens)* What is 900 divided by 30? If you're not sure, you can think of 90 tens divided by 3 tens. (30) When we calculate the exact quotient, our answer should be somewhere close to 30.

$26\overline{)834.6}$

To calculate the exact quotient, let's set up our division in vertical form. *(write 834.6 inside a division bar, and write 26 outside the division bar)* Can 8 hundreds be divided by 26 without regrouping? (No.) Let's look at the next place value after hundreds. 834.6 has 83 tens. How many groups of 26 can go into 83 tens, and how do you know? Possible Student Answers, Key Points:

- I know my estimate has 3 tens in it, so I can start by seeing if 3 groups of 26 goes into 83 tens.
- I can find multiples of 26 that get me close to 83. 2 x 26 = 52. 3 x 26 = 78. So 83 tens divided by 26 is 3 tens.

32.1
26) 834.6
-78
54
-52
26
-26
0

(Record 3 in the tens place of the quotient) 83 tens divided by 26 is 3 tens. When we subtract 78 tens from 83 tens, we are left with 5 tens. *(Subtract, then record 5 tens in the algorithm)* We can't divide 5 tens by 26, so let's rename it as 50 ones and bring down the 4 ones from our total. What is 54 ones divided by 26, and how do you know? Possible Student Answers, Key Points:

- 54 ones divided by 26 is 2 ones, because 26 x 2 = 52.
- One group of 26 is 26. Two groups of 26 is 52, so 52 ones divided by 26 is 2 ones.

Let's record 2 ones in our quotient and subtract 52 ones from the total. *(write 2 in the ones place of the quotient, then subtract 52 from 54)* We can't divide 2 ones by 26, so let's rename it as 20 tenths and bring down the 6 tenths from our total. What is 26 tenths divided by 26? (1 tenth) So we can put 1 tenth in the quotient. *(Record 1 in the tenths place, then subtract 26 tenths from 26 tenths)* There is no remainder. We just calculated the exact quotient of 834.6 divided by 26. What is it? (32.1) The quotient is 32.1. *(circle it)*

32.1 seems reasonable, because our estimate was 30. If we want to double-check our work, we can always use multiplication. Multiply 32.1 x 26, and see if you get the same total as we started with. If it helps, you can just multiply 321 x 26 as if they were both whole numbers, then adjust your answer knowing that 321 is actually 321 *tenths*. Let me know when you're ready to check your thinking, and I'll share what I did. *(wait for student to multiply)*

32.1
x 26
1926
+6420
834.6 ✓

(write as you narrate) I know 321 x 6 is 1926. I wrote that as one partial product. I know 321 x 20 is 6420. I wrote that as the second partial product. When I added them together, I got 8,346, but since the first factor is 321 tenths, I know many answer should be 8,346 tenths. That's 834.6, which is the total we started with. Our answer checks out!

Let's Think (Slide 5): Let's do one more for some additional practice. This problem wants us to divide 8.61 by 41. As always, let's start with an estimate. How would you round these two numbers? Possible Student Answers, Key Points:

- We can think of the divisor as 40.
- The dividend is closer to 9 than 8, but 8 might be better to think about if we're using 40 as the divisor.

$8 \div 40$
$8 \div 4 \div 10$
$2 \div 10$
0.2

We can estimate by thinking of 8 divided by 40. *(write expression)* Let's divide in parts, so we can use mental math. We can divide by 4, then by 10. *(write 8 ÷ 4 ÷ 10)* What is 8 divided by 4? (2) What is 2 divided by 10? (0.2 or 2 tenths) A good estimate for the quotient in this problem is 0.2, or 2 tenths. Let's calculate to see if we get an exact quotient close to 0.2.

Let's write the problem in vertical form. *(write 41 outside the division bar and 8.61 inside the division bar)*

0.21
41) 8.61
-82
41
-41
0

Can 8 ones be divided by 41 without regrouping? (No.) Let's look at the next place value. Can 86 tenths be divided by 41 without regrouping? (Yes.) What is 86 tenths divided by 41? You can skip count, use mental math, or use our estimate to help you think about it. Possible Student Answers, Key Points:

- Two groups of 41 is 82, which is close to 86.
- 86 tenths divided by 41 is 2 tenths, because 41 x 2 = 82.

Since 2 groups of 41 is 82, we know that 86 tenths divided by 41 is 2 tenths. Let's write that in our quotient, and subtract 82 tenths from the total. *(write 0.2 in the quotient, then subtract 82 tenths from 86 tenths)* We now have 4 tenths. Let's rename that as 41 hundredths by bringing down the 1 hundredth left in the total. What is 41 hundredths divided by 41? (0.01 or 1 hundredth) We can put 1 hundredth in our answer *(record 1 in the hundredths place)*, and we are left without a remainder. What is 8.61 divided by 41? (0.21 or 21 hundredths) We did it!

How can we check to make sure our exact quotient makes sense? Possible Student Answers, Key Points:

- It makes sense because our estimate was 0.2, and 0.21 is close to that.
- We can multiply 0.21 x 41 to see if we end up with 8.61 as the product.

Take a few moments to multiply 21 hundredths x 41, and see if you end up with the original total. When you're ready, let me know, and we can compare our thinking. *(wait, as needed review the multiplication shown below)*

$$\begin{array}{r} .21 \\ \times\ 41 \\ \hline 21 \\ +\ 840 \\ \hline 8.61 \end{array}$$

I multiplied 21 hundredths x 41. I know 21 x 1 is 21, so I wrote that as a partial product. I know 21 x 40 is 840, so that was my other partial product. I added those together and got 861, but I remembered that the factor of 21 was actually 21 *hundredths*. My answer was 861 hundredths of 8.61. That means we did our division correctly, because we ended up with the total from our division problem.

Let's Try it (Slides 6 - 7): Now that we've practiced calculating quotients of decimal dividends, I think you're ready to take the lead on practicing. As we work, let's remember to estimate first. Not only will this help to make sure our quotients are reasonable, but it will also help us think about numbers we can use as we calculate the quotient. When we arrive at the final quotient, we can cross-check our answer with the estimate, and we can use multiplication to make sure our work is precise. Let's go for it!

WARM WELCOME

Today we will divide decimal dividends by two-digit divisors, estimating quotients, reasoning about the placement of the decimal point, and making connections to a written method

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Let’s Talk:

6 apples

$7.38

I wonder how much 1 apple costs…

Let’s Think:

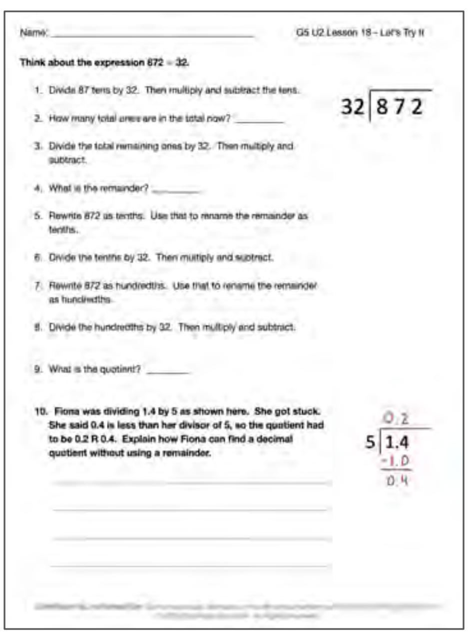
834.6 ÷ 26 = ?

Let's Think:

$8.61 \div 41 = ?$

Let's Try It:

Let's explore dividing decimal dividends by two-digit divisors together.



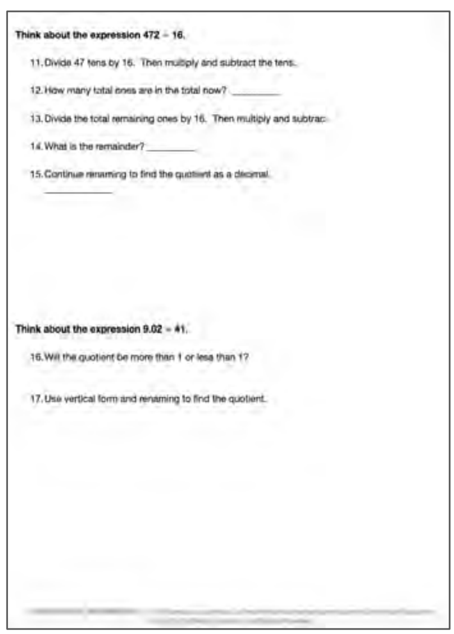
Name: ______________________ G5 U2 Lesson 18 – Let's Try It

Think about the expression 872 ÷ 32.

$32\overline{)872}$

1. Divide 87 tens by 32. Then multiply and subtract the tens.
2. How many total ones are in the total now? ________
3. Divide the total remaining ones by 32. Then multiply and subtract.
4. What is the remainder? ________
5. Rewrite 872 as tenths. Use that to rename the remainder as tenths.
6. Divide the tenths by 32. Then multiply and subtract.
7. Rewrite 872 as hundredths. Use that to rename the remainder as hundredths.
8. Divide the hundredths by 32. Then multiply and subtract.
9. What is the quotient? ________
10. **Fiona was dividing 1.4 by 5 as shown here. She got stuck. She said 0.4 is less than her divisor of 5, so the quotient had to be 0.2 R 0.4. Explain how Fiona can find a decimal quotient without using a remainder.**

$$\begin{array}{r} 0.2 \\ 5\overline{)1.4} \\ -1.0 \\ \hline 0.4 \end{array}$$



Think about the expression 472 ÷ 16.

11. Divide 47 tens by 16. Then multiply and subtract the tens.
12. How many total ones are in the total now? ________
13. Divide the total remaining ones by 16. Then multiply and subtrac
14. What is the remainder? ________
15. Continue renaming to find the quotient as a decimal. ________

Think about the expression 9.02 ÷ 41.

16. Will the quotient be more than 1 or less than 1?
17. Use vertical form and renaming to find the quotient.

On your Own:

Now it's time to divide decimal dividends by two-digit divisors on your own.

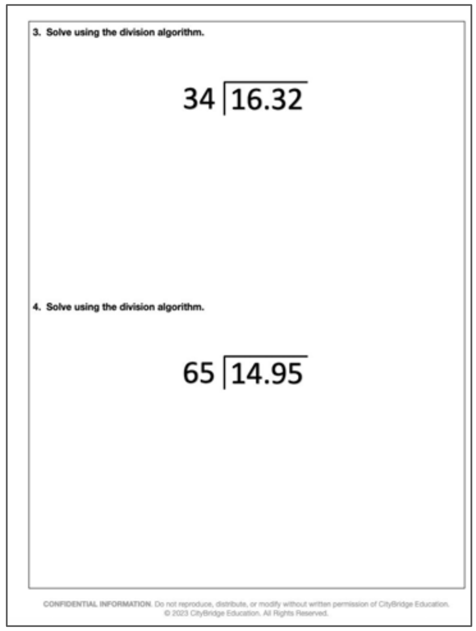

Name: ______________________ G5 U2 Lesson 18 - Independent Work

1. Solve using the division algorithm.

$23 \overline{)38.87}$

2. Solve using the division algorithm.

$61 \overline{)225.7}$


3. Solve using the division algorithm.

$34 \overline{)16.32}$

4. Solve using the division algorithm.

$65 \overline{)14.95}$

Name: ____ G5 U2 Lesson 18 - Let's Try It

Think about the expression 872 ÷ 32.

$$32 \overline{)\,8\,7\,2}$$

1. Divide 87 tens by 32. Then multiply and subtract the tens.
2. How many total ones are in the total now? ___________
3. Divide the total remaining ones by 32. Then multiply and subtract.
4. What is the remainder? ___________
5. Rewrite 872 as tenths. Use that to rename the remainder as tenths.
6. Divide the tenths by 32. Then multiply and subtract.
7. Rewrite 872 as hundredths. Use that to rename the remainder as hundredths.
8. Divide the hundredths by 32. Then multiply and subtract.
9. What is the quotient? __________
10. Fiona was dividing 1.4 by 5 as shown here. She got stuck. She said 0.4 is less than her divisor of 5, so the quotient had to be 0.2 R 0.4. Explain how Fiona can find a decimal quotient without using a remainder.

____

____

____

____

Think about the expression 472 ÷ 16.

11. Divide 47 tens by 16. Then multiply and subtract the tens.
12. How many total ones are in the total now? ___________
13. Divide the total remaining ones by 16. Then multiply and subtract.
14. What is the remainder? ___________

15. Continue renaming to find the quotient as a decimal.

____

Think about the expression $9.02 \div 41$.

16. Will the quotient be more than 1 or less than 1?

17. Use vertical form and renaming to find the quotient.

1. Solve using the division algorithm.

$$23\overline{)38.87}$$

2. Solve using the division algorithm.

$$61\overline{)225.7}$$

3. Solve using the division algorithm.

$$34 \overline{)16.32}$$

4. Solve using the division algorithm.

$$65 \overline{)14.95}$$

Name: KEY

Think about the expression 872 ÷ 32.

$$\begin{array}{r} 27.25 \\ 32\overline{)872.00} \\ -64 \\ \hline 232 \\ -224 \\ \hline 8\,0 \\ -6\,4 \\ \hline 1\,60 \\ -1\,60 \\ \hline 0 \end{array}$$

1. Divide 87 tens by 32. Then multiply and subtract the tens.
2. How many total ones are in the total now? 232

$$\begin{array}{r} 32 \\ \times\ 7 \\ \hline 224 \end{array}$$

3. Divide the total remaining ones by 32. Then multiply and subtract.
4. What is the remainder? 8
5. Rewrite 872 as tenths. Use that to rename the remainder as tenths.
6. Divide the tenths by 32. Then multiply and subtract.
7. Rewrite 872 as hundredths. Use that to rename the remainder as hundredths.
8. Divide the hundredths by 32. Then multiply and subtract.
9. What is the quotient? 27.25

10. Fiona was dividing 1.4 by 5 as shown here. She got stuck. She said 0.4 is less than her divisor of 5, so the quotient had to be 0.2 R 0.4. Explain how Fiona can find a decimal quotient without using a remainder.

$$\begin{array}{r} 0.28 \\ 5\overline{)1.40} \\ -1.0 \\ \hline 0.40 \\ -0.40 \\ \hline 0 \end{array}$$

She can rewrite 1.4 as hundredths to continue dividing. The 0.4 left in the total can be 0.40 which means she can put 8 hundredths in the quotient.

Think about the expression 472 ÷ 16.

11. Divide 47 tens by 16. Then multiply and subtract the tens.

12. How many total ones are in the total now? 152

13. Divide the total remaining ones by 16. Then multiply and subtract.

14. What is the remainder? 8 or 8.0

15. Continue renaming to find the quotient as a decimal.
29.5

$$\begin{array}{r} 29.5 \\ 16\overline{)472.0} \\ -32 \\ \hline 152 \\ -144 \\ \hline 80 \\ -80 \\ \hline 0 \end{array}$$

Think about the expression 9.02 ÷ 41.

16. Will the quotient be more than 1 or less than 1?
Less than 1.

17. Use vertical form and renaming to find the quotient.

$$\begin{array}{r} 0.22 \\ 41\overline{)9.02} \\ -8.2 \\ \hline 82 \\ -82 \\ \hline 0 \end{array}$$

$\boxed{0.22}$

Name: KEY

1. **Solve using the division algorithm.**

23 × 6 = 138

23 × 9 = 207

$$
\begin{array}{r}
1.69 \\
23 \overline{)38.87} \\
-23 \\
\hline
158 \\
-138 \\
\hline
207 \\
-207 \\
\hline
0
\end{array}
$$

1.69

2. **Solve using the division algorithm.**

61 × 3 = 183

61 × 7 = 427

$$
\begin{array}{r}
003.7 \\
61 \overline{)225.7} \\
-183 \\
\hline
427 \\
-427 \\
\hline
0
\end{array}
$$

3.7

3. **Solve using the division algorithm.**

$$\begin{array}{r} 34 \\ \times\ 4 \\ \hline 136 \end{array} \qquad \begin{array}{r} 34 \\ \times\ 8 \\ \hline 272 \end{array}$$

$$\begin{array}{r} 00.48 \\ 34\overline{)16.32} \\ -136 \\ \hline 272 \\ -272 \\ \hline 0 \end{array}$$

0.48

4. **Solve using the division algorithm.**

$$\begin{array}{r} 65 \\ *\ 3 \\ \hline 195 \end{array}$$

$$\begin{array}{r} 00.23 \\ 65\overline{)14.95} \\ -130 \\ \hline 195 \\ -195 \\ \hline 0 \end{array}$$

0.23

CITYTUTOR DC

G5 Unit 3:

Add and Subtract Fractions

G5 U3 Lesson 1

Make equivalent fractions with the number line, the area model, and numbers

CITYTUTOR DC

G5 U3 Lesson 1 - Students will make equivalent fractions with the number line, the area model, and numbers

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): Today is our first lesson of a new unit all about fractions. You've likely worked with fractions in math class since around third grade, but fractions show up all the time in the world around us. Can you think of a time in your everyday life where you might see fractions? Possible Student Answers, Key Points:

- I see fractions in the kitchen when I use measuring cups.
- When I share a pizza with my family, those equal parts represent fractions.
- In sports they have "half time" and sometimes games are split into quarters.

Fractions are everywhere. Today, we're going to focus on making equivalent fractions using a number line, an area model, and numbers.

Let's Talk (Slide 3): Before we work on a few problems, take a second and look at these models. What do you notice? What do you wonder? Possible Student Answers, Key Points:

- I notice the models are paired up. I notice some are rectangular and some are circles. I notice the colored-in parts are the same amount, but different pieces.
- I wonder what these are supposed to represent. I wonder why one in each pair has smaller pieces and one in each pair has bigger pieces.

Interesting ideas. Thanks for sharing! Each pair of models here represent equivalent fractions. Equivalent fractions are fractions that have the same value, but use different numerators and denominators. For example, let's look at the yellow models. The top model shows 3 shaded pieces out of 4 pieces in the whole. We'd write that in fraction form as 3 over 4. *(write ¾)* The model underneath is the same whole, just cut into smaller pieces. I see 6 pieces shaded out of 8 pieces in the whole. We'd write that as 6 over 8 in fraction form. *(write = 6/8 after ¾)* These fractions are equivalent. We can visually see that in the model, because the yellow shaded region is the same amount in both models.

$\frac{3}{4} = \frac{6}{8}$

The circular fraction models also represent equivalent fractions. The first fraction modeled is ½, and the second fraction is 2/4. *(write ½ = 2/4)* Look at the red fraction models. How do those represent equivalent fractions? Possible Student Answers, Key Points:

$\frac{1}{2} = \frac{2}{4}$

- The first shows 2 shaded pieces out of 6. The second shows 1 shaded piece out of 3. So these show that 2/6 is equivalent to ⅓
- The red shaded region on both is the same, so even though the pieces are different sizes, the red shading represents an equivalent amount.

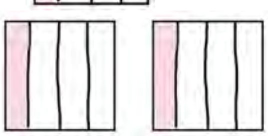
$\frac{2}{6} = \frac{1}{3}$

Excellent. Today, we'll use number lines, area models, and numbers to help us make equivalent fractions. Let's give it a try!

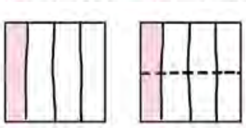
Let's Think (Slide 4): This question is asking us to use a number line, area model, and numbers to find a fraction equivalent to ¼. We'll start by using an area model. How can I show the fraction ¼ on an area model? Possible Student Answers, Key Points:

- Draw a square for the whole and cut it into four pieces.
- Shade 1 of the 4 pieces, since we want to think about ¼.

(draw as you narrate) I'll draw the whole as a square. Then I'll partition the whole into 4 equal pieces. I'm going to use vertical lines to partition. I now see four equal pieces, so I will shade one of them to represent ¼.

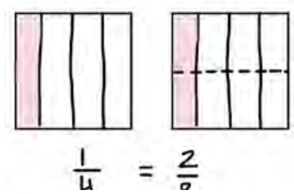


Since our goal is to make an equivalent fraction, let's draw another area model exactly like the one we just drew. We'll use this other area model to represent our equivalent fraction. *(draw another identical area model)*



We can use a horizontal line to partition our other area model into different-sized pieces. Watch! *(draw a horizontal dotted-line to partition the second area model into eighths)* What do you notice about the fraction we see now? Possible Student Answers, Key Points:

- The shaded part didn't change at all. We just cut across it.
- There are 8 total pieces now instead of 4. There are 2 shaded pieces now instead of 1.

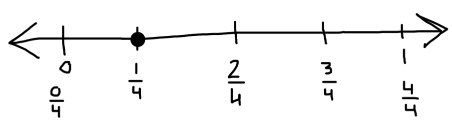


Our first area model showed 1 shaded piece out of 4, or ¼. *(write ¼ underneath the first area model)* The second area model shows 2 shaded pieces out of 8, or 2/8. *(write = 2/8 underneath the second area model)* The shaded amount didn't change at all. We see that ¼ and 2/8 are equivalent fractions.

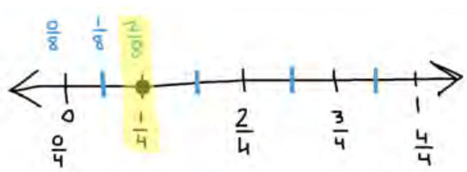
$$\frac{1}{4} = \frac{1 \times 2}{4 \times 2} = \frac{2}{8}$$

If we want to show all this thinking with numbers, we can think of it like this. We started by drawing ¼, and then we drew another area model representing ¼. *(write ¼ = ¼)* We partitioned the second area model so we had twice as many shaded pieces and total pieces. It's like we doubled the shaded and total pieces with our horizontal line, without changing the whole. We can show that using multiplication. *(write x2 in numerator and denominator)* We ended up with 2 shaded pieces and 8 total pieces in our equivalent fraction model. *(write = 2/8)* So, with an area model or with numbers, we can see that ¼ is equivalent to 2/8.

Let's think about how we can show this same work using a number line. What two whole numbers is the fraction ¼ between? (¼ is more than 0 and less than 1) I'll draw a number line and label 0 and 1 at each end.



(sketch number line as you narrate) Since we're talking about fourths, I'll partition my number line into 4 units by making 3 tick marks. Let's label each tick mark in terms of fourths. 0 is 0/4, then ¼, 2/4, ¾, and 1 is 4/4.



In our area model, we drew a horizontal line that cut each piece into two equal parts. We can show that on the number line by partitioning each unit into two parts. *(draw a tick mark between each unit using a different color)* See? I cut each fourth into two pieces, so now we have 8 units or eighths. If I count my eighths *(label 0/8, ⅛ and 2/8 above the number line as you verbally count)*, I can see that ¼ is equivalent to 2/8.

What was different about the three ways we just thought about these equivalent fractions? Possible Student Answers, Key Points:

- They look different. The area models and the number line are very visual, but the numbers are more abstract.

What was the same about the three ways we just thought about these equivalent fractions? Possible Student Answers, Key Points:

- They each show fourths partitioned into eighths in some way. The area model showed it with a horizontal line. The number line showed it with the tick marks between each unit. The numbers showed it using multiplication.

We just used three different strategies to find that 2/8 is equivalent to ¼. Let's try one more example.

Let's Think (Slide 5): This problem wants us to use the same strategies to find a fraction equivalent to 3/2. What's different about this fraction? Possible Student Answers, Key Points:

- It's an improper fraction or a fraction greater than 1.
- This fraction's numerator is bigger than its denominator. This fraction is more than 1 whole.

I wonder if we can use the same work to help us. Let's give it a try. We'll start with an area model. I know 2/2 is equal to 1 whole, so I'll need to draw more than 1 square to make my area model. *(draw 2 squares partitioned into halves, then shade 3 of the halves)*

There, each whole is partitioned into halves, and I've shaded 3 of them. This is 3/2. I'll draw another identical model that we can use to show the equivalent fraction. *(draw it)*

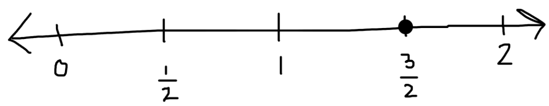
What can I do in the second area model to show an equivalent fraction? (Partition it horizontally) I can cut, or partition, the model horizontally. Last time, we made one cut. That could work this time too, but let's try making 2 cuts. We know there are many different equivalent fractions we can make from one fraction, so let's try out something different this time just for fun. *(use 2 dotted horizontal lines to partition the second area model)* Notice, the shaded region stayed the same. Our first area model shows 3 halves, or 3/2. *(write 3/2*

=) Our second area model now shows 9 sixths, because each whole has 6 pieces and we see 9 shaded pieces. *(write 9/6)* We just used area models to show that 3/2 is equivalent to 9/6.

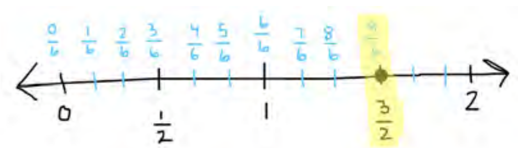
$$\frac{3}{2} = \frac{3 \times 3}{2 \times 3} = \frac{9}{6}$$

If we were to show this with numbers, we'd do it similar to how we thought of it in our last example. *(write equation as you narrate)* The fraction we started with was 3/2. In our last example, we cut each piece into 2, so we multiplied our numerator and denominator by 2. In this case, we cut each piece into 3 to try something different. What do you think I'll need to multiply the numerator and denominator by, then? (3, since we cut each part into 3 pieces) Right, we can multiply the numerator and denominator by 3. 3 x 3 = 9 shaded pieces. 2 x 3 = 6 pieces in each whole. We just used numbers to show that 3/2 is equivalent to 9/6.

Last but not least, let's think about a number line. What two whole numbers is 3/2 between? (1 and 2) I'll sketch a number line from 0 to 2, and I'll make tick marks to represent halves. *(sketch number line, then count as you label)* The first tick mark is 0, or 0/2. Then ½. Then 1, or 2/2. Then 1 ½, or 3/2. Then 2, or 4/2.



We partitioned the area model using two horizontal lines in this case. How can we show that on a number line? (Cut each unit into three pieces, or put two tick marks between each unit) Let's use two tick marks between each unit. *(partition each unit with two tick marks using a different color)* The original tick marks show halves, and the new tick marks in blue show sixths. If I label each sixth, I can see what 3/2 is equivalent to in terms of sixths. *(count from 0/6 to 9/6, labeling the number line as you go)* We drew 3/2 on the number line, partitioned to show sixths, and then we were able to see that 3/2 is equivalent to 9/6.



In our first problem, we found a fraction equivalent to ¼. In our second problem, we had to find a fraction equivalent to 3/2, which is greater than 1 whole. What was the same or different about how we went about making equivalent fractions? Possible Student Answers, Key Points:

- We used the same strategies for the fraction <1 and the fraction >1. Nothing was really different.
- For the fraction >1, we had to build our area model and number line to be a little bigger, but nothing about our steps or our thinking changed.

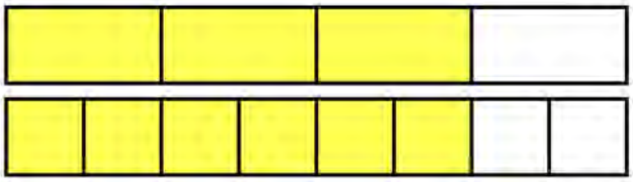
Let's Try it (Slides 6 - 7): Now let's work on making equivalent fractions together. We'll use number lines, area models, and mathematical expressions with numbers to show our thinking. We will want to carefully use horizontal and vertical partitions as we work to make equal-sized pieces with precision. We've also seen that there are *many* different equivalent fractions we can make from a given fraction, so we're not necessarily just looking for *one* correct answer. Let's go for it.

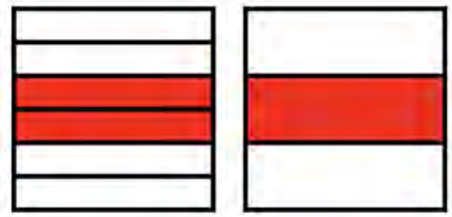
WARM WELCOME

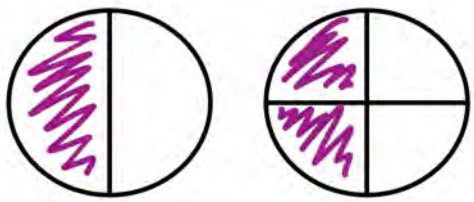
Today we will make equivalent fractions with the number line, the area model, and numbers.

Let's Talk:

What do you notice? What do you wonder?







Let's Think:

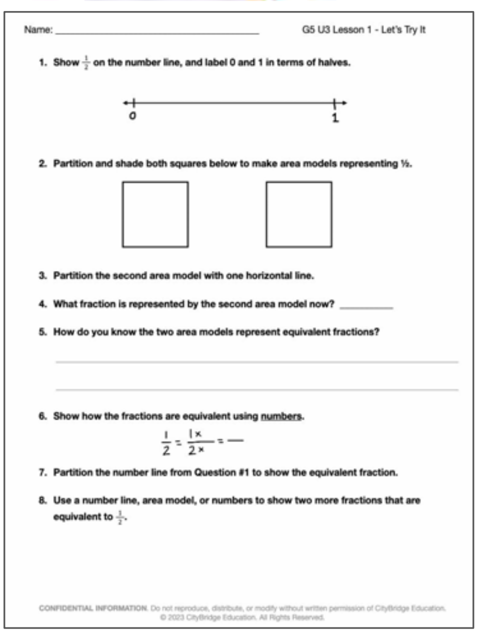
Use a number line, area model, and numbers to find a fraction equivalent to ¼.

Let's Think:

Use a number line, area model, and numbers to find a fraction equivalent to 3/2.

Let's Try It:

Let's explore making equivalent fractions with number lines, area models, and numbers together.

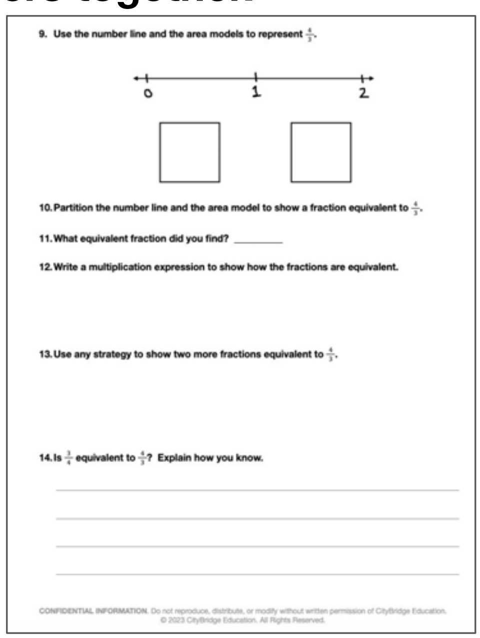

Name: ________________ G5 U3 Lesson 1 - Let's Try It

1. Show $\frac{1}{2}$ on the number line, and label 0 and 1 in terms of halves.

2. Partition and shade both squares below to make area models representing ½.
3. Partition the second area model with one horizontal line.
4. What fraction is represented by the second area model now? ________
5. How do you know the two area models represent equivalent fractions?
6. Show how the fractions are equivalent using numbers.

$$\frac{1}{2} = \frac{1\times}{2\times} = \frac{}{}$$

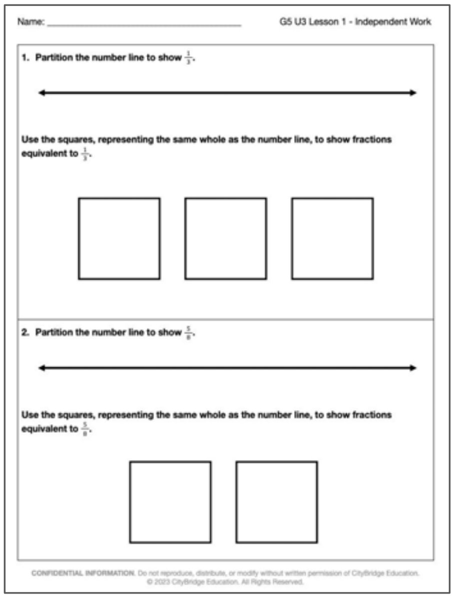
7. Partition the number line from Question #1 to show the equivalent fraction.
8. Use a number line, area model, or numbers to show two more fractions that are equivalent to $\frac{1}{2}$.


9. Use the number line and the area models to represent $\frac{4}{3}$.

10. Partition the number line and the area model to show a fraction equivalent to $\frac{4}{3}$.
11. What equivalent fraction did you find? ________
12. Write a multiplication expression to show how the fractions are equivalent.
13. Use any strategy to show two more fractions equivalent to $\frac{4}{3}$.
14. Is $\frac{3}{4}$ equivalent to $\frac{4}{3}$? Explain how you know.

On your Own:

Now it's time to explore making equivalent fractions with number lines, area models, and numbers on your own.



Name: ______________________ G5 U3 Lesson 1 - Independent Work

1. Partition the number line to show $\frac{1}{3}$.

Use the squares, representing the same whole as the number line, to show fractions equivalent to $\frac{1}{3}$.

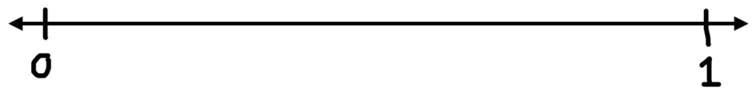
2. Partition the number line to show $\frac{5}{8}$.

Use the squares, representing the same whole as the number line, to show fractions equivalent to $\frac{5}{8}$.

3. Use a number line to show $\frac{7}{6}$. Then model a fraction that is equivalent to $\frac{7}{6}$.

3. Irene said the fractions $\frac{5}{4}$ and $\frac{4}{5}$ are equivalent because they use the same numbers. Explain why Irene is incorrect using words and models.

1. Show $\frac{1}{2}$ on the number line, and label 0 and 1 in terms of halves.



2. Partition and shade both squares below to make area models representing ½.

3. Partition the second area model with one horizontal line.

4. What fraction is represented by the second area model now? ____________

5. How do you know the two area models represent equivalent fractions?

____

____

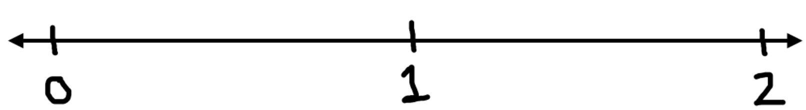
6. Show how the fractions are equivalent using <u>numbers</u>.

$$\frac{1}{2} = \frac{1\times}{2\times} = \frac{\quad}{\quad}$$

7. Partition the number line from Question #1 to show the equivalent fraction.

8. Use a number line, area model, or numbers to show two more fractions that are equivalent to $\frac{1}{2}$.

9. Use the number line and the area models to represent $\frac{4}{3}$.



10. Partition the number line and the area model to show a fraction equivalent to $\frac{4}{3}$.

11. What equivalent fraction did you find? ___________

12. Write a multiplication expression to show how the fractions are equivalent.

13. Use any strategy to show two more fractions equivalent to $\frac{4}{3}$.

14. Is $\frac{3}{4}$ equivalent to $\frac{4}{3}$? Explain how you know.

1. Partition the number line to show $\frac{1}{3}$.

Use the squares, representing the same whole as the number line, to show fractions equivalent to $\frac{1}{3}$.

2. Partition the number line to show $\frac{5}{8}$.

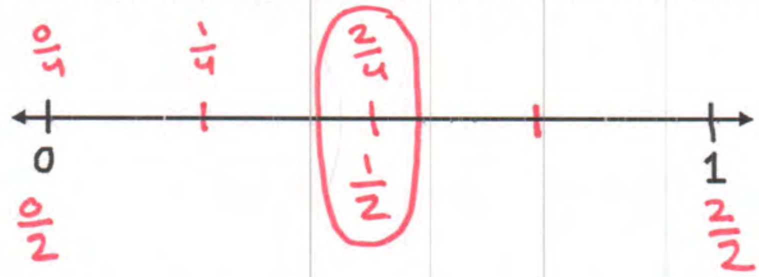
Use the squares, representing the same whole as the number line, to show fractions equivalent to $\frac{5}{8}$.

3. Use a number line to show $\frac{7}{6}$. Then model a fraction that is equivalent to $\frac{7}{6}$.

3. Irene said the fractions $\frac{5}{4}$ and $\frac{4}{5}$ are equivalent because they use the same numbers. Explain why Irene is incorrect using words and models.

Name: KEY

1. Show $\frac{1}{2}$ on the number line, and label 0 and 1 in terms of halves.



2. Partition and shade both squares below to make area models representing ½.

3. Partition the second area model with one horizontal line.

4. What fraction is represented by the second area model now? 2/4

5. How do you know the two area models represent equivalent fractions?

They both have the same area. They take up the same amount of the whole.

6. Show how the fractions are equivalent using <u>numbers</u>.

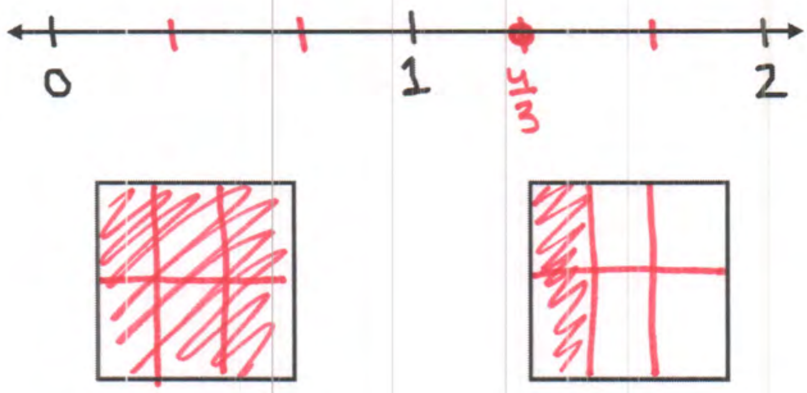
$$\frac{1}{2} = \frac{1 \times 2}{2 \times 2} = \frac{2}{4}$$

7. Partition the number line from Question #1 to show the equivalent fraction.

8. Use a number line, area model, or numbers to show two more fractions that are equivalent to $\frac{1}{2}$.

$\frac{1}{2} \times \frac{3}{3} = \frac{3}{6}$ $\qquad$ $\frac{1}{2} \times \frac{10}{10} = \frac{10}{20}$

9. **Use the number line and the area models to represent $\frac{4}{3}$.**



10. **Partition the number line and the area model to show a fraction equivalent to $\frac{4}{3}$.**

11. **What equivalent fraction did you find?** 8/6

12. **Write a multiplication expression to show how the fractions are equivalent.**

$$\frac{4}{3} = \frac{4 \times 2}{3 \times 2} = \frac{8}{6}$$

13. **Use any strategy to show two more fractions equivalent to $\frac{4}{3}$.**

$\frac{4}{3} \times \frac{5}{5} = \frac{20}{15}$ $\frac{4}{3} \times \frac{3}{3} = \frac{12}{15}$

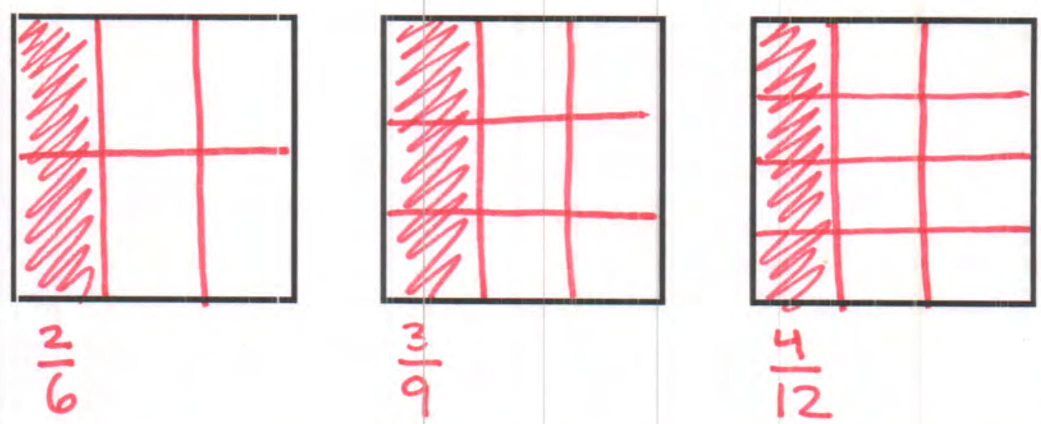
14. **Is $\frac{3}{4}$ equivalent to $\frac{4}{3}$? Explain how you know.**

No. 3/4 is 3 pieces out of 4. It's less than a whole. 4/3 is 4 pieces that are thirds. It's greater than a whole.

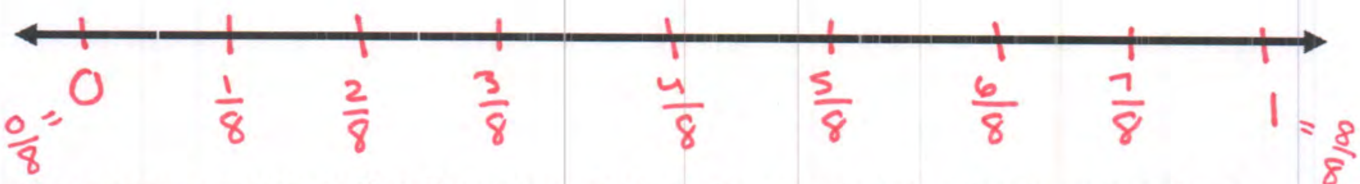
Name: KEY

1. **Partition the number line to show $\frac{1}{3}$.**

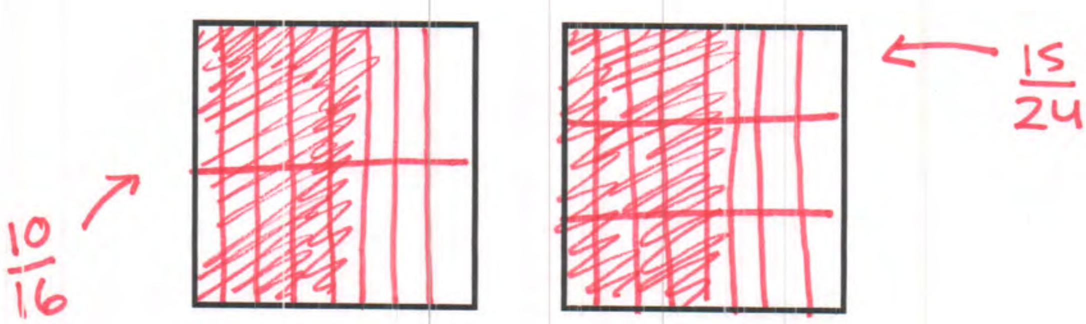
Use the squares, representing the same whole as the number line, to show fractions equivalent to $\frac{1}{3}$.



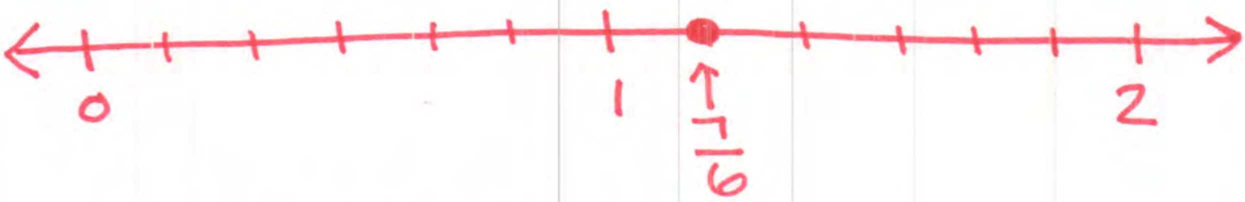
2. **Partition the number line to show $\frac{5}{8}$.**

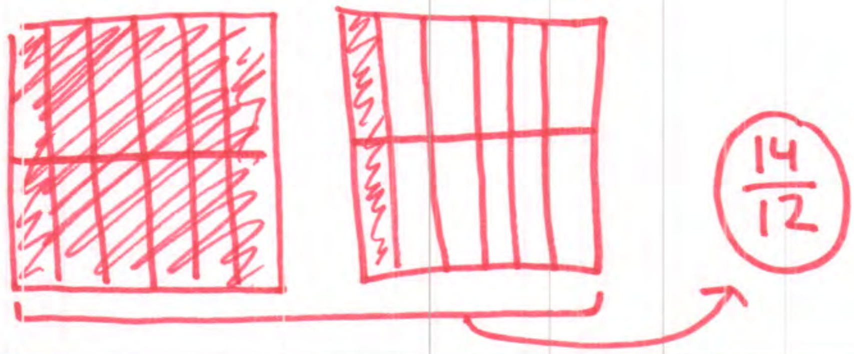


Use the squares, representing the same whole as the number line, to show fractions equivalent to $\frac{5}{8}$.



3. **Use a number line to show $\frac{7}{6}$. Then model a fraction that is equivalent to $\frac{7}{6}$.**





3. **Irene said the fractions $\frac{5}{4}$ and $\frac{4}{5}$ are equivalent because they use the same numbers. Explain why Irene is incorrect using words and models.**

They are not equivalent. 4/5 is less than 1, and $\frac{5}{4}$ is greater than 1. Irene can't just switch the numerator and denominator.

G5 U3 Lesson 2

Make equivalent fractions with sums of fractions with like denominators

CITYTUTOR DC

G5 U3 Lesson 2 - Students will make equivalent fractions with sums of fractions with like denominators

Warm Welcome (Slide 1): Tutor choice

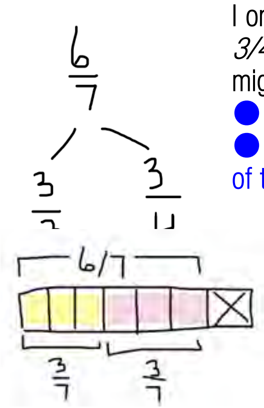
Frame the Learning/Connect to Prior Learning (Slide 2): Today, we're going to continue the work we've been doing with fractions. Our focus today is going to be on adding fractions to find sums with like denominators. We'll think about ways we can use addition to help us compose and decompose fractions with like units.

Let's Talk (Slide 3): There are many ways to decompose a numbers. For example, I can decompose 5 into 2 and 3, or 4 and 1. *(draw number bonds for each example you name)* We could even decompose 5 into more parts like 1, 1, and 3. There are so many ways to decompose 5.

What if, instead of 5, we thought about the fraction 6/7. Take a second and think about different ways you could decompose 6/7 into parts. Feel free to write your ideas down to keep track of them. Possible Student Answers, Key Points:

- I can do 3/7 and 3/7, 4/7 and 2/7, 5/7 and 1/7, 0/7 and 6/7.
- I can decompose into more pieces like 1/7, 1/7, 1/7, 1/7, 1/7, and 1/7.

(write a number bond to keep track of any correct possibilities the student shares) There are many ways we can decompose the fraction 6/7. Thinking of a fraction as the sum of other fractions with like units will help us a lot in our work today.

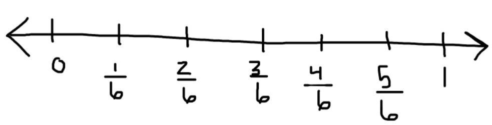


I once had a student show me this decomposition. *(write a number bond showing 6/7 decomposed into 3/3 and 3/4)* They said if they added the numerators and the denominators together it could make 6/7. I saw where they might think that, but why is this example NOT an accurate decomposition? Possible Student Answers, Key Points:

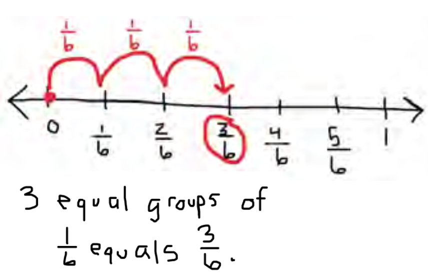
- The pieces are sevenths, so if I decompose 6 of them into 3 parts and 3 parts, they'll still be sevenths.
- We don't actually add the denominators when thinking about fractions. The denominator just tells us the size of the pieces.

Great thinking. We want to be careful not to add denominators, because the denominator is just telling us the size of the pieces. If we picture 6/7 being decomposed *(draw a rectangular tape diagram showing 6/7)*, and if we're decomposing it into 3 parts and 3 parts, the parts are still 7ths. *(shade and label 3/7 and 3/7 and point out the denominators)* The parts aren't changing size, so the denominator remains the same.

Let's Think (Slide 4): This problem wants us to use a number line, words, and multiplication to find the total of the expression. Let's start with the number line. What unit should I partition the number line into? (sixths)



Okay, let's show a number line from 0 to 1. We'll partition it into six equal units. *(sketch and label number line)*



Since our number line is partitioned into sixths, If we want to show ⅙ + ⅙ + ⅙ we can start at 0 and move up one unit three times. *(draw hops along the number line as you simultaneously say ⅙ plus ⅙ plus ⅙)* So, what's the total? Where did we end up? (3/6)
Correct! ⅙ + ⅙ + ⅙ = 3/6, and we see that clearly on the number line.

If we were using words to describe this, we could say that 3 equal groups of ⅙ is equivalent to 3/6. *(write this sentence underneath the number line)*

We know that when we want a fast way to describe equal groups, we can use multiplication. What multiplication equation do you think could represent the words we just wrote and why? Possible Student Answers, Key Points:

- 3 x ⅙ = 3/6
- We have 3 equal groups, so we can multiply ⅙ by 3 to get the total.

$3 \times \frac{1}{6} = \frac{3}{6}$ *(write multiplication equation)* We can use multiplication to show equal groups, so 3 x ⅙ = 3/6 is another way to show that 3 groups of ⅙ make a total of 3/6.

We just used a number line, words, and multiplication to find the total. How are the three ways we thought about ⅙ + ⅙ + ⅙ the same or different? Possible Student Answers, Key Points:

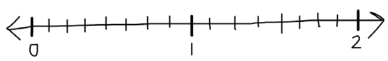
- The number line, words, and multiplication all look like different representations. One shows hops on a line, one is just words, and one uses symbols and numbers.
- They're the same, because they all show that 3 equal groups of ⅙ make a total of 3/6.

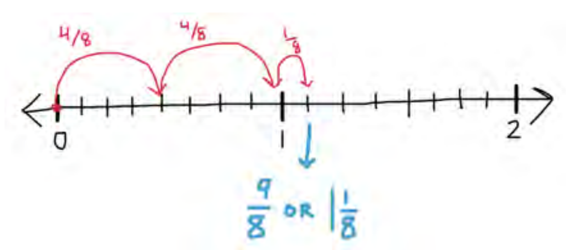
Let's try one more example that's just a bit different.

Let's Think (Slide 5): What do you notice is the same or different about this problem? Possible Student Answers, Key Points:

- Our last problem was just unit fractions. This problem has unit and non-unit fractions. This problem also involves eighths, not sixths.
- This problem still involves three fractions and wants us to find the total using a number line, words, and multiplication.

Let's see if we can use similar thinking to find this total. We'll start by making a number line. *(draw number line from 0 to 2 labeling just the whole numbers)* What should I partition the number line into for this problem? (eighths) I'll cut each whole into 8 pieces, using 7 tick marks between each whole. *(partition each whole into 8 units)*





We want to show 4 eighths plus 4 eighths plus 1 eighth. I'll show that using one hop of four units, then another hop of four units, then another hop of just 1 unit. *(model and label on the number line, saying 4/8 plus 4/8 plus 1/8 as you make each hop)*

We ended up ⅛ past the 1 whole mark. We can write that total as 9/8 or as 1 ⅛ in mixed number form.

If you were to describe the addition we just modeled on the number line to a friend, how would you describe it? Possible Student Answers, Key Points:

- We made two bigger hops of 4/8, and then we hopped 1 more unit.
- Our first two jumps were the same, 4/8 each, and then our last jump was smaller, because we only needed to go 1 more eighth.

2 groups of $\frac{4}{8}$ and $\frac{1}{8}$ more is $\frac{9}{8}$

Thinking about what we see on the number line can help us describe the composition in words. We can say that *(write as you say it)* 2 groups of 4/8 and ⅛ more is 9/8.

Would the multiplication expression 3 x 4/8 represent this total? Why or why not? Possible Student Answers, Key Points:

- No, we don't have 3 groups of 4/8. We don't have three equal groups in this problem.
- 3 groups of 4/8 is 12/8, but our total is 9/8.

$\left(2 \times \frac{4}{8}\right) + \frac{1}{8}$

Since we don't have exclusively equal groups like we did in our previous problem, we need to write our multiplication expression a little different. We can show two groups of 4/8 using multiplication, but then we'll need to add the ⅛ to that amount. We can write that like *(write as you say it)* (2 x 4/8) + 1/8 = 9/8.

We just found the total of this expression using a number line, words, and multiplication. This problem was similar to our last one, but we noted some differences. What did we have to consider differently in this problem? Possible Student Answers, Key Points:

- Since we didn't have all equal groups, the jumps on the number line had to be different sizes. For our word form and the multiplication, we had to show the equal groups *plus* the extra eighth.
- This problem's total was greater than 1 whole, so we had to make our number line a little longer. We can also write our total as a fraction or a mixed number.

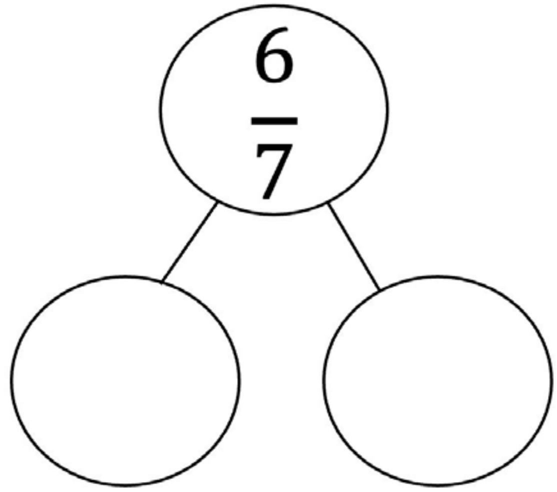
Let's Try it (Slides 6 - 7): Now let's work on making equivalent fractions with sums of fractions with like denominators together. We'll show our thinking with number lines, words, and multiplication like we've been doing. When we compose or decompose fractions, remember that the unit, or the denominator, remains the same; the size of the pieces remains consistent in the problems we've seen today, so it makes sense that the denominator remains consistent. Let's work on some problems together.

WARM WELCOME

Today we will make equivalent fractions with sums of fractions with like denominators.

Let's Talk:

How many different ways can we decompose the fraction?



Let's Think:

Use a number line, words, and multiplication to find the total of the expression.

$$\frac{1}{6}+\frac{1}{6}+\frac{1}{6}$$

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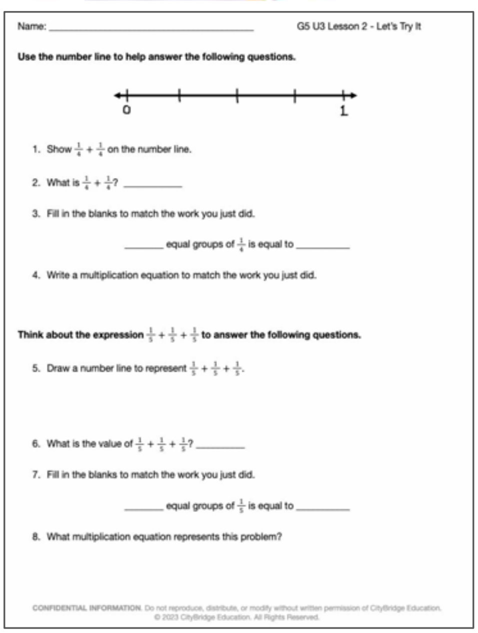
Let's Think:

Use a number line, words, and multiplication to find the total of the expression.

$$\frac{4}{8}+\frac{4}{8}+\frac{1}{8}$$

Let's Try It:

Let's explore making equivalent fractions with sums of fractions with like denominators together.



Name: ______________________ G5 U3 Lesson 2 - Let's Try It

Use the number line to help answer the following questions.

1. Show $\frac{1}{4}+\frac{1}{4}$ on the number line.
2. What is $\frac{1}{4}+\frac{1}{4}$? ________
3. Fill in the blanks to match the work you just did.

   ______ equal groups of $\frac{1}{4}$ is equal to ________

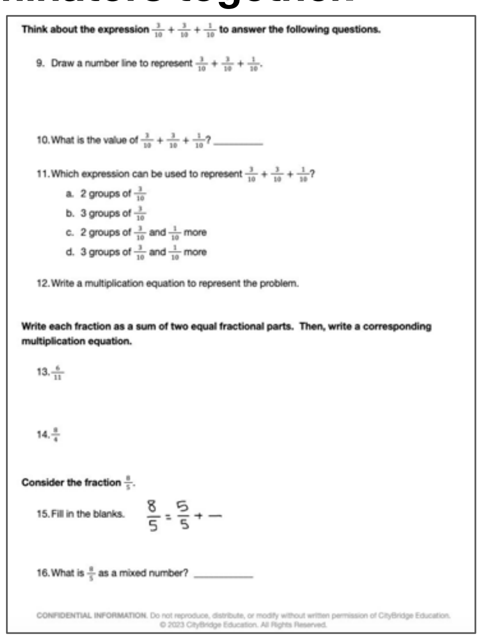
4. Write a multiplication equation to match the work you just did.

Think about the expression $\frac{1}{5}+\frac{1}{5}+\frac{1}{5}$ to answer the following questions.

5. Draw a number line to represent $\frac{1}{5}+\frac{1}{5}+\frac{1}{5}$.
6. What is the value of $\frac{1}{5}+\frac{1}{5}+\frac{1}{5}$? ________
7. Fill in the blanks to match the work you just did.

   ______ equal groups of $\frac{1}{5}$ is equal to ________

8. What multiplication equation represents this problem?



Think about the expression $\frac{3}{10}+\frac{3}{10}+\frac{1}{10}$ to answer the following questions.

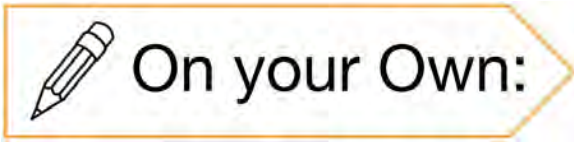
9. Draw a number line to represent $\frac{3}{10}+\frac{3}{10}+\frac{1}{10}$.
10. What is the value of $\frac{3}{10}+\frac{3}{10}+\frac{1}{10}$? ________
11. Which expression can be used to represent $\frac{3}{10}+\frac{3}{10}+\frac{1}{10}$?
    a. 2 groups of $\frac{3}{10}$
    b. 3 groups of $\frac{3}{10}$
    c. 2 groups of $\frac{3}{10}$ and $\frac{1}{10}$ more
    d. 3 groups of $\frac{3}{10}$ and $\frac{1}{10}$ more
12. Write a multiplication equation to represent the problem.

Write each fraction as a sum of two equal fractional parts. Then, write a corresponding multiplication equation.

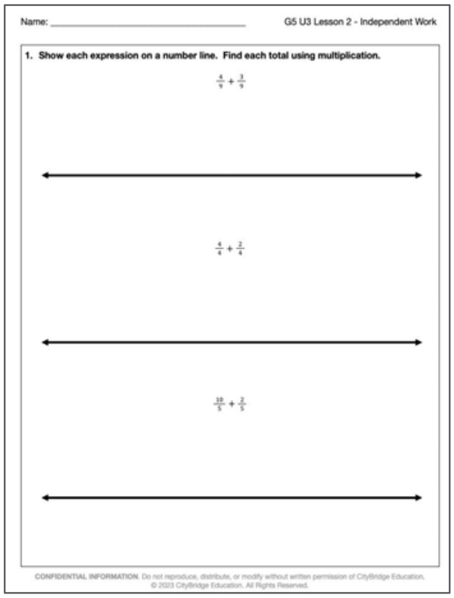
13. $\frac{6}{11}$
14. $\frac{8}{4}$

Consider the fraction $\frac{8}{5}$.

15. Fill in the blanks. $\frac{8}{5}=\frac{5}{5}+\frac{}{}$
16. What is $\frac{8}{5}$ as a mixed number? ________



Now it's time to explore making equivalent fractions with sums of fractions with like denominators on your own.



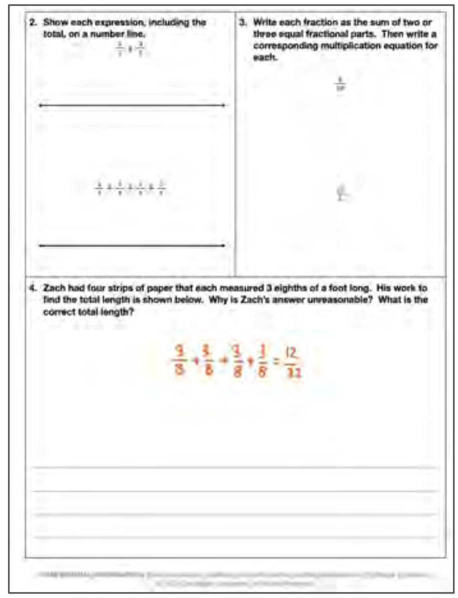
Name: ______________________ G5 U3 Lesson 2 - Independent Work

1. Show each expression on a number line. Find each total using multiplication.

$\frac{4}{9} + \frac{3}{9}$

$\frac{4}{4} + \frac{2}{4}$

$\frac{10}{5} + \frac{2}{5}$



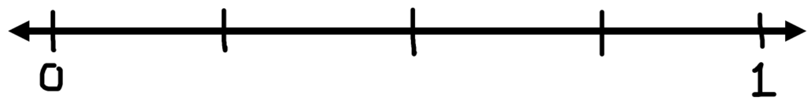
2. Show each expression, including the total, on a number line.

3. Write each fraction as the sum of two or three equal fractional parts. Then write a corresponding multiplication equation for each.

4. Zach had four strips of paper that each measured 3 eighths of a foot long. His work to find the total length is shown below. Why is Zach's answer unreasonable? What is the correct total length?

$\frac{3}{8} + \frac{3}{8} + \frac{3}{8} + \frac{3}{8} = \frac{12}{32}$

Use the number line to help answer the following questions.



1. Show $\frac{1}{4} + \frac{1}{4}$ on the number line.

2. What is $\frac{1}{4} + \frac{1}{4}$? ____________

3. Fill in the blanks to match the work you just did.

   ________ equal groups of $\frac{1}{4}$ is equal to ___________

4. Write a multiplication equation to match the work you just did.

Think about the expression $\frac{1}{5} + \frac{1}{5} + \frac{1}{5}$ to answer the following questions.

5. Draw a number line to represent $\frac{1}{5} + \frac{1}{5} + \frac{1}{5}$.

6. What is the value of $\frac{1}{5} + \frac{1}{5} + \frac{1}{5}$? __________

7. Fill in the blanks to match the work you just did.

   ________ equal groups of $\frac{1}{5}$ is equal to ___________

8. What multiplication equation represents this problem?

Think about the expression $\frac{3}{10} + \frac{3}{10} + \frac{1}{10}$ to answer the following questions.

9. Draw a number line to represent $\frac{3}{10} + \frac{3}{10} + \frac{1}{10}$.

10. What is the value of $\frac{3}{10} + \frac{3}{10} + \frac{1}{10}$? __________

11. Which expression can be used to represent $\frac{3}{10} + \frac{3}{10} + \frac{1}{10}$?

    a. 2 groups of $\frac{3}{10}$
    b. 3 groups of $\frac{3}{10}$
    c. 2 groups of $\frac{3}{10}$ and $\frac{1}{10}$ more
    d. 3 groups of $\frac{3}{10}$ and $\frac{1}{10}$ more

12. Write a multiplication equation to represent the problem.

Write each fraction as a sum of two equal fractional parts. Then, write a corresponding multiplication equation.

13. $\frac{6}{11}$

14. $\frac{8}{4}$

Consider the fraction $\frac{8}{5}$.

15. Fill in the blanks. $\frac{8}{5} = \frac{5}{5} + \frac{\ }{\ }$

16. What is $\frac{8}{5}$ as a mixed number? ____________

1. Show each expression on a number line. Find each total using multiplication.

$\frac{4}{9} + \frac{3}{9}$

$\frac{4}{4} + \frac{2}{4}$

$\frac{10}{5} + \frac{2}{5}$

2. Show each expression, including the total, on a number line.

$\frac{1}{5} + \frac{3}{5}$

3. Write each fraction as the sum of two or three equal fractional parts. Then write a corresponding multiplication equation for each.

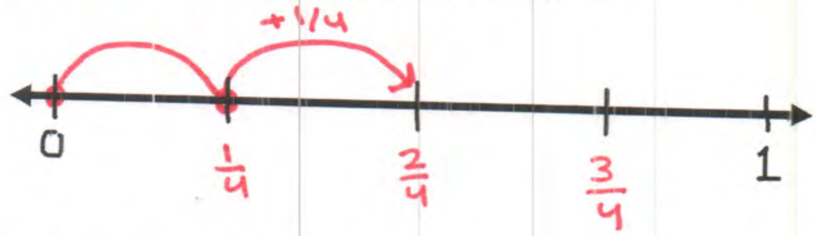
$\frac{1}{4}+\frac{1}{4}+\frac{1}{4}+\frac{1}{4}$	$\frac{8}{10}$ $\frac{15}{6}$

4. Zach had four strips of paper that each measured 3 eighths of a foot long. His work to find the total length is shown below. Why is Zach's answer unreasonable? What is the correct total length?

$$\frac{3}{8}+\frac{3}{8}+\frac{3}{8}+\frac{3}{8}=\frac{12}{32}$$

Name: KEY

Use the number line to help answer the following questions.



1. Show $\frac{1}{4} + \frac{1}{4}$ on the number line.

2. What is $\frac{1}{4} + \frac{1}{4}$? 2/4

3. Fill in the blanks to match the work you just did.

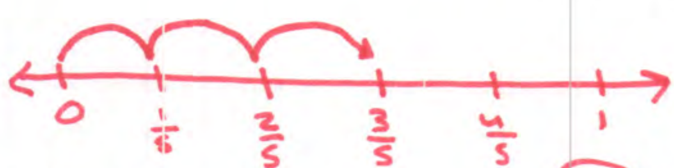
   2 equal groups of $\frac{1}{4}$ is equal to 2/4

4. Write a multiplication equation to match the work you just did.

   $2 \times \frac{1}{4} = \frac{2}{4}$

Think about the expression $\frac{1}{5} + \frac{1}{5} + \frac{1}{5}$ to answer the following questions.

5. Draw a number line to represent $\frac{1}{5} + \frac{1}{5} + \frac{1}{5}$.



6. What is the value of $\frac{1}{5} + \frac{1}{5} + \frac{1}{5}$? 3/5

7. Fill in the blanks to match the work you just did.

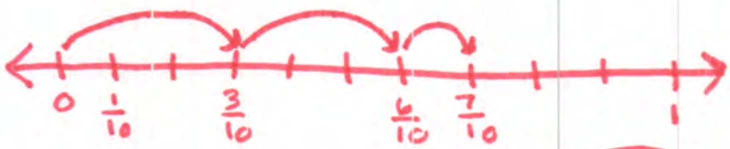
   3 equal groups of $\frac{1}{5}$ is equal to 3/5

8. What multiplication equation represents this problem?

   $3 \times \frac{1}{5} = \frac{3}{5}$

Think about the expression $\frac{3}{10} + \frac{3}{10} + \frac{1}{10}$ to answer the following questions.

9. Draw a number line to represent $\frac{3}{10} + \frac{3}{10} + \frac{1}{10}$.



10. What is the value of $\frac{3}{10} + \frac{3}{10} + \frac{1}{10}$? 7/10

11. Which expression can be used to represent $\underbrace{\frac{3}{10} + \frac{3}{10}}_{\text{2 groups of } \frac{3}{10}} + \frac{1}{10}$?

a. 2 groups of $\frac{3}{10}$

b. 3 groups of $\frac{3}{10}$

c. 2 groups of $\frac{3}{10}$ and $\frac{1}{10}$ more

d. 3 groups of $\frac{3}{10}$ and $\frac{1}{10}$ more

12. Write a multiplication equation to represent the problem.

$$\left(2 \times \frac{3}{10}\right) + \frac{1}{10} = \frac{7}{10}$$

Write each fraction as a sum of two equal fractional parts. Then, write a corresponding multiplication equation.

13. $\frac{6}{11}$ $\quad \frac{3}{11} + \frac{3}{11} = \frac{6}{11} \qquad 2 \times \frac{3}{11} = \frac{6}{11}$

14. $\frac{8}{4}$ $\quad \frac{4}{4} + \frac{4}{4} = \frac{8}{4} \qquad 2 \times \frac{4}{4} = \frac{8}{4}$

Consider the fraction $\frac{8}{5}$.

15. Fill in the blanks. $\quad \frac{8}{5} = \frac{5}{5} + \frac{3}{5}$

16. What is $\frac{8}{5}$ as a mixed number? $1\frac{3}{5}$

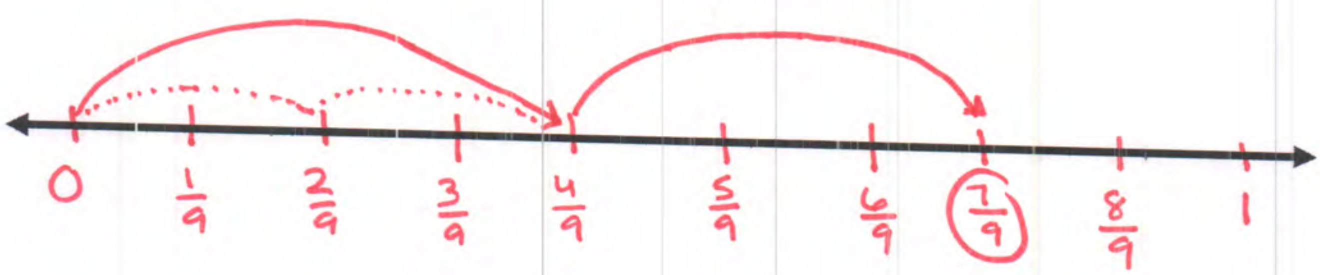
Name: KEY

1. Show each expression on a number line. Find each total using multiplication.

$\frac{4}{9} + \frac{3}{9}$

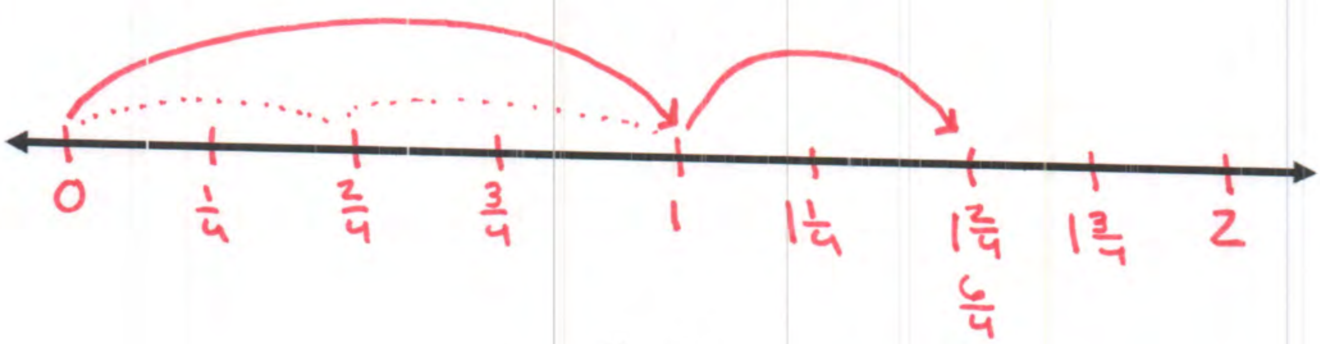
$\frac{2}{9}$ $\frac{2}{9}$

$(2 \times \frac{2}{9}) + \frac{3}{9} = \frac{7}{9}$



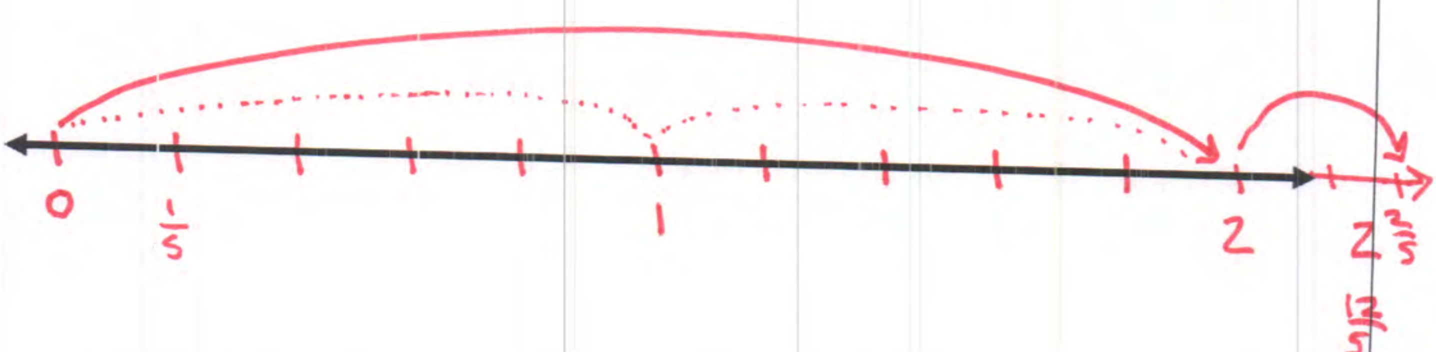
$\frac{4}{4} + \frac{2}{4}$

$3 \times \frac{2}{4} = \frac{6}{4}$



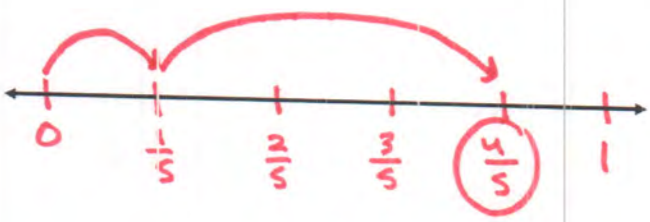
$\frac{10}{5} + \frac{2}{5}$

$(2 \times \frac{5}{5}) + \frac{2}{5} = \frac{12}{5}$

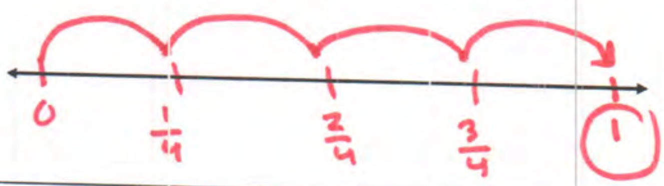


2. **Show each expression, including the total, on a number line.**

$\frac{1}{5} + \frac{3}{5}$



$\frac{1}{4} + \frac{1}{4} + \frac{1}{4} + \frac{1}{4}$



3. **Write each fraction as the sum of two or three equal fractional parts. Then write a corresponding multiplication equation for each.**

$\frac{8}{10}$

$\frac{4}{10} + \frac{4}{10}$

$2 \times \frac{4}{10} = \frac{8}{10}$

$\frac{15}{6}$

$\frac{5}{6} + \frac{5}{6} + \frac{5}{6}$

$3 \times \frac{5}{6} = \frac{15}{6}$

4. **Zach had four strips of paper that each measured 3 eighths of a foot long. His work to find the total length is shown below. Why is Zach's answer unreasonable? What is the correct total length?**

$\frac{3}{8} \times 4 = \frac{12}{8}$

$\frac{3}{8} + \frac{3}{8} + \frac{3}{8} + \frac{3}{8} = \frac{12}{32}$

Four groups of 3/8 would be more than a whole, but Zach's answer is less than a whole. Zach added his denominators, but 4 groups of 3 eighths would be 12 eighths.

G5 U3 Lesson 3

Add fractions with unlike units using the strategy of creating equivalent fractions

CITYTUTOR DC

G5 U3 Lesson 3 - Students will add fractions with unlike units using the strategy of creating equivalent fractions

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): In our past few lessons, we've been thinking about equivalent fractions. Today, we will use what we've been thinking about to help us add fractions with unlike units.

Let's Talk (Slide 3): Before we solve some problems, take a look at these equations. What do you notice about them? Possible Student Answers, Key Points:

- I notice they're all addition equations. They all have 4 and 2 in them. They all would have an answer of 6. I notice some are objects like apples, and some are math units like tenths.
- They all have like units. Apples and apples, cows and cows, etc.

There is a lot you can notice about these four equations, but I want to specifically point out the units. I know that if I add 2 apples with 4 apples, my answer will be 6 *apples*. We see the same with more math-y units. I know 2 tens plus 4 tens will be 6 *tens.* I know 2 tenths plus 4 tenths will be 6 *tenths*.

If I gave you a problem like this *(write 2 cows + 4 apples)*, what would you think?

2 cows + 4 apples = ?

Possible Student Answers, Key Points:

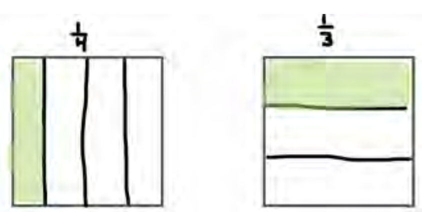
- They're not like units. I can't really add cows and apples together, because they're different things.
- 2 + 4 is 6, but the unit is confusing.

It is easier to think about addition when we have like units. Today, we'll be asked to think about sums of fractions with unlike units. We'll use what we know about equivalent fractions to help us rewrite fractions so they have like units, which will make it easier for us to add. Let me show you what I mean.

Let's Think (Slide 4): This question wants us to add ¼ and ⅓ What fractional units does this problem involve? *(fourths and thirds)* Since these fractions don't have the same unit, we can't automatically add them, because we don't know what unit the total would be. It's sort of like trying to add cows + apples, from before.

Let's use an area model to represent both fractions. Then we'll use what we know about equivalent fractions to help us find like units. How can I represent these two addends using area models? Possible Student Answers, Key Points:

- For ¼, you can split an area model into four pieces and shade one of them.
- For ⅓you can split an area model into three pieces and shade one of them.

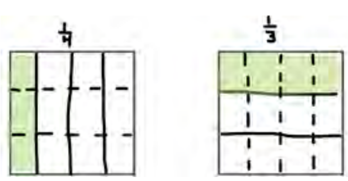


(draw the area models and label each as you narrate) I'm going to partition the first area model into four pieces vertically, and shade one of them. This shows ¼. I'm going to partition the second area model into three pieces horizontally, and shade one of them. This shows ⅓ I want to add these two fractions, but they're unlike units.

I need to think of a like unit that I can use to make equivalent fractions with both ¼ and ⅓ Maybe you know one off the top of your head, but if you're not sure of a common unit to use for each fraction, you can visualize creating equivalent fractions.

4, 8, 12, 16 ...
3, 6, 9, 12...

(list multiples as you name them) For instance, I know if I partition fourths once, I'll make 8 pieces. If I partition fourths twice, I'll make 12 pieces. If I partition fourths three times, I'll make 16 pieces. I can do the same thinking with thirds. If I partition thirds once, I'll make 6 pieces. If I partition thirds twice, I'll make 9 pieces. If I partition thirds three times, I'll make 12 pieces. Which fractional unit could we use to write two equivalent fractions with like units? (12ths or 12 pieces)



To write ¼ as an equivalent fraction with 12 pieces, I can partition the area model with two horizontal lines. *(draw two horizontal lines)* I didn't change the shaded region at all, I just partitioned the model to make an equivalent fraction with different-sized pieces. How can I use my area model to show ⅓ as an equivalent fraction with 12 pieces? (draw 3 lines to cut the thirds into twelfths) Great, I'll use 3 vertical lines to cut the thirds into twelfths. *(draw three vertical lines)*

What equivalent fractions did we make, and how do you know? Possible Student Answers, Key Points:

- The first area model showed ¼. We partitioned it into 12 pieces, and I see 3 are shaded. The equivalent fraction is 3/12.
- The second area model showed ⅓ We partitioned it into 12 pieces, and I see 4 are shaded. The equivalent fraction is 4/12.

$\frac{3}{12} + \frac{4}{12} = \frac{7}{12}$

Instead of ¼ + ⅓we can now think of our equation with like units. *(write new equation)* We have 3/12 + 4/12 = ?. Now that we have like units, it's much easier to think about the addition. What is 3 twelfths plus 4 twelfths? (7 twelfths) Well done. *(write answer to equation)* We just used area models to help us find like units, so that we could add fractions that originally had unlike units. Let's try one more.

Let's Think (Slide 5): *(read problem)* What do you notice is the same or different about this problem? Possible Student Answers, Key Points:

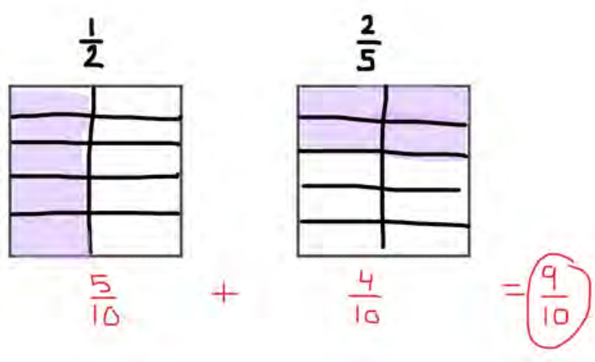
- It's still an addition problem. It still involves fractions. The fractions have unlike units again.
- It's different because these fractions have units of halves and fifths. It's different because one fraction isn't a unit fraction.

These fractions, once again, don't have like units. This means we can't just add automatically, because these fractions don't represent the same size pieces. Let's see if we can use similar thinking to find this sum. We'll start by drawing an area model to represent each. Since I know I'll have to make like units, I'll model ½ by partitioning vertically and ⅖ by partitioning horizontally. *(draw and shade ½ using a vertical cut, then draw and shade ⅖ using four horizontal cuts)*

We know, and we can see in our models, that halves and fifths are not the same size. How did we find a common unit in the last example, and how could we use that to find a common unit in this problem? Possible Student Answers, Key Points:

- We thought about each fraction and what units we could make if we partitioned each one a few times. We listed out the new parts each partition would make.
- Halves can make fourths, sixths, eighths, tenths, and so on. Fifths can make tenths, fifteenths, twentieths, and so on.

Since I know I can partition halves into ten pieces *and* fifths into ten pieces, we can make equivalent fractions using tenths as our denominator. Let's partition each area model to show tenths.



(partition each area model as you narrate) I can use four horizontal cuts to partition ½ into tenths. I can use one vertical cut to partition ⅖ into tenths. What equivalent fractions do we see now? (½ is equivalent to 5/10, and ⅖ is equivalent to 4/10)

If we rewrite our original expression using like units, *(write 5/10 + 4/10 underneath corresponding area models)* we can now add with ease. 5 tenths plus 4 tenths is equal to 9 tenths. *(write = 9/10)*

When asked to add fractions with unlike units, or unlike denominators, we can rewrite the problem using equivalent fractions with like units to make the addition easier to think about.

Let's Try it (Slides 6 - 7): Now let's work on adding fractions with unlike units by making equivalent fractions together. As we work, we'll draw area models to visualize our fractions. We can skip-count or visualize partitioning each fraction to find a common unit we can convert each fraction into, and then partition our area models to match. Let's give it a try!

WARM WELCOME

Today we will add fractions with unlike units by using the strategy of creating equivalent fractions.

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Let's Talk:

2 apples + 4 apples = ?

2 cows + 4 cows = ?

2 tens + 4 tens = ?

2 tenths + 4 tenths = ?

Let's Think:

Use an area model to find the sum.

$$\frac{1}{4}+\frac{1}{3}$$

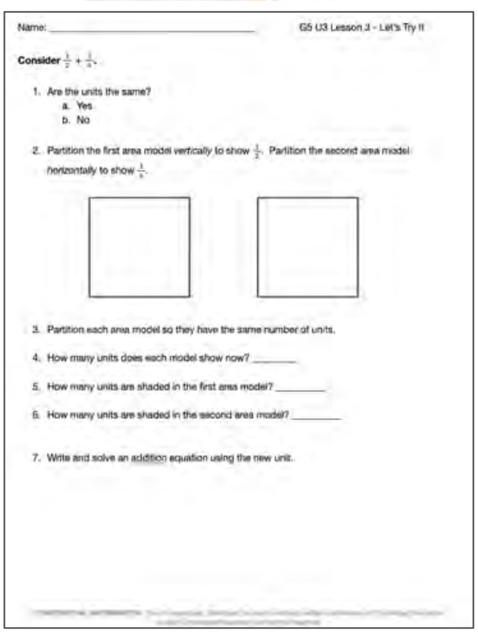
Let's Think:

Use an area model to find the sum.

$$\frac{1}{2} + \frac{2}{5}$$

Let's Try It:

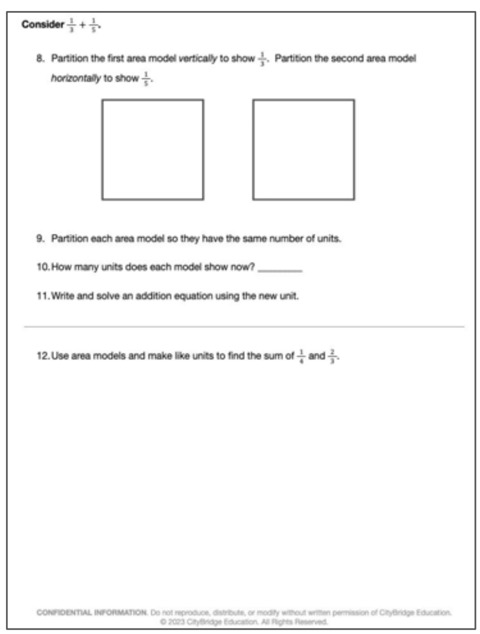
Let's explore adding fractions with unlike units together.



Name: ______________________ G5 U3 Lesson 3 - Let's Try It

Consider $\frac{1}{2} + \frac{1}{4}$.

1. Are the units the same?
   a. Yes
   b. No
2. Partition the first area model vertically to show $\frac{1}{2}$. Partition the second area model horizontally to show $\frac{1}{4}$.
3. Partition each area model so they have the same number of units.
4. How many units does each model show now? ________
5. How many units are shaded in the first area model? ________
6. How many units are shaded in the second area model? ________
7. Write and solve an addition equation using the new unit.



Consider $\frac{1}{3} + \frac{1}{5}$.

8. Partition the first area model *vertically* to show $\frac{1}{3}$. Partition the second area model *horizontally* to show $\frac{1}{5}$.
9. Partition each area model so they have the same number of units.
10. How many units does each model show now? ________
11. Write and solve an addition equation using the new unit.

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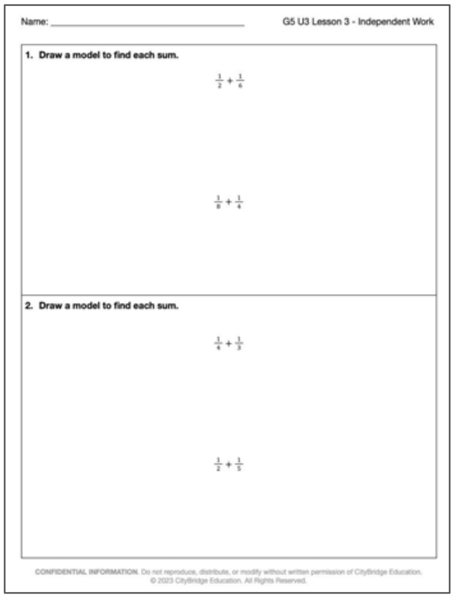
12. Use area models and make like units to find the sum of $\frac{1}{4}$ and $\frac{2}{3}$.

On your Own:

Now it's time to explore adding fractions with unlike units on your own.


Name: ______________________ G5 U3 Lesson 3 - Independent Work

1. Draw a model to find each sum.

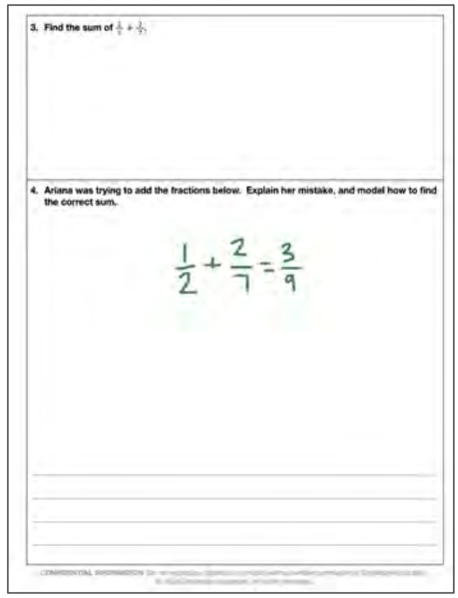
$\frac{1}{2} + \frac{1}{6}$

$\frac{1}{8} + \frac{1}{4}$

2. Draw a model to find each sum.

$\frac{1}{4} + \frac{1}{3}$

$\frac{1}{2} + \frac{1}{5}$


3. Find the sum of [illegible]

4. Ariana was trying to add the fractions below. Explain her mistake, and model how to find the correct sum.

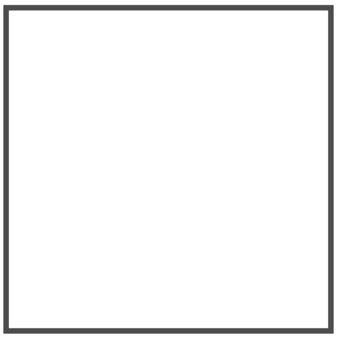
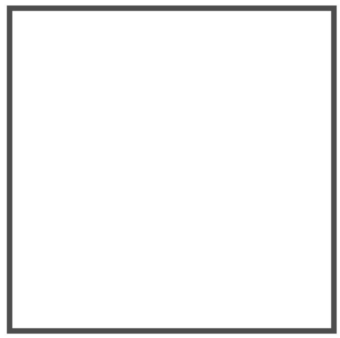
$\frac{1}{2} + \frac{2}{7} = \frac{3}{9}$

Name: ____

Consider $\frac{1}{2} + \frac{1}{6}$.

1. Are the units the same?
   a. Yes
   b. No

2. Partition the first area model *vertically* to show $\frac{1}{2}$. Partition the second area model *horizontally* to show $\frac{1}{6}$.

3. Partition each area model so they have the same number of units.

4. How many units does each model show now? __________

5. How many units are shaded in the first area model? ___________

6. How many units are shaded in the second area model? ___________

7. Write and solve an addition equation using the new unit.

Consider $\frac{1}{3} + \frac{1}{5}$.

8. Partition the first area model *vertically* to show $\frac{1}{3}$. Partition the second area model *horizontally* to show $\frac{1}{5}$.


9. Partition each area model so they have the same number of units.

10. How many units does each model show now? __________

11. Write and solve an addition equation using the new unit.

---

12. Use area models and make like units to find the sum of $\frac{1}{4}$ and $\frac{2}{3}$.

1. Draw a model to find each sum.

$$\frac{1}{2} + \frac{1}{6}$$

$$\frac{1}{8} + \frac{1}{4}$$

2. Draw a model to find each sum.

$$\frac{1}{4} + \frac{1}{3}$$

$$\frac{1}{2} + \frac{1}{5}$$

3. Find the sum of $\frac{2}{3} + \frac{2}{7}$.

4. Ariana was trying to add the fractions below. Explain her mistake, and model how to find the correct sum.

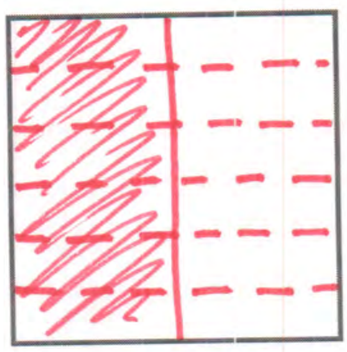
$$\frac{1}{2} + \frac{2}{7} = \frac{3}{9}$$

Name: KEY

Consider $\frac{1}{2} + \frac{1}{6}$.

1. Are the units the same?
   a. Yes
   b. No

2. Partition the first area model *vertically* to show $\frac{1}{2}$. Partition the second area model *horizontally* to show $\frac{1}{6}$.



3. Partition each area model so they have the same number of units.

4. How many units does each model show now? 12

5. How many units are shaded in the first area model? 6

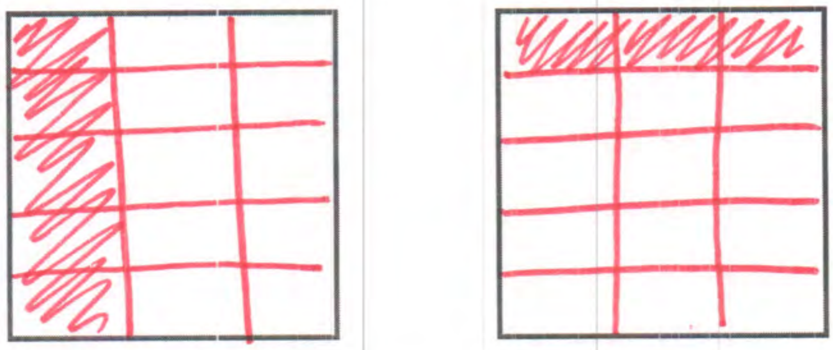
6. How many units are shaded in the second area model? 2

7. Write and solve an addition equation using the new unit.

$$\frac{6}{12} + \frac{2}{12} = \frac{8}{12}$$

Consider $\frac{1}{3} + \frac{1}{5}$.

8. Partition the first area model *vertically* to show $\frac{1}{3}$. Partition the second area model *horizontally* to show $\frac{1}{5}$.



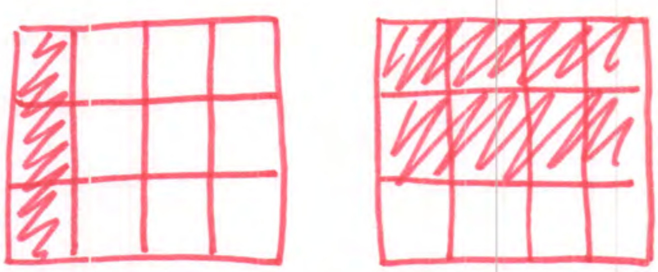
9. Partition each area model so they have the same number of units.

10. How many units does each model show now? 15

11. Write and solve an addition equation using the new unit. $\frac{5}{15} + \frac{3}{15} = \frac{8}{15}$

---

12. Use area models and make like units to find the sum of $\frac{1}{4}$ and $\frac{2}{3}$.



$\frac{3}{12} + \frac{8}{12} = \frac{11}{12}$

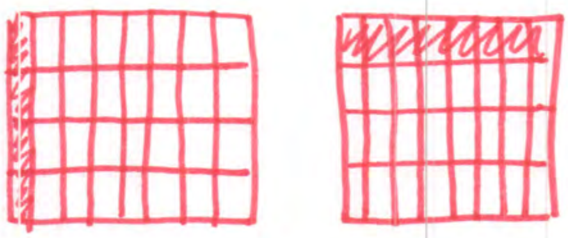
Name: KEY

1. Draw a model to find each sum.

$\frac{1}{2} + \frac{1}{6}$

$\frac{6}{12} + \frac{2}{12} = \frac{8}{12}$

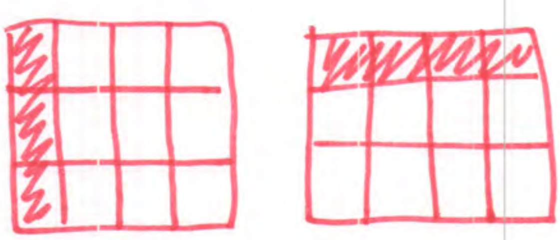
$\frac{1}{8} + \frac{1}{4}$



$\frac{4}{32} + \frac{8}{32} = \frac{12}{32}$

2. Draw a model to find each sum.

$\frac{1}{4} + \frac{1}{3}$

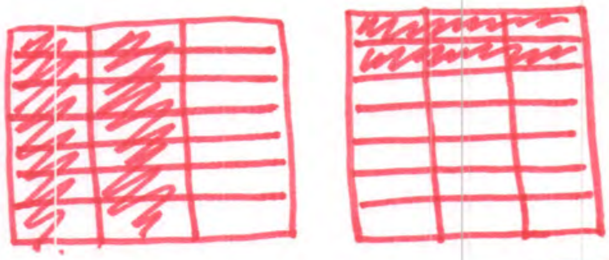


$\frac{3}{12} + \frac{4}{12} = \frac{7}{12}$

$\frac{1}{2} + \frac{1}{5}$

$\frac{5}{10} + \frac{2}{10} = \frac{7}{10}$

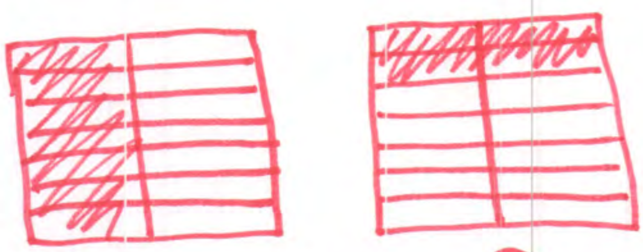
3. **Find the sum of $\frac{2}{3}+\frac{2}{7}$.**



$\frac{14}{21} + \frac{6}{21} = \frac{20}{21}$

4. **Ariana was trying to add the fractions below. Explain her mistake, and model how to find the correct sum.**

$$\frac{1}{2}+\frac{2}{7}=\frac{3}{9}$$



$\frac{7}{14} + \frac{4}{14} = \frac{11}{14}$

Ariana added straight across without thinking about finding like units. She can make halves and sevenths into fourteenths. Then $\frac{7}{14}+\frac{4}{14}$ would make a sum of 11 fourteenths ($\frac{11}{14}$).

G5 U3 Lesson 4

Add fractions with sums between 1 and 2

CITYTUTOR DC

G5 U3 Lesson 4 - Students will add fractions with sums between 1 and 2

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): Previously, we have worked to add fractions with like units. We know that when we add fractions with like units, say 1 fourth plus 2 fourths, the denominator stays the same. *(write ¼ + 2/4 = ¾)* This is because 1 fourth and 2 fourths have like units, so the unit remains consistent as we add. It's like adding 1 banana plus 2 more bananas and getting a total of 3 bananas.

$$\frac{1}{4}+\frac{2}{4}=\frac{3}{4}$$

$$\frac{1}{4}+\frac{2}{3}=?$$

In our previous lesson, we saw addition problems where our fractions did *not* have like units. For example, we saw problems like *(write equation)* ¼ + ⅔= ?. Fourths and thirds are not the same size units, so we couldn't automatically add. What did we do with our fractions to make problems like this easier? Possible Student Answers, Key Points:

- We drew each fraction using an area model, and then partitioned them so they had the same number of pieces.
- We found a common unit for each fraction, then rewrote the problem as the sum of two equivalent fractions with the same unit.

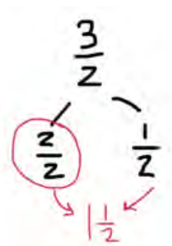
When we don't have the same unit, we can write equivalent fractions that *do* have the same unit to make adding fractions easier. We're going to keep practicing this today, but you'll notice that sometimes our totals will be greater than 1 whole. Let's dive in!

Let's Talk (Slide 3): Take a look at these three fractions. What do you notice? What do you wonder? Possible Student Answers, Key Points:

- I notice they all use threes or twos. I notice they're in order from least to greatest. I notice the middle one is equal to 1 whole.
- I wonder what these fractions represent. I wonder why they all use similar numbers.

Today, we'll be adding fractions, and many of our totals will be between 1 and 2. Which fraction here is between 1 and 2, and how do you know? Possible Student Answers, Key Points:

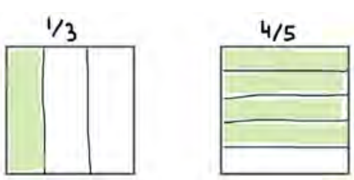
- The first fraction is less than 1, because 2 thirds is 1 third less than a whole. The second fraction is equal to a whole. The third fraction is greater than 1 whole, because 2/2 would be 1 whole.
- The third fraction is greater than 1 whole, because 3/2 is the same as 1 ½.



Well, 3/2 is between 1 and 2. *(write 3/2 with two branches of a number bond)* 2 halves would be 1 whole. (write 2/2 for one of the number bond branches) That leaves ½ as the other part. (write ½ for the other number bond branch) This means 3/2 is the same as 1 whole and ½ or the mixed number 1 ½. *(write this beneath the number bond)*

When we find the sum of fractions today, we should be prepared to see totals that are greater than 1 whole. This means our answers might be fractions greater than 1, sometimes called improper fractions, or mixed numbers.

Let's Think (Slide 4): This problem wants us to find the sum of ⅔and ⅔

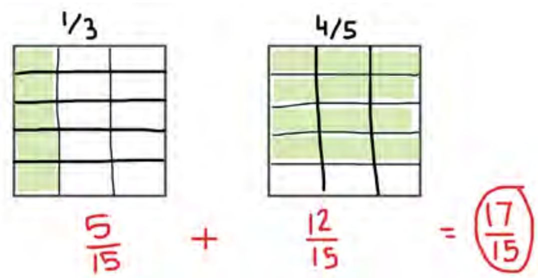


These fractions do not have the same unit. What units do we have in this problem? (thirds and fifths) Let's start by drawing an area model to represent each fraction. Since I know I'll need to find like units, let's partition thirds vertically and fifths horizontally. *(draw, shade, and label an area model for ⅔and another for ⅔)*

3, 6, 9, 12, 15

5, 10, 15

In order to add these fractions, we'll need a common denominator or a common unit. *(list multiples as you name them)* I know I can split thirds into 6 pieces, or 9 pieces, or 12 pieces, or 15 pieces depending on the number of cuts I use to partition the model. I know I can split fifths into 10 pieces, 15 pieces, or 20 pieces depending on the number of cuts I use to partition. What unit would be appropriate for these two fractions? We can partition each model into fifteenths!



I'll make 4 horizontal cuts to partition ⅓ into fifteen pieces. How can I partition ⅘ to make 15 pieces? (make 2 vertical cuts)

Now the pieces are the same size. We've made equivalent fractions with units of fifteenths. ⅓ is equivalent to 5/15 and ⅘ is equivalent to 12/15. *(write 5/15 + 12/15 = 17/15 underneath corresponding area models)* When we add the two equivalent fractions together, we end up with 17/15. Is this sum more or less than 1 whole, and how do you know?

Possible Student Answers, Key Points:

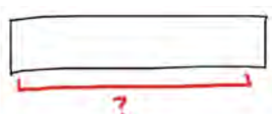
- It is more than 1 whole because 15/15 would be 1 whole.
- It is more than 1 whole because the numerator, or number of shaded pieces, is more than the denominator.

Our answer is greater than 1 whole, because 15/15 would be 1 whole. Right now, the sum is written as a fraction greater than 1. We could also write this sum as a mixed number. *(write number bond as you narrate)* I know 17/15 can be decomposed into 15/15, or 1 whole, and 2/15. So, in mixed number form, our sum is 1 2/15. Either a fraction greater than 1 or a mixed number is an acceptable answer, unless the problem we're given specifies the form they want the answer in.

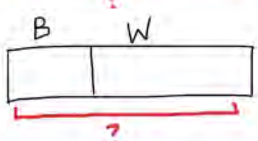
Let's Think (Slide 5): Let's try one more. *(Read story problem)* In your own words, what is this story problem about?

Possible Student Answers, Key Points:

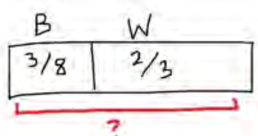
- Erik wants to find the total white sugar and brown sugar needed for his recipe.
- Part of his sugar is white and part of his sugar is brown, and we need to find the total sugar.



When I'm picturing this story, I know it's asking for the total amount of sugar. *(draw rectangle and label the entire tape diagram with a question mark)*



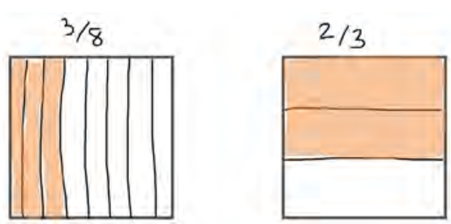
Some of the sugar is brown sugar, and some of the sugar is white sugar. So I know I'll need to combine, or add, these two types of sugar to find the total of the two parts. *(partition the tape diagram and label each type of sugar)*



If there is ⅜ cup of brown sugar and ⅔ cup of white sugar, I know this problem is asking me to find the sum of those two fractions. *(label tape diagram with corresponding numbers in each box)*

Now that we've made sense of the story, let's see what we can do to find the total amount of sugar. What do you think we'll need to do first to add these fractions? Possible Student Answers, Key Points:

- Eighths and thirds are not the same size pieces, so we'll want to make like units.
- We can draw an area model for each fraction and partition them so they have the same number of units.



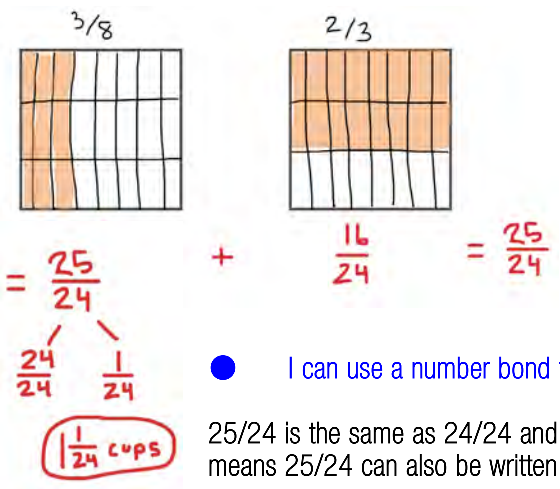
Eighths and thirds are not the same unit, so let's draw area models to help us think of equivalent fractions that are easier to add. I'll make an area model showing ⅜ vertically and another area model showing ⅔ horizontally. *(draw, shade, and label each area model)*

How can I determine a common denominator, or like unit, that will work for adding ⅜ and ⅔?

Possible Student Answers, Key Points:

- You can skip-count by 8 and by 3 to find a common multiple.
- You can list out ways you can partition thirds or eighths until you find a unit that both models could be partitioned into.

I can list out ways to partition eighths and thirds. When I'm doing that, I'm really just listing out multiples of 8 and 3. I know 8 and 3 share a multiple of 24, so I can partition each model into 24 like-sized pieces. Let's do that.



(partition models as you narrate) I'll partition 2/3 horizontally with 2 cuts to form 24 pieces. I'll partition 2/3 vertically with 7 cuts to form 24 pieces.

What equivalent fractions did we make? (9/24 and 16/24) When I add 9/24 and 16/24, we end up with 25/24. *(write equation)* We can leave the answer like that, or we can write it as a mixed number.

How can we write 25/24 as a mixed number? Possible Student Answers, Key Points:

- I know 24/24 is 1 whole, so we have 1 1/24.
- I can use a number bond to decompose 25/24 into 1 whole and 1/24.

25/24 is the same as 24/24 and 1/24. *(write number bond decomposing 25/24 into 24/24 and 1/24)* This means 25/24 can also be written as 1 1/24. Erik needs 1 1/24 cups of sugar in all.

Nice work so far adding fractions with sums between 1 and 2. How does adding with sums between 1 and 2 compare with adding from our previous lessons? Possible Student Answers, Key Points:

- It's not really different, just our answers are bigger.
- We can use the same strategies to find equivalent fractions. The only difference is our answer is more than 1 whole, so we can write them as mixed numbers.

It's not that different! Finding a common denominator, or like unit, made it possible for us to make equivalent fractions so we could add fractions with unlike units.

Let's Try it (Slides 6 - 7): Now let's work on adding fractions with sums between 1 and 2 together. Just like we saw in our previous lesson and earlier today, we'll want to make sure we have like units before adding. We can use an area model to help us rewrite any problem with unlike units as an easier problem with like units. Let's give it a try.

WARM WELCOME

Today we will add fractions with sums between 1 and 2.

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Let's Talk:

What do you notice about the fractions below?

$$\frac{2}{3} \qquad \frac{3}{3} \qquad \frac{3}{2}$$

Let's Think:

Use an area model to find the sum.

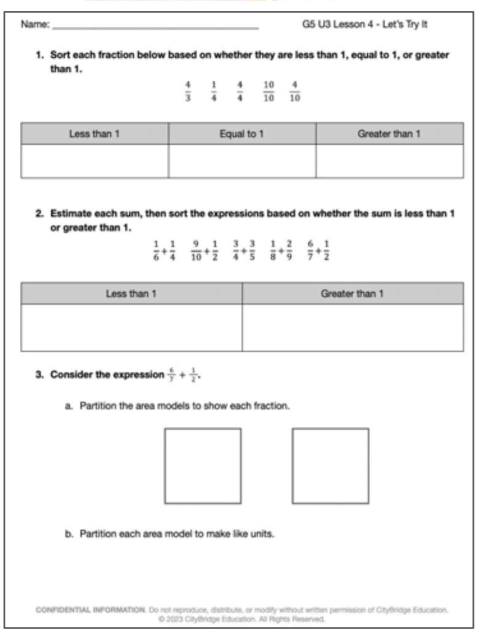
$$\frac{1}{3} + \frac{4}{5}$$

Let's Think:

Erik needs ⅜ cup of brown sugar and ⅔ cup of white sugar to make muffins. How much sugar does Erik need in all?

Let's Try It:

Let's explore adding fractions with sums between 1 and 2 together.



Name: ______________________ G5 U3 Lesson 4 - Let's Try It

1. **Sort each fraction below based on whether they are less than 1, equal to 1, or greater than 1.**

$\frac{4}{3}$ $\frac{1}{4}$ $\frac{4}{4}$ $\frac{10}{10}$ $\frac{4}{10}$

Less than 1	Equal to 1	Greater than 1

2. **Estimate each sum, then sort the expressions based on whether the sum is less than 1 or greater than 1.**

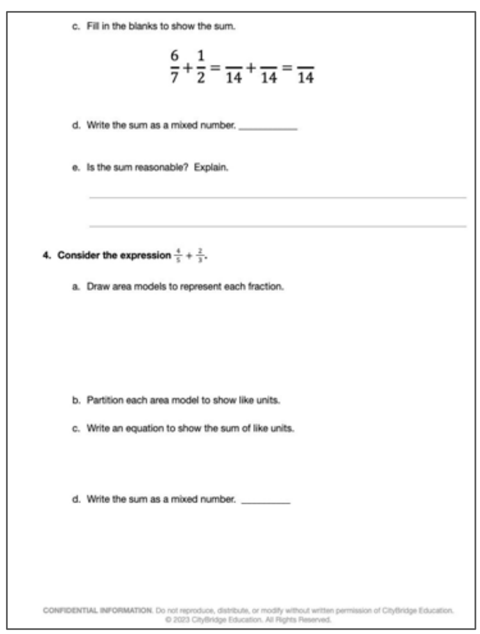
$\frac{1}{6}+\frac{1}{4}$ $\frac{9}{10}+\frac{1}{2}$ $\frac{3}{4}+\frac{3}{5}$ $\frac{1}{8}+\frac{2}{9}$ $\frac{6}{7}+\frac{1}{2}$

Less than 1	Greater than 1

3. **Consider the expression $\frac{6}{7}+\frac{1}{2}$.**

a. Partition the area models to show each fraction.

b. Partition each area model to make like units.



c. Fill in the blanks to show the sum.

$$\frac{6}{7}+\frac{1}{2}=\frac{\_\_}{14}+\frac{\_\_}{14}=\frac{\_\_}{14}$$

d. Write the sum as a mixed number. __________

e. Is the sum reasonable? Explain.

4. **Consider the expression $\frac{4}{5}+\frac{2}{3}$.**

a. Draw area models to represent each fraction.

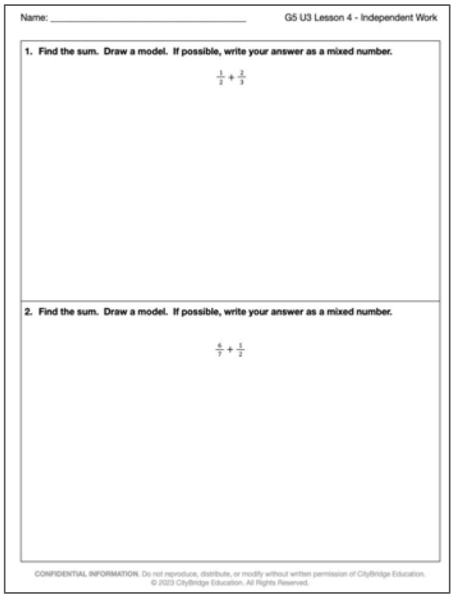
b. Partition each area model to show like units.

c. Write an equation to show the sum of like units.

d. Write the sum as a mixed number. ________

On your Own:

Now it's time to explore adding fractions with sums between 1 and 2 on your own.



Name: ______________________ G5 U3 Lesson 4 - Independent Work

1. Find the sum. Draw a model. If possible, write your answer as a mixed number.

$\frac{1}{2} + \frac{2}{3}$

2. Find the sum. Draw a model. If possible, write your answer as a mixed number.

$\frac{6}{7} + \frac{1}{2}$

3. Leland and Norman are at the candy store. Leland's bag of candy weighs $\frac{3}{5}$ lb, and Norman's bag of candy weighs $\frac{3}{4}$ lb. How much does their candy weigh in all?

Solve the problem. Include a model and a number sentence.

4. Mae needs 1 cup of flour for a recipe. She has $\frac{3}{4}$ cup and borrowed $\frac{7}{10}$ cup from a neighbor. She wrote $\frac{3}{4} + \frac{7}{10} = \frac{10}{14}$. Since $\frac{10}{14}$ is less than 1 whole, she thinks she doesn't have enough flour.

Explain why her thinking is incorrect. Include a model.

1. Sort each fraction below based on whether they are less than 1, equal to 1, or greater than 1.

$$\frac{4}{3} \quad \frac{1}{4} \quad \frac{4}{4} \quad \frac{10}{10} \quad \frac{4}{10}$$

Less than 1	Equal to 1	Greater than 1

2. Estimate each sum, then sort the expressions based on whether the sum is less than 1 or greater than 1.

$$\frac{1}{6}+\frac{1}{4} \quad \frac{9}{10}+\frac{1}{2} \quad \frac{3}{4}+\frac{3}{5} \quad \frac{1}{8}+\frac{2}{9} \quad \frac{6}{7}+\frac{1}{2}$$

Less than 1	Greater than 1

3. Consider the expression $\frac{6}{7}+\frac{1}{2}$.

   a. Partition the area models to show each fraction.

   b. Partition each area model to make like units.

   c. Fill in the blanks to show the sum.

$$\frac{6}{7}+\frac{1}{2}=\frac{\quad}{14}+\frac{\quad}{14}=\frac{\quad}{14}$$

d. Write the sum as a mixed number. ____________

e. Is the sum reasonable? Explain.

____

____

4. Consider the expression $\frac{4}{5} + \frac{2}{3}$.

a. Draw area models to represent each fraction.

b. Partition each area model to show like units.

c. Write an equation to show the sum of like units.

d. Write the sum as a mixed number. ____________

1. Find the sum. Draw a model. If possible, write your answer as a mixed number.

$$\frac{1}{2} + \frac{2}{3}$$

2. Find the sum. Draw a model. If possible, write your answer as a mixed number.

$$\frac{6}{7} + \frac{1}{2}$$

3. Leland and Norman are at the candy store. Leland's bag of candy weighs $\frac{3}{5}$ lb, and Norman's bag of candy weighs $\frac{3}{4}$ lb. How much does their candy weigh in all?

Solve the problem. Include a model and a number sentence.

4. Mae needs 1 cup of flour for a recipe. She has $\frac{3}{4}$ cup and borrowed $\frac{7}{10}$ cup from a neighbor. She wrote $\frac{3}{4} + \frac{7}{10} = \frac{10}{14}$. Since $\frac{10}{14}$ is less than 1 whole, she thinks she doesn't have enough flour.

Explain why her thinking is incorrect. Include a model.

Name: KEY

G5 U3 Lesson 4 - Let's Try It

1. **Sort each fraction below based on whether they are less than 1, equal to 1, or greater than 1.**

$\cancel{\frac{4}{3}}$ $\cancel{\frac{1}{4}}$ $\cancel{\frac{4}{4}}$ $\cancel{\frac{10}{10}}$ $\frac{4}{10}$

Less than 1	Equal to 1	Greater than 1
$\frac{1}{4}$ $\frac{4}{10}$	$\frac{4}{4}$ $\frac{10}{10}$	$4/3$

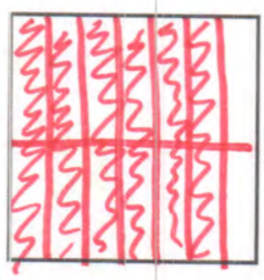
2. **Estimate each sum, then sort the expressions based on whether the sum is less than 1 or greater than 1.**

$\cancel{\frac{1}{6}+\frac{1}{4}}$ $\cancel{\frac{9}{10}+\frac{1}{2}}$ $\cancel{\frac{3}{4}+\frac{3}{5}}$ $\cancel{\frac{1}{8}+\frac{2}{9}}$ $\cancel{\frac{6}{7}+\frac{1}{2}}$

Less than 1	Greater than 1
$\frac{1}{6}+\frac{1}{4}$ $\frac{1}{8}+\frac{2}{9}$	$\frac{9}{10}+\frac{1}{2}$ $\frac{3}{4}+\frac{3}{5}$ $\frac{6}{7}+\frac{1}{2}$

3. **Consider the expression $\frac{6}{7}+\frac{1}{2}$.**

   a. Partition the area models to show each fraction.



   b. Partition each area model to make like units.

c. Fill in the blanks to show the sum.

$$\frac{6}{7}+\frac{1}{2}=\frac{12}{14}+\frac{7}{14}=\frac{19}{14}$$

$\frac{14}{14}$

$\frac{5}{14}$

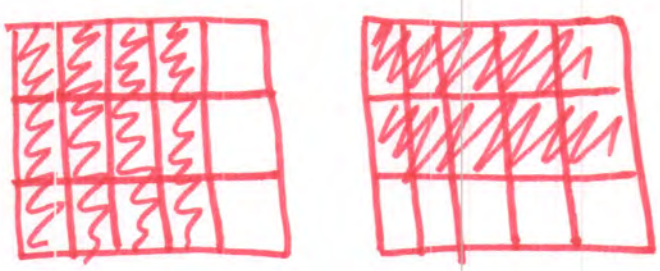
d. Write the sum as a mixed number. $1\frac{5}{14}$

e. Is the sum reasonable? Explain.

Yes. $\frac{6}{7}$ is close to 1, so our answer should be close to $1+\frac{1}{2}$, or $1\frac{1}{2}$.

4. Consider the expression $\frac{4}{5}+\frac{2}{3}$.

a. Draw area models to represent each fraction.



b. Partition each area model to show like units.

c. Write an equation to show the sum of like units.

$$\frac{12}{15}+\frac{10}{15}=\frac{22}{15}$$

d. Write the sum as a mixed number. $1\frac{7}{15}$

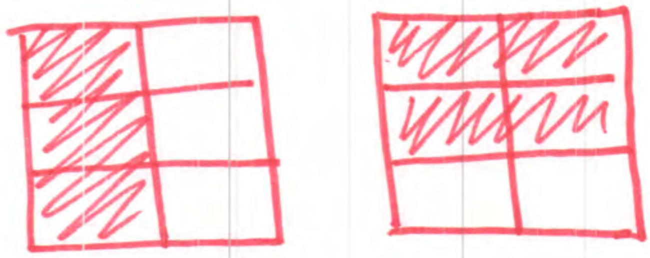
$\frac{22}{15}$

$\left(\frac{15}{15}\right) \rightarrow 1$ $\frac{7}{15}$

Name: KEY

1. Find the sum. Draw a model. If possible, write your answer as a mixed number.

$$\frac{1}{2} + \frac{2}{3}$$



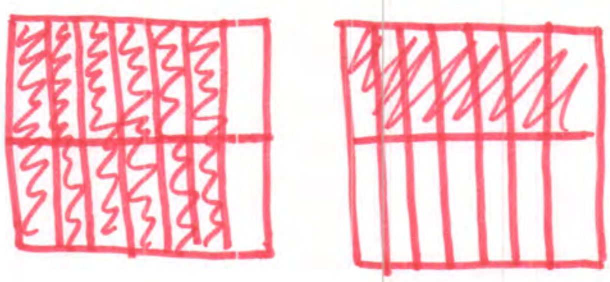
$$\frac{3}{6} + \frac{4}{6} = \frac{7}{6}$$

$$\frac{6}{6} \quad \frac{1}{6}$$

$$1\frac{1}{6}$$

2. Find the sum. Draw a model. If possible, write your answer as a mixed number.

$$\frac{6}{7} + \frac{1}{2}$$



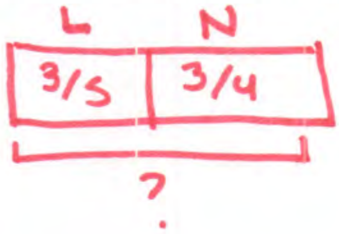
$$\frac{12}{14} + \frac{7}{14} = \frac{19}{14}$$

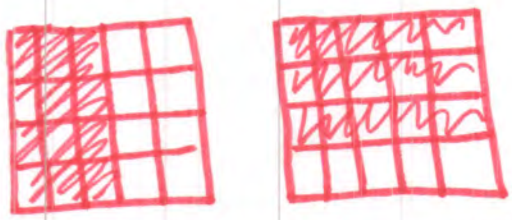
$$\frac{14}{14} \quad \frac{5}{14}$$

$$1\frac{5}{14}$$

3. Leland and Norman are at the candy store. Leland's bag of candy weighs $\frac{3}{5}$ lb, and Norman's bag of candy weighs $\frac{3}{4}$ lb. How much does their candy weigh in all?

Solve the problem. Include a model and a number sentence.



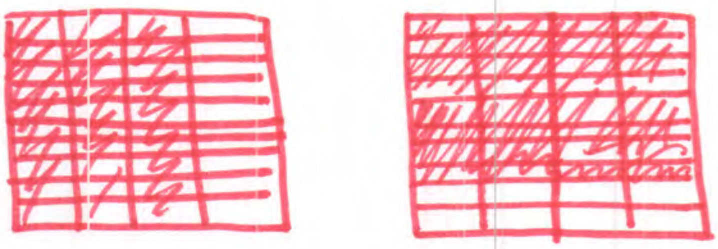


$\frac{12}{20} + \frac{15}{20} = \frac{27}{20}$

$1\frac{7}{20}$ lb.

4. Mae needs 1 cup of flour for a recipe. She has $\frac{3}{4}$ cup and borrowed $\frac{7}{10}$ cup from a neighbor. She wrote $\frac{3}{4} + \frac{7}{10} = \frac{10}{14}$. Since $\frac{10}{14}$ is less than 1 whole, she thinks she doesn't have enough flour.

Explain why her thinking is incorrect. Include a model.



$\frac{30}{40} + \frac{28}{40} = \frac{58}{40}$

She added the denominators and didn't think about finding like units. She actually has more than 1 cup. 3/4 is equivalent to 30/40. 7/10 is equivalent to 28/40. Combined, that's $\frac{58}{40}$ which is greater than $\frac{40}{40}$ or 1 whole.

G5 U3 Lesson 5

Subtract fractions with unlike units using the strategy of creating equivalent fractions

G5 U3 Lesson 5 - Students will subtract fractions with unlike units using the strategy of creating equivalent fractions

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): We've spent the past few lessons thinking about adding fractions. What are some things we've learned about fraction addition? Possible Student Answers, Key Points:

- We need like units or common denominators when we add.
- We can use area models or number lines to help us add.
- Sometimes when we add, we get totals that are greater than 1. We can write some totals as mixed numbers.

Today, we're going to keep exploring operations with fractions, but our focus is going to shift to subtraction. As we work today, notice how a lot of the same ideas that help us add fractions also help us when we subtract fractions.

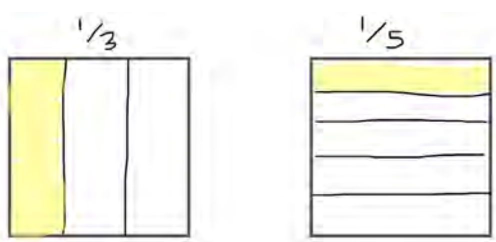
Let's Talk (Slide 3): Take a look at the equations here. What do you notice about them? Possible Student Answers, Key Points:

- I notice they all involve subtraction.
- I notice they're kind of like the equations we saw in an earlier lesson.
- I notice they all involve like units.

Each of these equations involves subtracting and each equation involves like units. 5 apples minus 2 apples would be…? (3 apples) 5 cows minus 2 cows would be…? (3 cows) 5 tens minus 2 tens would be…? (3 tens or 30) And 5 tenths minus 2 tenths would be…? (3 tenths or 0.3 or 3/10)

We've learned in previous lessons that when we add fractions, it's important to add like units. Today, we'll see that the same is true for subtraction. When we subtract fractions, it's important that we subtract like units.

Let's Think (Slide 4): Our first problem wants us to subtract ⅓ ⅕. Are these like units? (No, thirds and fifths are different sizes) Since we don't have like units, we'll want to rewrite ⅓ ⅕ using like units. Just like when we added fractions, let's begin by drawing an area model to represent each fraction.

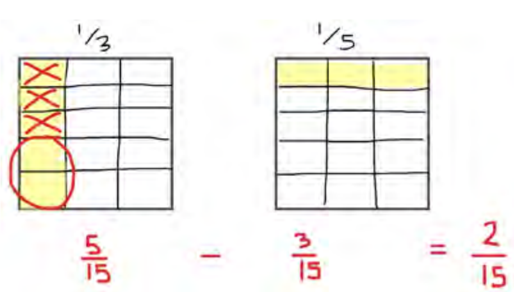


(draw two squares) Each square represents 1 whole. *(partition, shade, and label each area model as you narrate)* I'll show ⅓ by partitioning the first area model using 2 vertical cuts. I'll show ⅕ by partitioning the second area model using 4 horizontal cuts. As we know, thirds and fifths are not like units, and our area model makes that even more apparent.

What is a common denominator, or like unit, that we can use to help us subtract these fractions, and how do you know? Possible Student Answers, Key Points:

- I can cut thirds into 9, 12, or 15 pieces. I can cut fifths into 10, 15, or 20 pieces. Since they can both be cut into 15 pieces, we can use fifteenths.
- 15 is a common multiple of 3 and 5, so we can write equivalent fractions in terms of fifteenths.

Let's use fifteen as our unit. I'll make four horizontal cuts to partition ⅓ into fifteen pieces. I'll make two vertical cuts to partition ⅕ into fifteen pieces. What equivalent fractions did we make? (5/15 and 3/15) *(label the equivalent fractions under the corresponding area model)*



Our rewritten equation is 5/15 - 3/15 = ?. When we were adding, we knew to count or add up all the pieces. Now that we're subtracting, we'll want to take away pieces. Let's cross out 3/15 from our total amount. *(mark an X through three pieces on the first area model and circle the remaining 2 pieces)*

What is 5/15 minus 3/15? (2/15) *(write answer)*

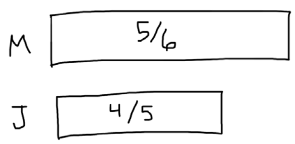
We just subtracted fractions with unlike units by creating equivalent fractions with like units. What did you notice was the same and different about subtracting fractions compared to adding fractions? Possible Student Answers, Key Points:

- It's the same in that we used area models to find like units. We needed to find a common denominator before we could perform the operation.
- It's only different in that we took away pieces at the end rather than combining them.

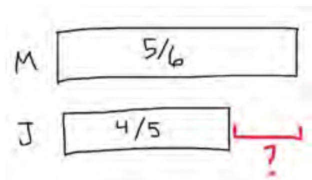
Let's try one more, just to make sure we feel confident.

Let's Think (Slide 5): This one is a story problem. *(read problem)* In your own words, could you retell what this story is about?
Possible Student Answers, Key Points:

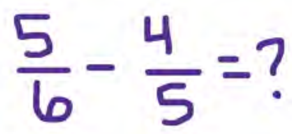
- Two people have candy, and I want to find out how much more one person has than the other.
- We're comparing Maria's amount of candy to Joshua's amount of candy.



Before we start with any computation, let's visualize the story with a quick tape diagram. I know we're comparing Maria's amount of candy to Joshua's. I'll draw two rectangles to represent those amounts, making sure that Maria's is a bit longer since she has more candy. *(draw two rectangles as stated, label with the person's initial and the amount of candy)*



We're being asked to find how much more, so we're trying to find the difference. I'll label the difference between the two amounts with a question mark, since that is what is unknown. *(draw a bracket and a question mark to represent the unknown difference)* When we're looking for a difference, we can subtract the two values.

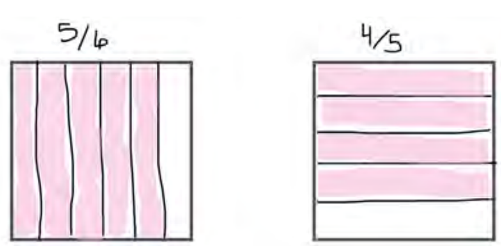


(write $\frac{5}{6}$ $\frac{4}{5}$ = ?) Can I subtract these right now? 5 - 4 = 1 and 6 - 5 = 1, so could my answer be 1/1?
Possible Student Answers, Key Points:

- No, we have to have like units to help us subtract. We need to rewrite these as equivalent fractions with a common denominator.
- No, if we got 1/1 that wouldn't make sense. 1/1 is 1, and neither student even had 1 lb of candy to start with. That's unreasonable.

Great thinking. Like the last problem, let's find equivalent fractions by using area models. How could I set up my area models for this problem? Possible Student Answers, Key Points:

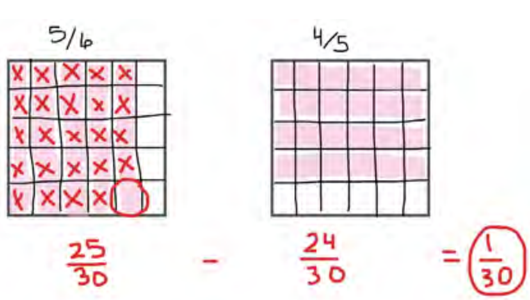
- For $\frac{5}{6}$, draw a square partitioned into 6 columns, then shade in 5 of the pieces.
- For $\frac{4}{5}$, draw a square partitioned into 5 rows, then shade 4 of the pieces.



(draw both area models as student describes them) $\frac{5}{6}$ looks like 5 pieces shaded out of 6 equal pieces. $\frac{4}{5}$ looks like 4 pieces shaded out of 5 equal pieces. We made one area model vertically and the other horizontally, since we know we'll have to partition them to make like units.

If one fraction is cut into sixths and the other is cut into fifths, I know that thirtieths can work for this problem. I can cut 6ths and 5ths into 30 equal pieces. Before we do that, I once had a student tell me that they wanted to cut each area model into 60 equal pieces, since 6 and 5 both have 60 as a multiple. This isn't wrong, but can you think of why thirtieths might be a better choice? Possible Student Answers, Key Points:

- We're already cutting into a lot of pieces. I'd rather cut into 30 pieces than 60, just to save time.
- Sixty pieces would mean they're really small. It would be hard to see and count those pieces.



Let's cut into 30 pieces. *(partition as you narrate)* I will cut across the first area model to make 5 rows of 6, making 30 pieces. I'll cut down the second area model to make 6 columns of 5, making 30 pieces. Now, we have equivalent fractions with like units. What is our new equation we can write, and what is the answer? *(write as student shares)* Possible Student Answers, Key Points:

- Our new equation is 25/30 - 24/30.
- 25 minus 24, means the numerator is 1. The answer is 1/30.

Our answer is 1/30. Maria has 1/30 pound more candy than Joshua. We can see that in the model and in the equation. *(cross 24 pieces from the first area model)* 25 thirtieths take away 24 thirtieths leaves us with 1 thirtieth.

Thanks for the help with these problems. You did a great job applying what we know about fraction equivalence and fraction addition to help us think about subtracting fractions with unlike units.

Let's Try it (Slides 6 - 7):   Now let's work on subtracting fractions with unlike units together. Just like when we added fractions in previous lessons, we will want to make sure our fractions have like units before subtracting. We can use area models to help us find equivalent fractions before rewriting our subtraction problems. Let's give it a try!

WARM WELCOME

Today we will subtract fractions with unlike units using the strategy of creating equivalent fractions.

Let's Talk:

5 apples - 2 apples = ?

5 cows - 2 cows = ?

5 tens - 2 tens = ?

5 tenths - 2 tenths = ?

Let's Think:

Use an area model to find the difference.

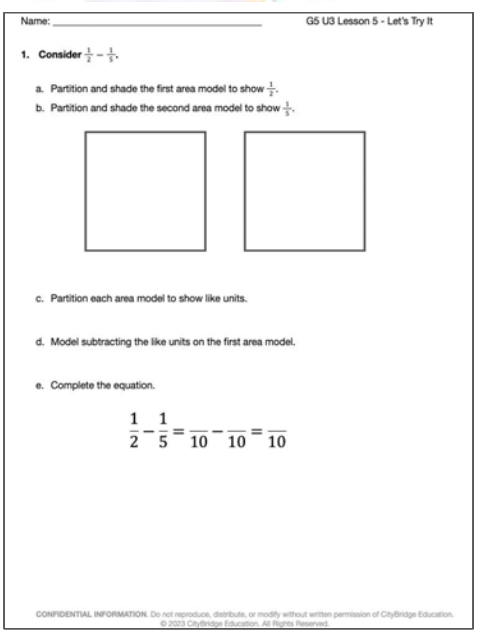
$$\frac{1}{3} - \frac{1}{5}$$

Let's Think:

Maria has $\frac{5}{6}$ pound of candy. Joshua has $\frac{4}{5}$ pound of candy. How much more candy does Maria have than Joshua?

Let's Try It:

Let's explore subtracting fractions with unlike units using the strategy of creating equivalent fractions together.



Name: ______________________ G5 U3 Lesson 5 - Let's Try It

1. Consider $\frac{1}{2} - \frac{1}{5}$.

a. Partition and shade the first area model to show $\frac{1}{2}$.

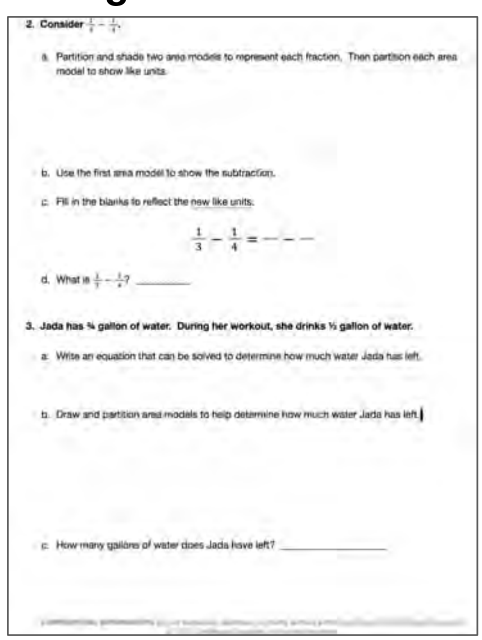
b. Partition and shade the second area model to show $\frac{1}{5}$.

c. Partition each area model to show like units.

d. Model subtracting the like units on the first area model.

e. Complete the equation.

$$\frac{1}{2} - \frac{1}{5} = \frac{\ }{10} - \frac{\ }{10} = \frac{\ }{10}$$



2. Consider $\frac{1}{3} - \frac{1}{4}$.

a. Partition and shade two area models to represent each fraction. Then partition each area model to show like units.

b. Use the first area model to show the subtraction.

c. Fill in the blanks to reflect the new like units.

$$\frac{1}{3} - \frac{1}{4} = \_\_ - \_\_$$

d. What is $\frac{1}{3} - \frac{1}{4}$? ________

3. Jada has ¾ gallon of water. During her workout, she drinks ½ gallon of water.

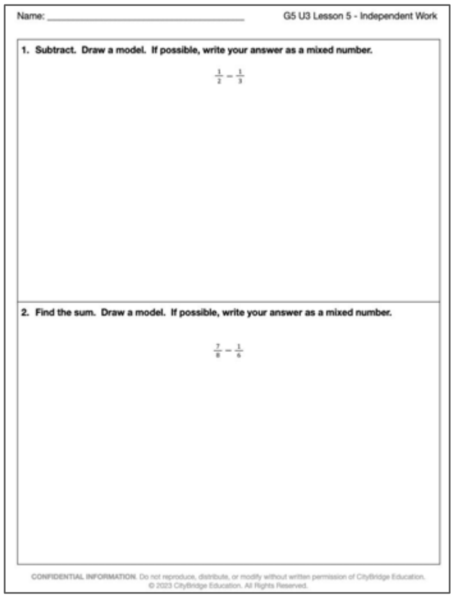
a. Write an equation that can be solved to determine how much water Jada has left.

b. Draw and partition area models to help determine how much water Jada has left.

c. How many gallons of water does Jada have left? ______________

On your Own:

Now it's time to explore subtracting fractions with unlike units using the strategy of creating equivalent fractions on your own.



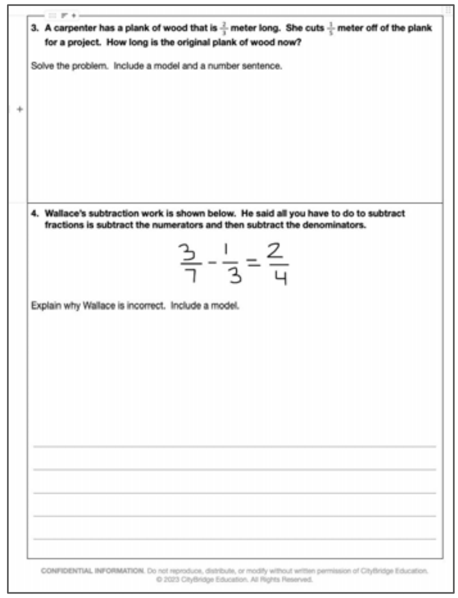
Name: ____________________ G5 U3 Lesson 5 - Independent Work

1. Subtract. Draw a model. If possible, write your answer as a mixed number.

$\frac{1}{2} - \frac{1}{3}$

2. Find the sum. Draw a model. If possible, write your answer as a mixed number.

$\frac{7}{8} - \frac{1}{6}$



3. A carpenter has a plank of wood that is $\frac{2}{3}$ meter long. She cuts $\frac{1}{5}$ meter off of the plank for a project. How long is the original plank of wood now?

Solve the problem. Include a model and a number sentence.

4. Wallace's subtraction work is shown below. He said all you have to do to subtract fractions is subtract the numerators and then subtract the denominators.

$\frac{3}{7} - \frac{1}{3} = \frac{2}{4}$

Explain why Wallace is incorrect. Include a model.

1. Consider $\frac{1}{2} - \frac{1}{5}$.

   a. Partition and shade the first area model to show $\frac{1}{2}$.

   b. Partition and shade the second area model to show $\frac{1}{5}$.

   c. Partition each area model to show like units.

   d. Model subtracting the like units on the first area model.

   e. Complete the equation.

$$\frac{1}{2} - \frac{1}{5} = \frac{\quad}{10} - \frac{\quad}{10} = \frac{\quad}{10}$$

2. Consider $\frac{1}{3} - \frac{1}{4}$.

   a. Partition and shade two area models to represent each fraction. Then partition each area model to show like units.

b. Use the first area model to show the subtraction.

c. Fill in the blanks to reflect the new like units.

$$\frac{1}{3} - \frac{1}{4} = \frac{\blacksquare}{\blacksquare} - \frac{\blacksquare}{\blacksquare}$$

d. What is $\frac{1}{3} - \frac{1}{4}$? ____________

3. Jada has ¾ gallon of water. During her workout, she drinks ⅛ gallon of water.

a. Write an equation that can be solved to determine how much water Jada has left.

b. Draw and partition area models to help determine how much water Jada has left.

c. How many gallons of water does Jada have left? _______________________

1. Subtract. Draw a model. If possible, write your answer as a mixed number.

$$\frac{1}{2} - \frac{1}{3}$$

2. Find the difference. Draw a model. If possible, write your answer as a mixed number.

$$\frac{7}{8} - \frac{1}{6}$$

3. A carpenter has a plank of wood that is $\frac{2}{3}$ meter long. She cuts $\frac{1}{5}$ meter off of the plank for a project. How long is the original plank of wood now?

Solve the problem. Include a model and a number sentence.

4. Wallace's subtraction work is shown below. He said all you have to do to subtract fractions is subtract the numerators and then subtract the denominators.

$$\frac{3}{7} - \frac{1}{3} = \frac{2}{4}$$

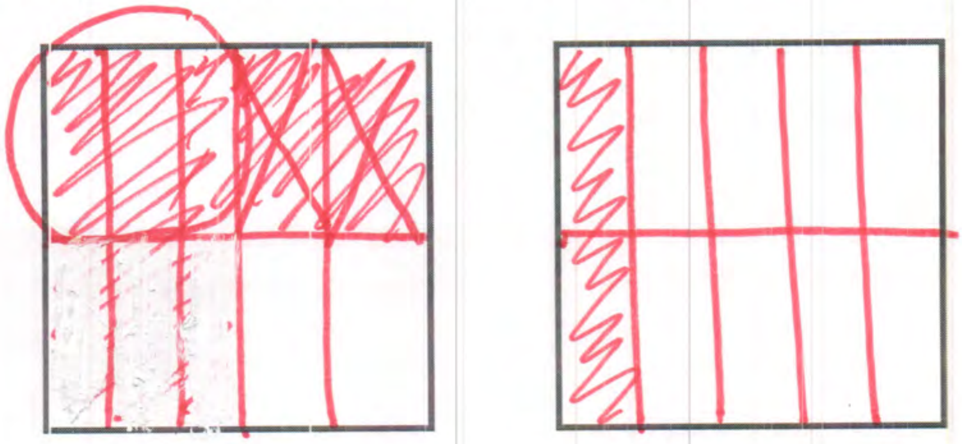
Explain why Wallace is incorrect. Include a model.

Name: KEY

1. Consider $\frac{1}{2} - \frac{1}{5}$.

a. Partition and shade the first area model to show $\frac{1}{2}$.

b. Partition and shade the second area model to show $\frac{1}{5}$.



c. Partition each area model to show like units.

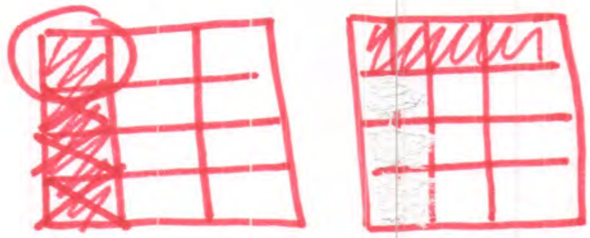
d. Model subtracting the like units on the first area model.

e. Complete the equation.

$$\frac{1}{2} - \frac{1}{5} = \frac{5}{10} - \frac{2}{10} = \frac{3}{10}$$

2. Consider $\frac{1}{3} - \frac{1}{4}$.

a. Partition and shade two area models to represent each fraction. Then partition each area model to show like units.



b. Use the first area model to show the subtraction.

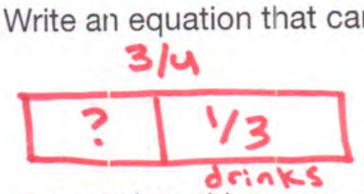
c. Fill in the blanks to reflect the new like units.

$$\frac{1}{3} - \frac{1}{4} = \frac{4}{12} - \frac{3}{12}$$

d. What is $\frac{1}{3} - \frac{1}{4}$? $\frac{1}{12}$

3. Jada has ¾ gallon of water. During her workout, she drinks ⅓ gallon of water.

a. Write an equation that can be solved to determine how much water Jada has left.



$\frac{3}{4} - \frac{1}{3} = ?$

b. Draw and partition area models to help determine how much water Jada has left.

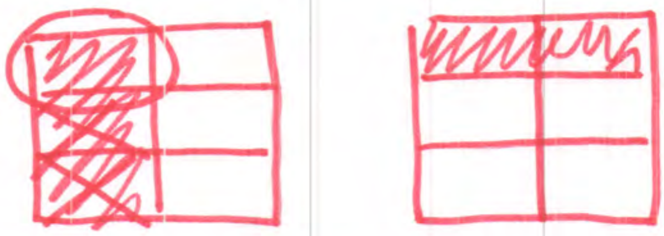
$\frac{9}{12} - \frac{4}{12} = \frac{5}{12}$

c. How many gallons of water does Jada have left? 5/12 gallon

Name: KEY

1. Subtract. Draw a model. If possible, write your answer as a mixed number.

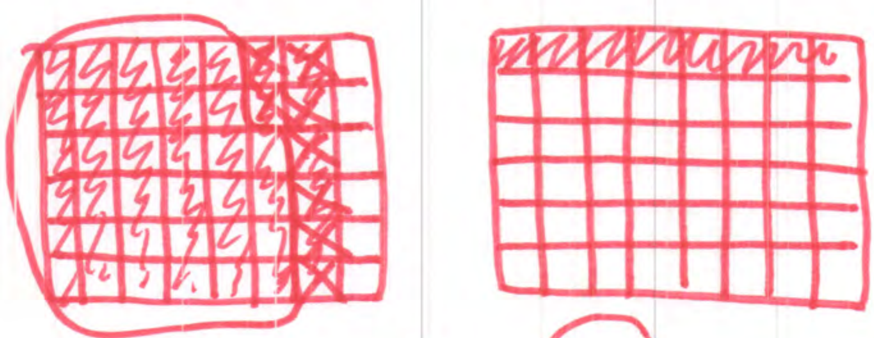
$$\frac{1}{2} - \frac{1}{3}$$



$$\frac{3}{6} - \frac{2}{6} = \frac{1}{6}$$

2. Find the ~~sum~~ difference. Draw a model. If possible, write your answer as a mixed number.

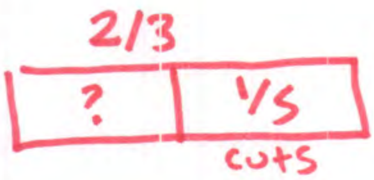
$$\frac{7}{8} - \frac{1}{6}$$

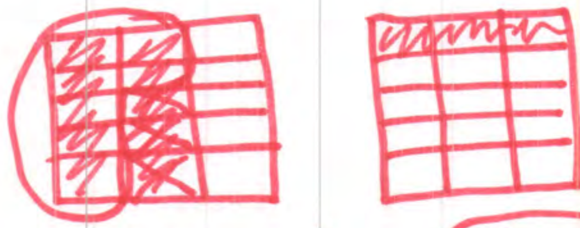


$$\frac{42}{48} - \frac{8}{48} = \frac{34}{48}$$

3. **A carpenter has a plank of wood that is $\frac{2}{3}$ meter long. She cuts $\frac{1}{5}$ meter off of the plank for a project. How long is the original plank of wood now?**

Solve the problem. Include a model and a number sentence.



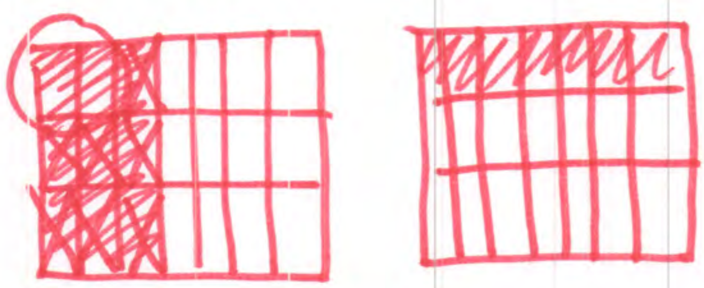


$\frac{10}{15} - \frac{3}{15} = \frac{7}{15}$ m

4. **Wallace's subtraction work is shown below. He said all you have to do to subtract fractions is subtract the numerators and then subtract the denominators.**

$$\frac{3}{7} - \frac{1}{3} = \frac{2}{4}$$

Explain why Wallace is incorrect. Include a model.



$\frac{9}{21} - \frac{7}{21} = \frac{2}{21}$

Wallace is incorrect, because you need like units to subtract. 3/7 is equivalent to 9/21. 1/3 is equivalent to 7/21. 9/21 minus 7/21 is 2/21.

G5 U3 Lesson 6

Subtract fractions from numbers between 1 and 2

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G5 U3 Lesson 6 - Students will subtract fractions with numbers between 1 and 2

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): In our last lesson we subtracted fractions with unlike units by making equivalent fractions. We drew an area model to represent each fraction, partitioned to show equivalent fractions with the same units, and then subtracted. Today we'll do similar work, only we'll be subtracting from totals greater than 1 whole in some cases.

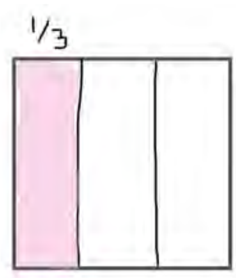
Let's Talk (Slide 3): Take a look at how this student subtracted ¼ from ½. Their work is correct, but it doesn't look identical to the work we did during our last lesson. What do you notice and what do you wonder about this student't work? Possible Student Answers, Key Points:

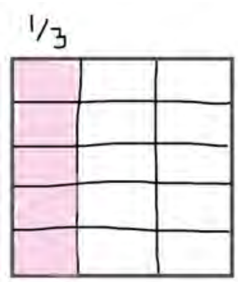
- I notice they rewrote their fractions as having like units of eighths. I notice they drew a model and partitioned it into eighths. I notice they crossed off parts of their model.
- I wonder why they only shaded ½. I wonder why they only used one area model, because we've previously drawn two area models for each problem.

You likely noticed that this student only modeled ½. They then partitioned it into eighths. Then, since they figured out that ¼ is equivalent to 2/8, they just took away the 2/8 rather than draw a whole other area model. As we work with our problems today that involve numbers greater than 1 whole, we'll try using this slightly different approach to modeling subtraction.

Our previous method works fine and could work for any problem we do today, but this method of only drawing one area model can save time and is generally more efficient.

Let's Think (Slide 4): Our first problem wants us to subtract ⅕ from ⅓ using only one area model. Do these fractions have like units? (No, one has thirds and one has fifths) We will need to find like units before subtracting.

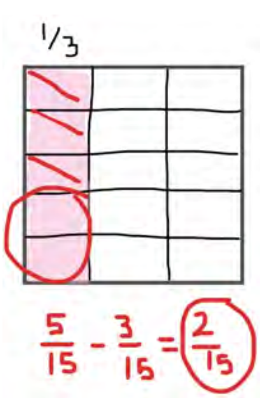




Let's start by drawing an area model to show ⅓ *(sketch, shade, and label area model as you narrate)* I'll draw a square to represent 1 whole, then partition it into three pieces and shade 1 of the pieces. What common unit can we partition thirds and fifths into? (fifteenths) I can partition thirds into fifteenths, and I can partition fifths into fifteenths. Fifteen is a multiple of 3 and 5. Let's partition ⅓ with four horizontal lines, so we can see 3 columns of 5. 15 pieces in all. *(partition the area model by making 4 horizontal cuts)*

Now, I can think of ⅓ as being equivalent to 5/15. If I want to subtract ⅕ from the total, I'll need to think of ⅕ in terms of fifteenths. What is ⅕ in terms of fifteenths, and how do you know? Possible Student Answers, Key Points:

- If I cut ⅕ into fifteenths, I would have 3/15.
- 5 total pieces x 3 = 15 total pieces. 1 shaded piece x 3 = 3 shaded pieces. ⅕ is equivalent to 3/15.

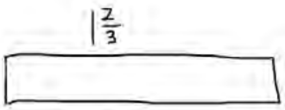


If ⅕ is equivalent to 3/15, I can think of the original problem as being 5/15 3/15. *(write 5/15 - 3/15 = underneath the area model)* 5 fifteenths take away 3 fifteenths would leave us with 2 fifteenths. *(cross out 3 pieces in the area model, circle the remaining 2 pieces, and write 2/15 as the solution to the equation)*

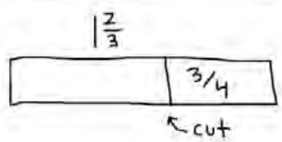
We just used one area model, instead of two, to subtract fractions with unlike units. Now let's try another example. This time we'll see a number that is between 1 and 2. You'll notice, our strategies and models will remain consistent.

Let's Think (Slide 5): Our next example is a story problem. Let's read it. *(read the problem)* Read the problem one more time to yourself, then retell it in your own words. Possible Student Answers, Key Points:

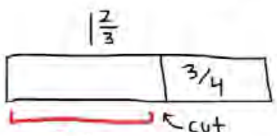
- Christian has some string. He cuts some off, and we're trying to figure out what's left over.
- A kid is doing an art project and he needs to figure out how much string he has left.



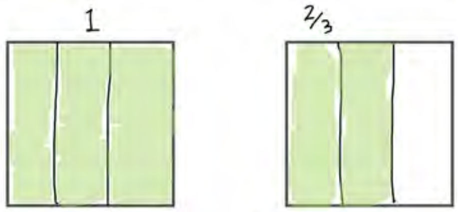
We can picture this with a tape diagram to help us make sense of the story. We know he has 1 ⅔ string to start with. I'll draw and label a rectangle to represent that entire amount of string. *(draw long rectangle and label 1 ⅔ on top)*



I know he's cutting a piece off, so I'll partition my rectangle to show what he's cutting off. *(partition a portion of the rectangle and label with ¾)*



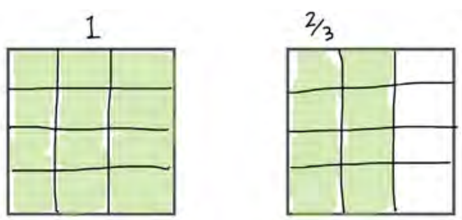
What is unknown? (the leftover piece) I'll label his leftover piece of string with a question mark, since that's what we're trying to find out. Since we know the total and one part, what can we do to find the other part? (subtract the total minus the part we know) We can use subtraction to find the missing part.



What fractional units are involved in this problem? (thirds and fourths) Thirds and fourths are not like units, so I know we'll need to do some work to find like units, or a common denominator. Let's start by drawing *one* tape diagram like we did in the last example. Our tape diagram for 1 ⅔ will need more than 1 whole. So I'll draw 1 whole fully shaded in, and then another whole to partitioned into thirds to show the fractional part of the mixed number. *(draw area model showing 1 ⅔ as described)*

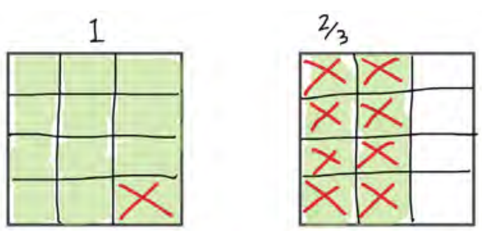
If we need to take away ¾, what like unit could we consider that could be made from thirds and fourths? Possible Student Answers, Key Points:

- 12 is a multiple of 3 and 4. We can use twelfths.
- I can partition thirds into 6, 9, or 12 pieces. I can partition fourths into 8, 12, or 16 pieces. Since 12 works with both units, let's use twelfths.



Let's partition each whole of our area model into twelve pieces by making 3 horizontal cuts. Each whole will have 4 rows of 3. *(partition each whole of the area model as described)* Now we see twelfths. We can see this as 1 8/12 or as 20/12.

I know if we're trying to subtract ¾, I will need to write an equivalent fraction in terms of twelfths. ¾ is equivalent to 9/12, because we'd be partitioning the shaded region and the entire whole into 3 times as many pieces. What's our new problem? (1 8/12 - 9/12, or 20/12 - 9/12)



$1\frac{8}{12} - \frac{9}{12} = \frac{11}{12}$

Let's take away 9 twelfths from our model. *(cross out 9 pieces starting with the second area model)* When I take away 9 twelfths, we see there are 11 twelfths left over. *(write 11/12)*

Returning to the original story, Christian has 11/12 meter of string left over. Nice work!

We just subtracted with a fraction between 1 and 2, since we started with 1 ⅔ in this problem. What was the same or different about subtracting with a number between 1 and 2 compared to subtracting with all fractions less than 1 whole? Possible Student Answers, Key Points:

- There really wasn't anything different. We just had to keep track of a bigger amount, which could mean more pieces.
- Since our area model was more than 1 whole, we needed to build a bigger area model. We still found a like unit and rewrote our problem.

Subtracting with larger fractions involves the same thinking and follows the same rules as subtracting with smaller values.

Let's Try it (Slides 6 - 7): Now let's work on subtracting fractions with numbers between 1 and 2. The strategies we use to subtract from numbers greater than 1 are no different than the strategies we use to subtract from fractions less than 1. As we work on the following problems, we'll try to be efficient and use one area model to represent the total, and then take what we need to subtract from that area model rather than draw two separate area models. Are you ready?

WARM WELCOME

Today we will subtract fractions with numbers between 1 and 2.

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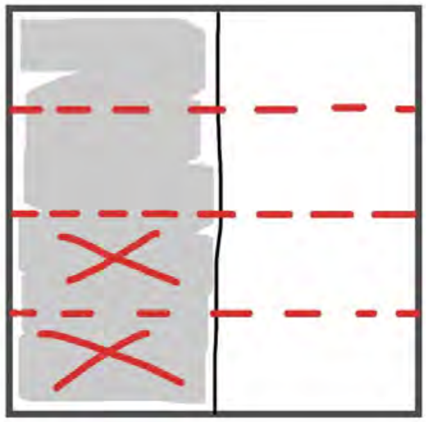
Let's Talk:

This doesn't look like how we've been subtracting…

$$\frac{1}{2} - \frac{1}{4} = ?$$

$$\frac{4}{8} - \frac{2}{8} = \frac{2}{8}$$



Let's Think:

Use <u>one</u> area model to find the difference.

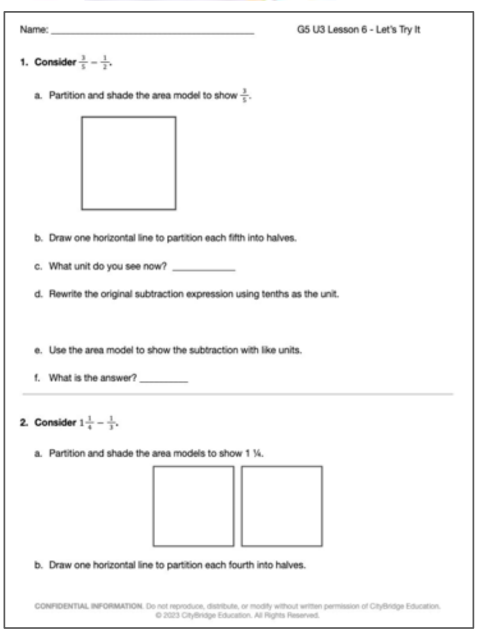
$$\frac{1}{3} - \frac{1}{5}$$

Let's Think:

Christian has a piece of yarn that is 1 ⅔ meters long. He needs to cut off ¾ meter for an art project. How much yarn does Christian have left?

Let's Try It:

Let's explore subtracting fractions with numbers between 1 and 2 together.


Name: ______________________ G5 U3 Lesson 6 - Let's Try It

1. **Consider $\frac{3}{5} - \frac{1}{2}$.**
   a. Partition and shade the area model to show $\frac{3}{5}$.
   b. Draw one horizontal line to partition each fifth into halves.
   c. What unit do you see now? __________
   d. Rewrite the original subtraction expression using tenths as the unit.
   e. Use the area model to show the subtraction with like units.
   f. What is the answer? ________

2. **Consider $1\frac{1}{4} - \frac{1}{3}$.**
   a. Partition and shade the area models to show 1 ¼.
   b. Draw one horizontal line to partition each fourth into halves.

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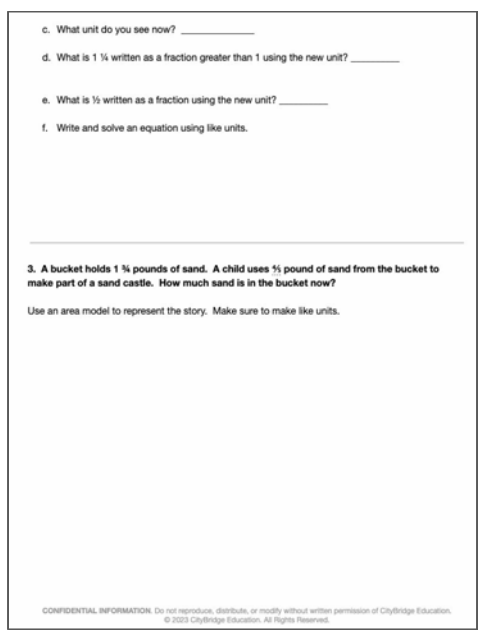
   c. What unit do you see now? __________
   d. What is 1 ¼ written as a fraction greater than 1 using the new unit? ________
   e. What is ½ written as a fraction using the new unit? ________
   f. Write and solve an equation using like units.

3. **A bucket holds 1 ¾ pounds of sand. A child uses ⅘ pound of sand from the bucket to make part of a sand castle. How much sand is in the bucket now?**

Use an area model to represent the story. Make sure to make like units.

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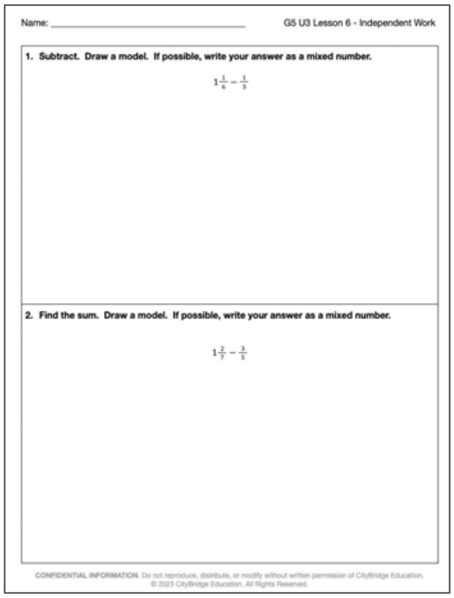
On your Own:

Now it's time to explore subtracting fractions with numbers between 1 and 2 on your own.



Name: ______________________ G5 U3 Lesson 6 - Independent Work

1. Subtract. Draw a model. If possible, write your answer as a mixed number.

$1\frac{1}{6} - \frac{1}{3}$

2. Find the sum. Draw a model. If possible, write your answer as a mixed number.

$1\frac{2}{7} - \frac{3}{5}$

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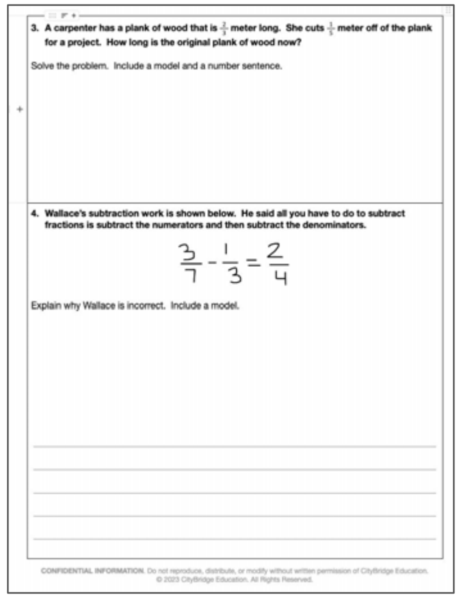

3. A carpenter has a plank of wood that is $\frac{2}{3}$ meter long. She cuts $\frac{1}{5}$ meter off of the plank for a project. How long is the original plank of wood now?

Solve the problem. Include a model and a number sentence.

4. Wallace's subtraction work is shown below. He said all you have to do to subtract fractions is subtract the numerators and then subtract the denominators.

$\frac{3}{7} - \frac{1}{3} = \frac{2}{4}$

Explain why Wallace is incorrect. Include a model.

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1. Consider $\frac{3}{5} - \frac{1}{2}$.

   a. Partition and shade the area model to show $\frac{3}{5}$.

   b. Draw one horizontal line to partition each fifth in half.

   c. What unit do you see now? ______________

   d. Rewrite the original subtraction expression using tenths as the unit.

   e. Use the area model to show the subtraction with like units.

   f. What is the answer? ___________

---

2. Consider $1\frac{1}{4} - \frac{1}{3}$.

   a. Partition and shade the area models to show 1 ¼.

   b. Draw two horizontal lines to partition each fourth into three pieces.

   c. What unit do you see now? ________________

   d. What is 1 ¼ written as a fraction greater than 1 using the new unit? ___________

e. What is ½ written as a fraction using the new unit? ___________

f. Write and solve an equation using like units.

---

3. A bucket holds 1 ¾ pounds of sand. A child uses ⅘ pound of sand from the bucket to make part of a sand castle. How much sand is in the bucket now?

Use an area model to represent the story. Make sure to make like units.

1. Subtract. Draw a model. If possible, write your answer as a mixed number.

$$1\frac{1}{6} - \frac{1}{3}$$

2. Find the difference. Draw a model. If possible, write your answer as a mixed number.

$$1\frac{2}{7} - \frac{3}{5}$$

3. A turtle traveled $1\frac{1}{4}$ yard in an hour. A caterpillar traveled $\frac{5}{6}$ yard in an hour. How much farther did the turtle travel than the caterpillar?

Solve the problem. Include a model and a number sentence.

4. Look at the work shown below. Identify and correct the mistake using words and models.

$$1\frac{1}{3} - \frac{5}{6}$$

$$1\frac{5}{6} - \frac{1}{3}$$

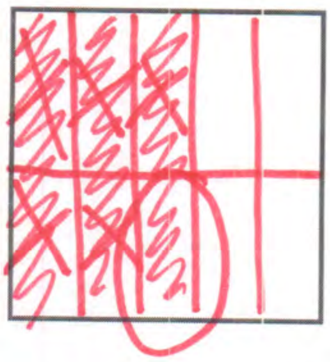
$$1\frac{5}{6} - \frac{2}{6}$$

$$1\frac{3}{6}$$

Name: KEY

1. Consider $\frac{3}{5} - \frac{1}{2}$.

a. Partition and shade the area model to show $\frac{3}{5}$.



b. Draw one horizontal line to partition each fifth in~~to halves~~ half.

c. What unit do you see now? tenths

d. Rewrite the original subtraction expression using tenths as the unit.

$$\frac{6}{10} - \frac{5}{10} = ?$$

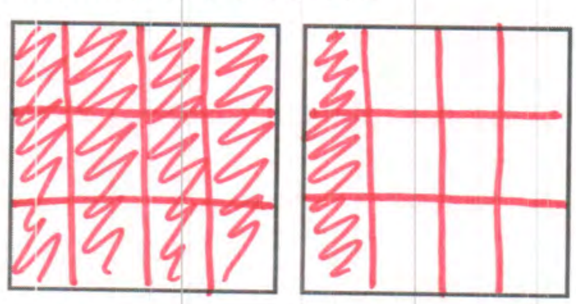
e. Use the area model to show the subtraction with like units.

f. What is the answer? 1/10

---

2. Consider $1\frac{1}{4} - \frac{1}{3}$.

a. Partition and shade the area models to show 1 ¼.



b. Draw ~~one~~ two horizontal lines to partition each fourth into ~~halves.~~ three pieces.

c. What unit do you see now? twelfths

d. What is 1 ¼ written as a fraction greater than 1 using the new unit? $1\frac{3}{12} = \frac{15}{12}$

e. What is ½ written as a fraction using the new unit? 6/12

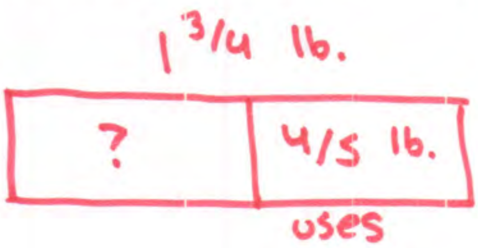
f. Write and solve an equation using like units.

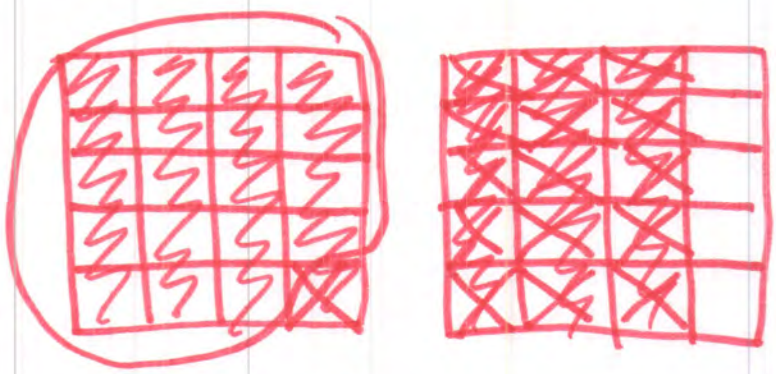
$$\frac{15}{12} - \frac{6}{12} = \frac{9}{12}$$

---

3. A bucket holds 1 ¾ pounds of sand. A child uses ⅘ pound of sand from the bucket to make part of a sand castle. How much sand is in the bucket now?

Use an area model to represent the story. Make sure to make like units.





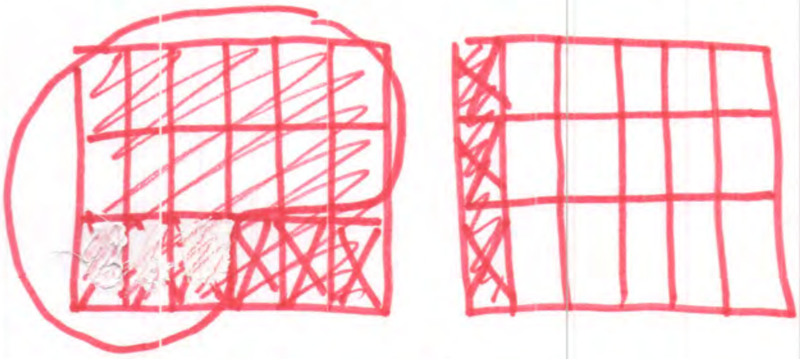
$$1\frac{15}{20} - \frac{16}{20}$$

$$\frac{35}{20} - \frac{16}{20} = \frac{19}{20} \text{ lb.}$$

Name: KEY

1. Subtract. Draw a model. If possible, write your answer as a mixed number.

$$1\frac{1}{6} - \frac{1}{3}$$

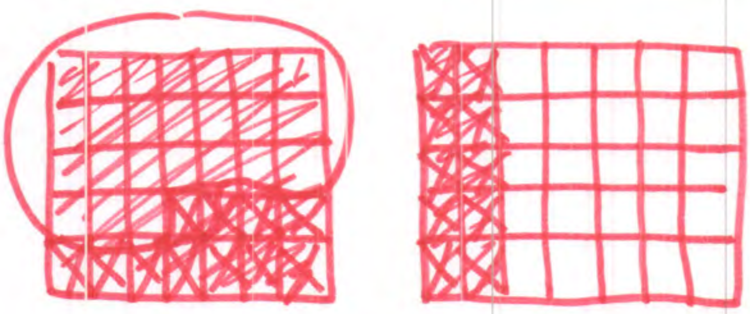


$1\frac{3}{18} - \frac{6}{18}$

$\frac{21}{18} - \frac{6}{18} = \frac{15}{18}$

2. Find the ~~sum~~ difference. Draw a model. If possible, write your answer as a mixed number.

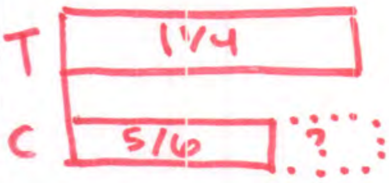
$$1\frac{2}{7} - \frac{3}{5}$$

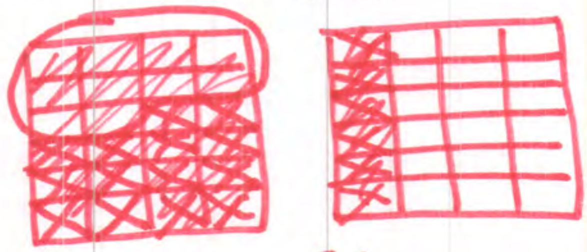


$1\frac{10}{35} - \frac{21}{35} \longrightarrow \frac{45}{35} - \frac{21}{35} = \frac{24}{35}$

3. **A turtle traveled $1\frac{1}{4}$ yard in an hour. A caterpillar traveled $\frac{5}{6}$ yard in an hour. How much farther did the turtle travel than the caterpillar?**

Solve the problem. Include a model and a number sentence.





$1\frac{6}{24} - \frac{20}{24}$

$\frac{30}{24} - \frac{20}{24} = \frac{10}{24}$ yd.

4. **Look at the work shown below. Identify and correct the mistake using words and models.**

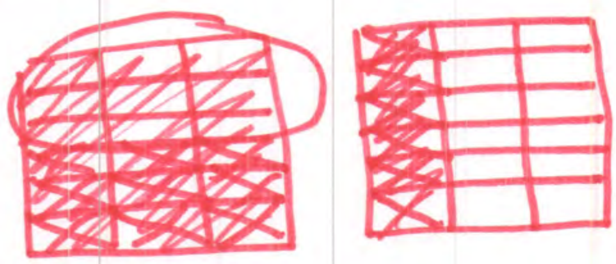
$1\frac{1}{3} - \frac{5}{6}$

$1\frac{5}{6} - \frac{1}{3}$

$1\frac{5}{6} - \frac{2}{6}$

$1\frac{3}{6}$

You can't just switch the fractions when we subtract.



$1\frac{6}{18} - \frac{15}{18}$

$\frac{24}{18} - \frac{15}{18} = \frac{9}{18}$

G5 U3 Lesson 7

Add fractions to and subtract fractions from whole numbers using equivalence and the number line as strategies

CITYTUTOR DC

G5 U3 Lesson 7 - Students will add fractions to and subtract fractions from whole numbers using equivalence and the number line as strategies

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): We've been working a lot around adding and subtracting fractions. We've worked with fractions with like units, we've worked with fractions with unlike units, and we've even worked with some fractions greater than 1 and some mixed numbers. Today, we'll continue the work we've been doing by focusing on efficient strategies to add and subtract from whole numbers. As a reminder, a whole number is just a number that does not include a fraction or a decimal. For example, 1, 5 and 42 are all whole numbers.

Let's Talk (Slide 3): Take a look at the two equations here. Take a second to notice and wonder about the equations, then share out what you're thinking.

Possible Student Answers, Key Points:

- I notice the equations seem color-coded. I notice some whole numbers, some fractions, and some mixed numbers. I notice the top equation involves addition, and the bottom equation involves subtraction. I notice the mixed numbers are decomposed into a whole number and a fraction.
- I wonder why the numbers are color-coded. I wonder why they person decomposed the mixed numbers. I wonder if writing equations like this can help us add and subtract with fractions.

$$2 + 1\frac{1}{2} = 2 + 1 + \frac{1}{2}$$

$$5 - 2\frac{3}{7} = 5 - 2 - \frac{3}{7}$$

This work shows adding to a whole number and subtracting from a whole number. The person broke apart their mixed numbers to help them add and subtract.

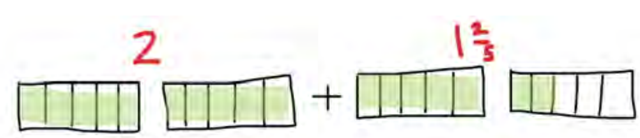
(circle the mixed number in each equation and draw an arrow to each decomposed part as you narrate) In the first equation, they were adding 2 and 1 ½. They decomposed the 1 ½ into 1 and ½. In the second equation, they were subtracting 5 minus 2 3/7. They decomposed the 2 3/7 into 2 and 3/7. We'll explore this strategy more in a moment. Why do you think this might help us add and subtract? Possible Student Answers, Key Points:

- Maybe breaking the mixed number up helps us add or subtract in easier parts.
- Breaking the mixed number up might help us so we can focus on the whole numbers first, and then handle the fractions after.

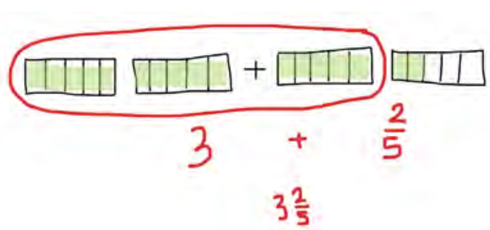
Let's keep this person's strategy in mind as we explore problems of our own.

Let's Think (Slide 4): This first problem wants us to find the sum of 2 and 1 ⅖. We'll solve this problem using a bar model, a number line, and an equation.

Let's start with a bar model. I'll start by drawing the first addend of 2 by drawing two rectangles. There isn't a fractional unit involved with this addend, but I know the other addend has fifths, so I'll partition each of the two wholes into fifths. *(draw and shade two rectangles partitioned into fifths)* Our other addend is 1 ⅖. How can I model 1 ⅖ using a bar model? (draw 1 rectangle for the whole and another showing 2 out of five pieces shaded) We can add *(write +)* another whole and 2 fifths to the model. I'll draw two rectangles partitioned into fifths. I'll shade one whole rectangle to represent the 1, and I'll shade 2 fifths of the other. *(draw as stated)* Now we see a model that shows 2 wholes plus 1 ⅖.



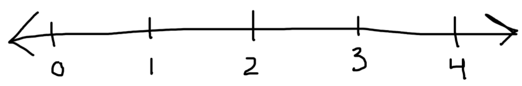
When adding these, I can first think about the whole numbers. *(Draw a circle to group the two wholes and the 1 whole)* 2 wholes plus 1 whole is 3 wholes. *(write 3 underneath the circled wholes)* Then, all I have left to add is the extra ⅖. 3 + ⅖ is 3 ⅖. *(write answer)*



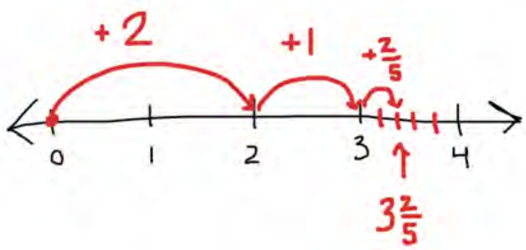
How did grouping the whole numbers in our bar model help us add? Possible Student Answers, Key Points:

- Adding whole numbers is easy. We can quickly group the whole numbers, then add the fraction part last.
- We decomposed the mixed number so we could group the whole numbers together. Adding whole numbers is quick, so we could efficiently find the entire total in two steps.

We already know the sum is 3 ⅖, but let's think of another way we can show similar thinking. We'll do the same problem on a number line.



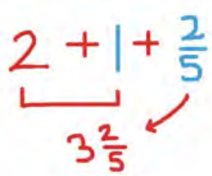
I'll start by sketching out a number line. *(draw a number line from 0 to 4 with labeled whole numbers)*



Since we're adding 2 + 1 ⅖, I'll make one hop to 2. (model and label hopping on the number line as narrated) Hopping 1 ⅖ all at once might be hard to visualize. Instead, I'll decompose 1 ⅖ and think of it as 1 and ⅖. I'll hop 1 whole. Where am I at now, and how much more do I need to hop? (You're at 3, and you need to hop ⅖ more) All that is left is to hop ⅖. I'll partition the next whole into fifths, so I can hop two units that are fifths. We ended up ⅖ after the 3 on the number line. Our sum is 3 ⅖.

How do we see decomposing the mixed number in our number line model of the sum? Possible Student Answers, Key Points:

- Instead of jumping 1 ⅖ all at once, we hopped 1 space and then ⅖ more.
- We hopped in steps so that we could add our whole numbers first, before adding the fractional unit.



Let's think about what we did numerically. Instead of thinking of 2 + 1 ⅖, we decomposed the mixed number to add in pieces. *(write 2 + 1 + ⅖, and bracket the parts as you narrate combining the whole numbers)* This made it easy to add the whole numbers. Once we had a whole number of 3, we added on the fractional unit to get a sum of 3 ⅖.

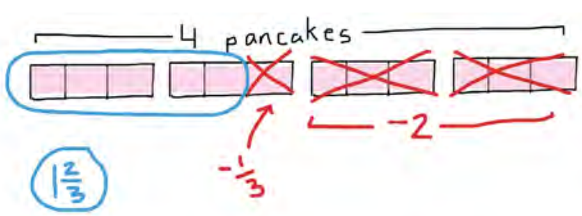
We just added a mixed number to a whole number using a visual model, a number line, and an equation. Let's try another example that is a little different.

Let's Think (Slide 5): This next example is a story problem. I'll read it, then I want you to re-read it to yourself. *(read problem aloud)* Once you've re-read the story, retell it in your own words. Possible Student Answers, Key Points:

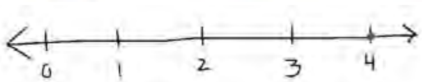
- She has 4 pancakes, and then she eats some. We want to know how many she has left.
- We know the total number of pancakes and a part that she ate. We're trying to find the other part that she did not eat.

Let's solve this problem using a bar model first. I know she has 4 pancakes. *(draw and shade four rectangles, each partitioned into thirds)*

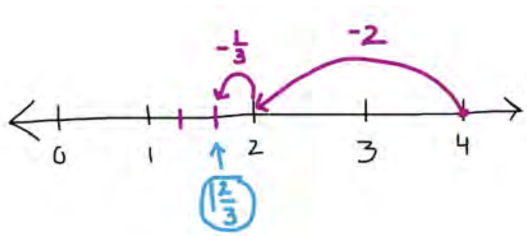
Why do you think I split each rectangle into three pieces, or thirds? (We need to take away 2 ⅓ so you were thinking ahead to the units you would need) I know I have to take away 2 ⅓ so splitting each whole into thirds will make my work easier in the long run.



Since she is eating the pancakes, and we want to know what is left over, I'm not adding in this problem. I'll need to take away 2 ⅓ pancakes. Let's take away 2 ⅓ in parts; we'll take away 2 wholes and then 1 third. *(cross off and label 2 wholes, then cross off and label ⅓)* How many pancakes do you see are left based on the model? (1 whole pancake and 2 pieces, so 1 ⅔ pancakes) Nicely done. *(write answer)*



Let's consider how the same problem might look on a number line. We know Angela has 4 pancakes to start, so I can sketch a number line to show that. *(draw a number line from 0 to 4 and place a point on 4)*



Rather than hop 2 ⅓ back all at once, because that might be tricky to visualize, we can subtract in parts. Let's subtract 2 and then subtract ⅓. *(draw and label a hop from 4 to 2)* I subtracted 2, and now I'm at 2 on the number line. I have to subtract ⅓ more, so I'll partition the whole between 1 and 2 into thirds. Then I can hop back ⅓. *(partition thirds by making 2 tick marks between 1 and 2, then label a hop back from 2 to 1 ⅔)* Where did we end up? (1 ⅔) We got the same answer as when we modeled with a bar model.

How is the work we did in the bar model the similar to and different from the work we did on the number line? Possible Student Answers, Key Points:

- One uses partitioned rectangles, whereas the other one uses a number line.
- They both show how we subtracted in parts. We first subtracted the whole number, and then subtracted the fractional piece.

$$4 - 2\frac{1}{3}$$

$$\underbrace{4 - 2} - \frac{1}{3} = ?$$

$$2 - \frac{1}{3} = 1\frac{2}{3}$$

They both show 4 minus 2 ⅓ *(write that expression)*

Both models show that we decomposed the 2 ⅓ into 2 and ⅓ *(rewrite expression using a number bond to decompose 2 ⅓ into 2 and ⅓)* This made it easy for us to subtract the whole numbers first. *(draw a bracket showing 4 - 2 is equal to 2, then rewrite the remaining problem as 2 - ⅓ = 1 ⅔)* Once we subtracted the whole numbers, it was simpler to subtract the remaining fractional piece.

When adding to or subtracting from whole numbers, it can be helpful to decompose a mixed number into a whole number and a fractional part.

Let's Try it (Slides 6 - 7): Now let's work on adding to and subtracting from whole numbers together. We can model our thinking with bar model or area models, number lines, and/or equations. As we saw in the examples today, it can be helpful to decompose a mixed number into a whole number and a fraction to help us efficiently add or subtract in parts. Let's try some out!

WARM WELCOME

Today we will add fractions to and subtract fractions from whole numbers using equivalence and the number line as strategies.

Let's Talk:

What do you notice?
What do you wonder?

$$2 + 1\frac{1}{2} = 2 + 1 + \frac{1}{2}$$

$$5 - 2\frac{3}{7} = 5 - 2 - \frac{3}{7}$$

Let's Think:

Find the sum.

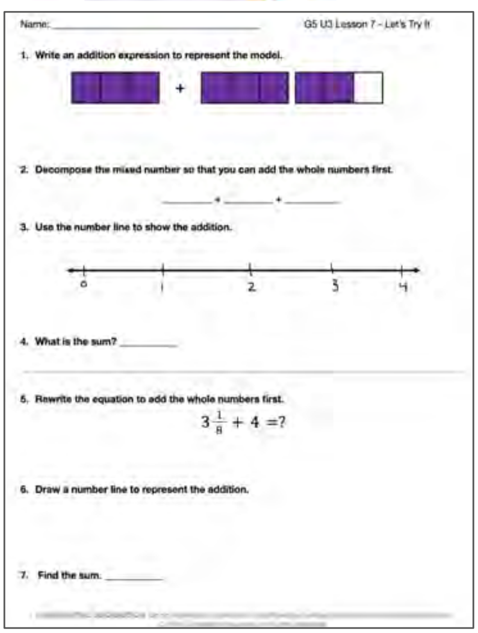
$$2 + 1\frac{2}{5}$$

Let's Think:

Angela has 4 pancakes. She eats 2 ⅓ of the pancakes. How many pancakes does Angela have now?

Let's Try It:

Let's explore adding fractions to and subtracting fractions from whole numbers using equivalence and the number line as strategies together.



Name: ______________________ G5 U3 Lesson 7 – Let's Try It

1. Write an addition expression to represent the model.

2. Decompose the mixed number so that you can add the whole numbers first.

   _______ + _______ + _______

3. Use the number line to show the addition.

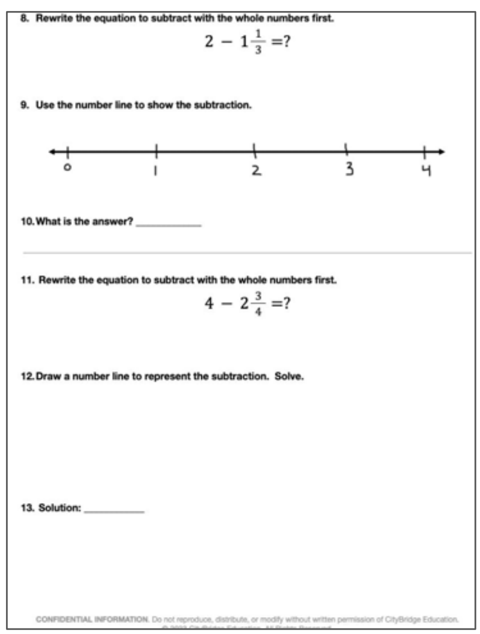
4. What is the sum? _______

5. Rewrite the equation to add the whole numbers first.

   $3\frac{1}{8} + 4 = ?$

6. Draw a number line to represent the addition.

7. Find the sum. _______



8. Rewrite the equation to subtract with the whole numbers first.

   $2 - 1\frac{1}{3} = ?$

9. Use the number line to show the subtraction.

10. What is the answer? _______

11. Rewrite the equation to subtract with the whole numbers first.

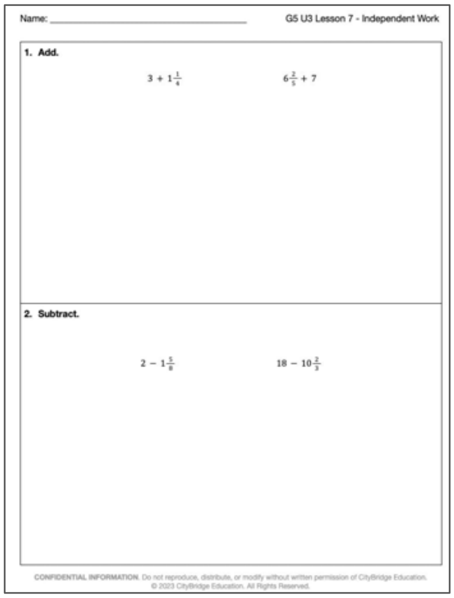
    $4 - 2\frac{3}{4} = ?$

12. Draw a number line to represent the subtraction. Solve.

13. Solution: _______

On your Own:

Now it's time to explore adding fractions to and subtracting fractions from whole numbers using equivalence and the number line as strategies on your own.


Name: ______________________________ G5 U3 Lesson 7 - Independent Work

1. Add.

$3 + 1\frac{1}{4}$ $6\frac{2}{5} + 7$

2. Subtract.

$2 - 1\frac{5}{8}$ $18 - 10\frac{2}{3}$


3. Catherine has a goal to run 8 miles this weekend. On Saturday she will run $2\frac{1}{2}$ miles. How far does Catherine need to run on Sunday to meet her goal?

Solve the problem. Include a model and a number sentence.

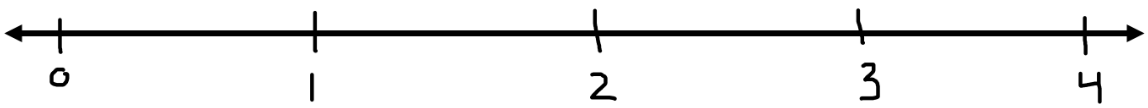
4. Bianca says $4 - 1\frac{1}{5}$ will be less than 3. Pedro says it will be more than 3. Who do you agree with? Explain using words and pictures.

1. Write an addition expression to represent the model.

2. Decompose the mixed number so that you can add the whole numbers first.

_________ + _________ + __________

3. Use the number line to show the addition.



4. What is the sum? ____________

5. Rewrite the equation to add the whole numbers first.

$$3\frac{1}{8} + 4 = ?$$

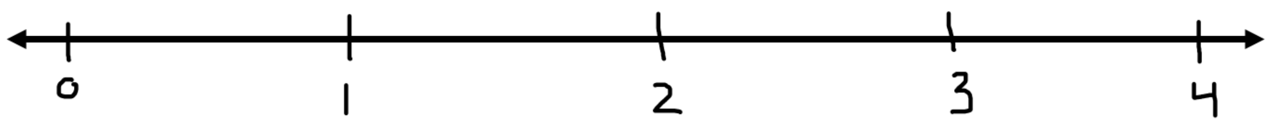
6. Draw a number line to represent the addition.

7. Find the sum. ____________

8. Rewrite the equation to subtract with the whole numbers first.

$$2 - 1\frac{1}{3} = ?$$

9. Use the number line to show the subtraction.



10. What is the answer? ______________

---

11. Rewrite the equation to subtract with the whole numbers first.

$$4 - 2\frac{3}{4} = ?$$

12. Draw a number line to represent the subtraction. Solve.

13. Solution: _____________

1. Add.

$3 + 1\frac{1}{4}$ $6\frac{2}{5} + 7$

2. Subtract.

$2 - 1\frac{5}{8}$ $18 - 10\frac{2}{3}$

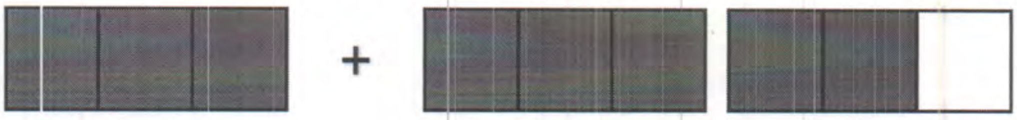
3. Catherine has a goal to run 8 miles this weekend. On Saturday she will run $2\frac{1}{2}$ miles. How far does Catherine need to run on Sunday to meet her goal?

Solve the problem. Include a model and a number sentence.

4. Bianca says $4 - 1\frac{1}{5}$ will be less than 3. Pedro says it will be more than 3. Who do you agree with? Explain using words and pictures.

Name: KEY

1. **Write an addition expression to represent the model.**

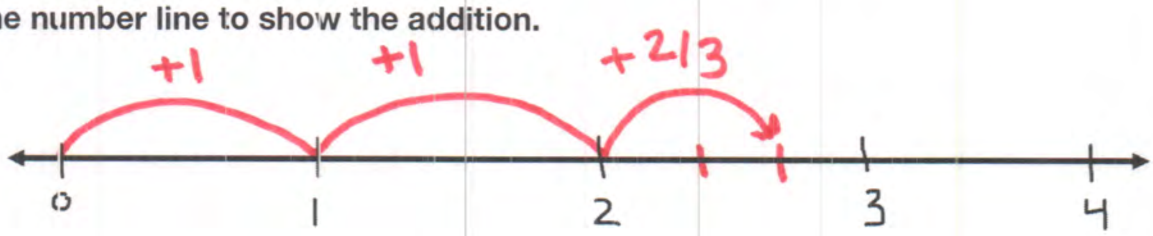


$1 + 1\frac{2}{3}$

2. **Decompose the mixed number so that you can add the whole numbers first.**

$1 + 1 + \frac{2}{3}$

3. **Use the number line to show the addition.**



4. **What is the sum?** $2\frac{2}{3}$

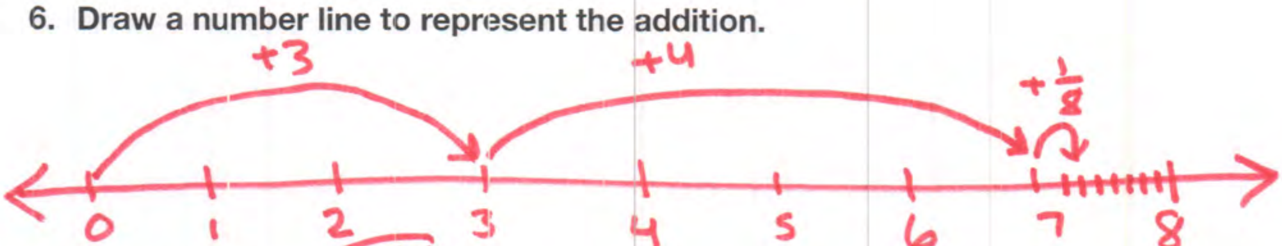
---

5. **Rewrite the equation to add the whole numbers first.**

$$3\frac{1}{8} + 4 = ?$$

$3 + 4 + \frac{1}{8}$

6. **Draw a number line to represent the addition.**



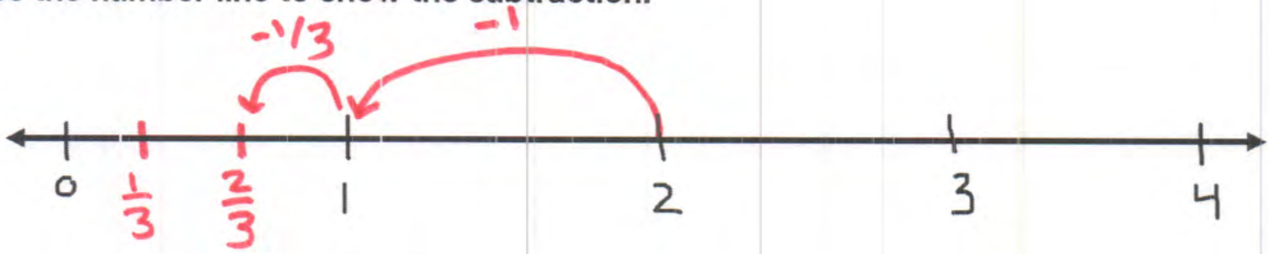
7. **Find the sum.** $7\frac{1}{8}$

8. **Rewrite the equation to subtract with the whole numbers first.**

$$2 - 1\frac{1}{3} = ?$$

$$2 - 1 - \frac{1}{3}$$

9. **Use the number line to show the subtraction.**



10. **What is the answer?** 2/3

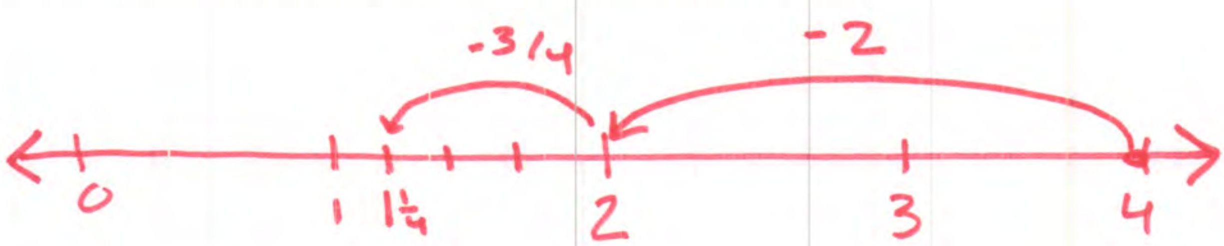
---

11. **Rewrite the equation to subtract with the whole numbers first.**

$$4 - 2\frac{3}{4} = ?$$

$$4 - 2 - \frac{3}{4}$$

12. **Draw a number line to represent the subtraction. Solve.**



13. **Solution:** $1\frac{1}{4}$

Name: KEY

1. Add.

$3 + 1\frac{1}{4}$

$3 + 1 + \frac{1}{4}$

$4 + \frac{1}{4}$

$4\frac{1}{4}$

$6\frac{2}{5} + 7$

$6 + 7 + \frac{2}{5}$

$13 + \frac{2}{5}$

$13\frac{2}{5}$

2. Subtract.

$2 - 1\frac{5}{8}$

$2 - 1 - \frac{5}{8}$

$1 - \frac{5}{8}$

$\frac{3}{8}$

$18 - 10\frac{2}{3}$

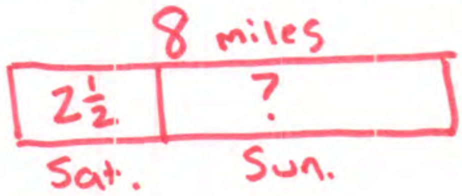
$18 - 10 - \frac{2}{3}$

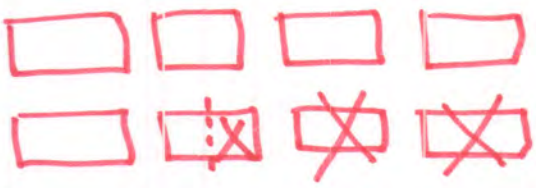
$8 - \frac{2}{3}$

$7\frac{1}{3}$

3. Catherine has a goal to run 8 miles this weekend. On Saturday she will run $2\frac{1}{2}$ miles. How far does Catherine need to run on Sunday to meet her goal?

Solve the problem. Include a model and a number sentence.





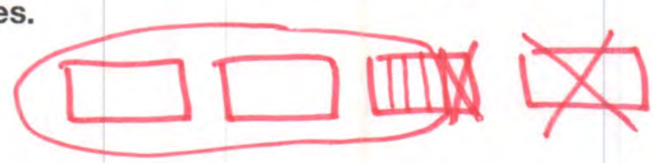
$8 - 2\frac{1}{2}$

$8 - 2 - \frac{1}{2}$

$6 - \frac{1}{2}$

$5\frac{1}{2}$ miles

4. Bianca says $4 - 1\frac{1}{5}$ will be less than 3. Pedro says it will be more than 3. Who do you agree with? Explain using words and pictures.



$4 - 1 - \frac{1}{5}$

$3 - \frac{1}{5} = 2\frac{4}{5}$

Bianca is correct. I know 4 minus 1 is 3, then I still need to subtract 1/5 more. This means my answer has to be a little less than 3.

G5 U3 Lesson 8

Add fractions making like units numerically

G5 U3 Lesson 8 - Students will add fractions making like units numerically

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): We've spent several lessons engaging in adding and subtracting fractions and showing our thinking. There are many ways we can show our work when adding and subtracting fractions. What ways have we tried so far? Possible Student Answers, Key Points:

- We've used visual models like tape diagrams or area models to help us think about the units in our fractions.
- We've added and subtracted on a number line.

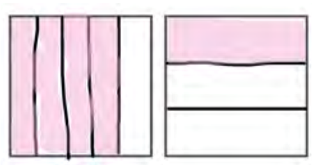
Today, we're going to focus on fraction addition, and we'll consider whether or not we always have to draw a model or a number line to help us find like units. Let's get started!

Let's Talk (Slide 3): Think about the problem ½ + ¼. We could draw an area model to think about our units and find the sum…but do we have to? Is there a way you can think of to find the sum without sketching out models? Possible Student Answers, Key Points:

- I know we can't add them right away, because they're not like units. Maybe I can picture what an area model might look like in my head and write out what I'm picturing using numbers.
- I know ½ is equivalent to 2 fourths. So I can think of 2/4 plus ¼ without needing to draw a model.

I wonder if your ideas will help us today! Let's try the first problem out with an area model and without an area model and see what we notice.

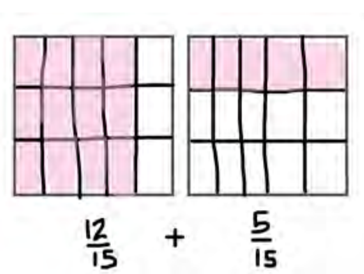
Let's Think (Slide 4): Our first question wants us to find the sum of ⅓and ⅓ Even though our focus today is working on making like units numerically, or with numbers, let's start by drawing a model for this problem.



Let's show ⅘ vertically and ⅓horizontally. *(cut the first area model into 5 columns and shade 4 of them, and then cut the second area model into 3 rows and shade 2 of them)*

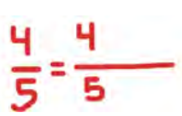
We know we can't add fifths and thirds together, because they're unlike units What can I do in my model to show these two fractions as equivalent fractions with like units? Possible Student Answers, Key Points:

- We can partition them into 15 pieces, since 15 is a multiple of 5 and 3.
- We can cut the first model into 3 horizontal rows and the second model into 5 vertical columns. That will make each area model have 15 pieces.

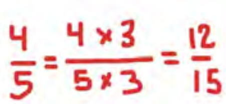


(partition each area model as you narrate) I can partition each model into 15 pieces since thirds and fifths can both be made into fifteenths. I'll use 2 horizontal cuts to partition the first area model into 15 pieces. I'll use 4 vertical cuts to partition the second area model into 15 pieces. What equivalent fractions do we see now? (12/15 and 5/15)

Sometimes, when we are dealing with a lot of pieces, partitioning area models isn't efficient. Let's think about how we can arrive at these same equivalent fractions numerically, so that we don't always need to rely on a model.



Let's think about ⅘ first.*(write ⅘ = ⅘ as shown)*We started with 4 shaded columns out of 5 columns in all. To partition fifths into fifteenths, we cut our model into 3 rows. This meant that we were essentially tripling our pieces. We had 3 times as many pieces after we cut the model.



We can show that using multiplication. We had 4 shaded pieces, but we cut to have 3 times as many shaded pieces. *(write x 3 in the numerator)* We had 5 columns, or 5 total pieces, but we cut to have 3 times as many shaded pieces. *(write x 3 in the numerator)* Since we tripled the number of shaded pieces and tripled the number of total pieces in the whole, we can show that by multiplying the numerator and denominator by 3. We end up with an equivalent fraction of 12/15. We see the same work we did numerically in our area model.

$$\frac{1}{3} = \frac{1}{3}$$

Now let's think about 1/3 *(write 1/3 = 1/3 as shown)* We started with 1 shaded row out of 3 rows in all. To partition thirds into fifteenths, we cut our model into 5 columns. We have 5 times as many pieces after we cut the model.

$$\frac{1}{3} = \frac{1 \times 5}{3 \times 5} = \frac{5}{16}$$

We can show that using multiplication. We had 1 shaded piece, but we cut to have 5 times as many shaded pieces. *(write x 5 in the numerator)* We had 3 rows, or 3 total pieces, but we cut to have 5 times as many shaded pieces. *(write x 5 in the numerator)* We can show that by multiplying the numerator and denominator by 5. We end up with an equivalent fraction of 5/15. Once again, this is just a numerical way to show the work we did partitioning our area model.

Whether we found like units using the area model or numerically, we're now ready to add. What is our equation with like units and what is the sum? Possible Student Answers, Key Points:

- Our new equation is 5/15 + 12/15 = ?
- I know 5 units and 12 units is 17 units, so the sum is 17/15. We can also write that as 1 2/15.

$$\frac{5}{15} + \frac{12}{15} = \frac{17}{15} \text{ OR } 1\frac{2}{15}$$

(write 5/15 + 12/15 = 17/15) We can add 5 fifteenths plus 12 fifteenths to get 17 fifteenths. We can leave our answer as a fraction greater than 1, like 17/15, or we can write our answer as a mixed number. I know 15/15 is 1 whole, so I can think of 17/15 as 1 whole with 2 extra fifteenths. The mixed number form is 1 2/15.

From this first example, how is finding like units with area models similar to or different from finding like units numerically? Possible Student Answers, Key Points:

- Both strategies help us to find like units. In this case, both ways helped us think about fifteenths.
- The area model involves drawing and partitioning, while the numerical way involves multiplying in place of actually partitioning. The area model way is more visual, but could take longer with some problems.

Let's try one more example together, and this time we'll try not to use a model at all. We'll just try to add by finding equivalent fractions numerically.

Let's Think (Slide 5): This problem wants us to find the sum of 1 ½ and 3/7. Without using a model, let's think about our units. What like unit can help us in this problem, and how do you know? Possible Student Answers, Key Points:

- We can use 14 since it is a multiple of 2 and 7.
- I could partition halves into 14 pieces and 7 into 14 pieces, so we can use fourteenths as a unit.

If we were drawing a model, we could partition both models into 14 pieces. We could also maybe use 28 pieces or something bigger, but 14 is arguably the easiest unit to use here.

$$1\frac{1}{2} = 1\frac{1 \times}{2 \times} = 1\frac{}{14}$$

Let's think about how we can make equivalent fractions with units of fourteenths numerically. We'll start with 1 ½. We know we can use multiplication to represent how we might partition our model. If I want to convert 1 ½ into fourteenths, I can think about what I can multiply each part of my fraction by to make 14 pieces. *(write incomplete equation as shown)*

Let's look at the fractional part of the mixed number, since I don't need to worry about the whole number when I write equivalent fractions. What can I multiply ½ by to write it as an equivalent fraction? (I know 2 x 7 = 14, so we can multiply the numerator and denominator by 7)

$$1\frac{1}{2} = 1\frac{1 \times 7}{2 \times 7} = 1\frac{7}{14}$$

We can multiply the numerator and denominator each by 7. It's as though we partitioned our model into 7 rows or columns to make 14 pieces. *(fill in 7s in the blanks of the equation you previously wrote)* 1 ½ is equivalent to 1 7/14. No area model required!

$$\frac{3}{7} = \frac{3 \times}{7 \times} = \frac{}{14}$$

Let's use the same thinking to write an equivalent fraction for 3/7. We want to think of 3/7 as being cut into 14 pieces. *(write incomplete equation as shown)* How can I use multiplication to show that I am partitioning 3/7 into 14 pieces? (I know 7 x 2 = 14, so we can multiply the numerator and denominator by 2)

$$\frac{3}{7} = \frac{3 \times 2}{7 \times 2} = \frac{6}{14}$$

It's like we partitioned the sevenths into 2 columns or 2 rows. *(fill in 2s in the blanks of the equation you previously wrote)* 3/7 is equivalent to 6/14. We figured this out numerically without the use of an area model.

$$1\frac{7}{14} + \frac{6}{14} = 1\frac{13}{14}$$

Now we can add our fractions with like units. 1 7/14 + 6/14 is 1 13/14, when we add our fractional units.

We've written equivalent fractions using area models for several lessons. Today we learned how to add by writing equivalent fractions numerically, without an area model. Which strategy do you prefer at this moment in time and why? Possible Student Answers, Key Points:

- I prefer finding equivalent fractions numerically, because it's more efficient. I don't have to draw as much and count up all the pieces.
- I prefer the area model because it's more visual, and I'm more used to it for now.
- I like both, it just depends on the problem. If there are a ton of pieces, I might prefer to use multiplication instead of an area model.

Let's Try it (Slides 6 - 7): Now let's work on adding fractions making like units numerically together. Rather than rely on partitioning a model, we can use multiplication to help us rewrite equivalent fractions with like units numerically. We can always go back to drawing models, but we know that sometimes this can be an inefficient, time-consuming strategy. This is especially true if our fractions will involve many pieces. Let's use what we've been practicing and try a few more problems together.

WARM WELCOME

Today we will add fractions making like units numerically.

Let's Talk:

Do I always have to draw a model to add fractions with unlike units?

$$\frac{1}{2} + \frac{1}{4}$$

Let's Think:

Find the sum by making like units numerically.

$$\frac{1}{3} + \frac{4}{5}$$

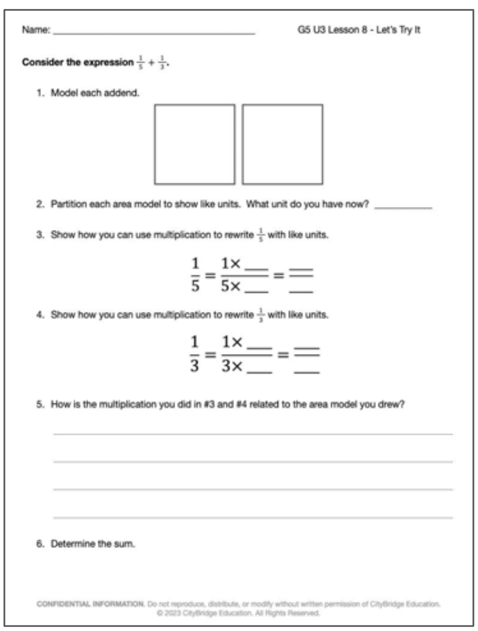
Let's Think:

Find the sum by making like units numerically.

$$1\frac{1}{2} + \frac{3}{7}$$

Let's Try It:

Let's explore adding fractions making like units numerically together.



Name: ______________________ G5 U3 Lesson 8 - Let's Try It

Consider the expression $\frac{1}{5} + \frac{1}{3}$.

1. Model each addend.
2. Partition each area model to show like units. What unit do you have now? ________
3. Show how you can use multiplication to rewrite $\frac{1}{5}$ with like units.

$$\frac{1}{5} = \frac{1 \times \_\_}{5 \times \_\_} = \frac{\_\_}{\_\_}$$

4. Show how you can use multiplication to rewrite $\frac{1}{3}$ with like units.

$$\frac{1}{3} = \frac{1 \times \_\_}{3 \times \_\_} = \frac{\_\_}{\_\_}$$

5. How is the multiplication you did in #3 and #4 related to the area model you drew?
6. Determine the sum.

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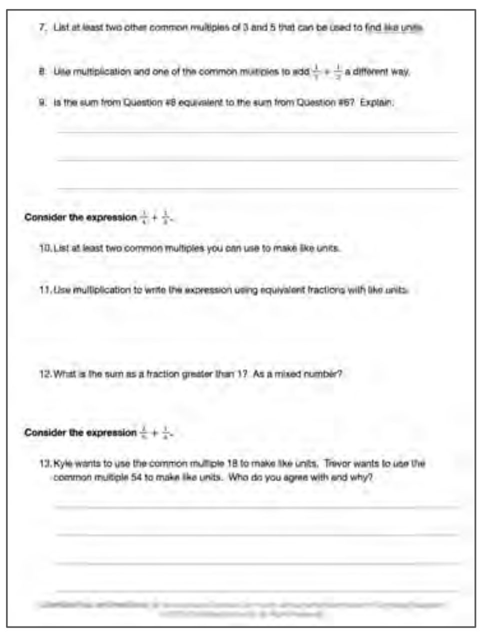


7. List at least two other common multiples of 3 and 5 that can be used to find like units.
8. Use multiplication and one of the common multiples to add $\frac{1}{5} + \frac{1}{3}$ a different way.
9. Is the sum from Question #8 equivalent to the sum from Question #6? Explain.

Consider the expression $\frac{1}{4} + \frac{1}{3}$.

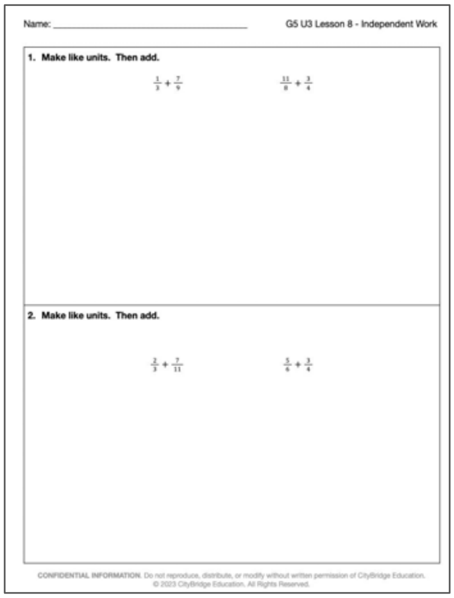
10. List at least two common multiples you can use to make like units.
11. Use multiplication to write the expression using equivalent fractions with like units.
12. What is the sum as a fraction greater than 1? As a mixed number?

Consider the expression $\frac{1}{6} + \frac{1}{4}$.

13. Kyle wants to use the common multiple 18 to make like units. Trevor wants to use the common multiple 54 to make like units. Who do you agree with and why?

On your Own:

Now it's time to explore adding fractions making like units numerically on your own.


Name: ______________________ G5 U3 Lesson 8 - Independent Work

1. Make like units. Then add.

$\frac{1}{3} + \frac{7}{9}$ $\frac{11}{8} + \frac{3}{4}$

2. Make like units. Then add.

$\frac{2}{3} + \frac{7}{11}$ $\frac{5}{6} + \frac{3}{4}$

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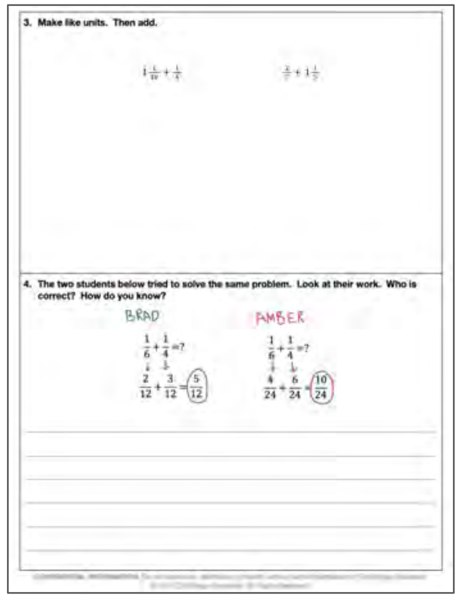

3. Make like units. Then add.

4. The two students below tried to solve the same problem. Look at their work. Who is correct? How do you know?

BRAD

$\frac{1}{6} + \frac{1}{4} = ?$

$\frac{2}{12} + \frac{3}{12} = \frac{5}{12}$

AMBER

$\frac{1}{6} + \frac{1}{4} = ?$

$\frac{4}{24} + \frac{6}{24} = \frac{10}{24}$

Name: ______________________________ G5 U3 Lesson 8 - Let's Try It

Consider the expression $\frac{1}{5}+\frac{1}{3}$.

1. Model each addend.

2. Partition each area model to show like units. What unit do you have now? __________

3. Show how you can use multiplication to rewrite $\frac{1}{5}$ with like units.

$$\frac{1}{5}=\frac{1\times \_\_\_}{5\times \_\_\_}=\frac{\_\_\_}{\_\_\_}$$

4. Show how you can use multiplication to rewrite $\frac{1}{3}$ with like units.

$$\frac{1}{3}=\frac{1\times \_\_\_}{3\times \_\_\_}=\frac{\_\_\_}{\_\_\_}$$

5. How is the multiplication you did in #3 and #4 related to the area model you drew?

6. Determine the sum.

7. List at least two other common multiples of 3 and 5 that can be used to find like units.

8. Use multiplication and one of the common multiples to add $\frac{1}{5}+\frac{1}{3}$ a different way.

9. Is the sum from Question #8 equivalent to the sum from Question #6? Explain.

Consider the expression $\frac{3}{4} + \frac{1}{3}$.

10. List at least two common multiples you can use to make like units.

11. Use multiplication to write the expression using equivalent fractions with like units.

12. What is the sum as a fraction greater than 1? As a mixed number?

Consider the expression $\frac{2}{9} + \frac{1}{6}$.

13. Kyle wants to use the common multiple 18 to make like units. Trevor wants to use the common multiple 54 to make like units. Who do you agree with and why?

1. Make like units. Then add.

$\frac{1}{3} + \frac{7}{9}$ $\frac{11}{8} + \frac{3}{4}$

2. Make like units. Then add.

$\frac{2}{3} + \frac{7}{11}$ $\frac{5}{6} + \frac{3}{4}$

3. Make like units. Then add.

$1\frac{1}{10} + \frac{1}{4}$ $\frac{2}{7} + 1\frac{1}{5}$

4. The two students below tried to solve the same problem. Look at their work. Who is correct? How do you know?

BRAD

$$\frac{1}{6}+\frac{1}{4}=?$$

$$\frac{2}{12}+\frac{3}{12}=\frac{5}{12}$$

AMBER

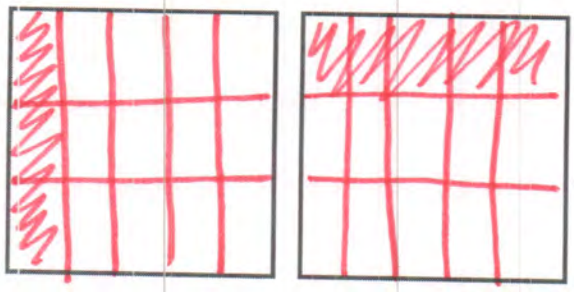
$$\frac{1}{6}+\frac{1}{4}=?$$

$$\frac{4}{24}+\frac{6}{24}=\frac{10}{24}$$

Name: KEY

Consider the expression $\frac{1}{5} + \frac{1}{3}$.

1. Model each addend.



2. Partition each area model to show like units. What unit do you have now? fifteenths

3. Show how you can use multiplication to rewrite $\frac{1}{5}$ with like units.

$$\frac{1}{5} = \frac{1 \times 3}{5 \times 3} = \frac{3}{15}$$

4. Show how you can use multiplication to rewrite $\frac{1}{3}$ with like units.

$$\frac{1}{3} = \frac{1 \times 5}{3 \times 5} = \frac{5}{15}$$

5. How is the multiplication you did in #3 and #4 related to the area model you drew?

I cut the fifths into 3 times as many pieces. I cut the thirds into 5 times as many pieces.

6. Determine the sum. $\frac{3}{15} + \frac{5}{15} = \frac{8}{15}$

7. List at least two other common multiples of 3 and 5 that can be used to find like units.

30, 45, 60, 75, 90... (any multiples of 15)

8. Use multiplication and one of the common multiples to add $\frac{1}{5}+\frac{1}{3}$ a different way.

$\frac{1}{3}\times\frac{10}{10}=\frac{10}{30}$ $\frac{1}{5}\times\frac{6}{6}=\frac{6}{30}$ $\frac{10}{30}+\frac{6}{30}=\frac{16}{30}$

9. Is the sum from Question #8 equivalent to the sum from Question #6? Explain.

Yes, $\frac{16}{30}$ is equivalent to $\frac{8}{15}$. The products are equivalent, but the pieces are partitioned differently.

Consider the expression $\frac{3}{4}+\frac{1}{3}$.

10. List at least two common multiples you can use to make like units.

12, 24, 36, 48... (any multiple of 12)

11. Use multiplication to write the expression using equivalent fractions with like units.

$\frac{3\times3}{4\times3}=\frac{9}{12}$ $\frac{1\times4}{3\times4}=\frac{4}{12}$

$\frac{9}{12}+\frac{4}{12}=\frac{13}{12}$ OR $1\frac{1}{12}$

12. What is the sum as a fraction greater than 1? As a mixed number?

Consider the expression $\frac{2}{9}+\frac{1}{6}$.

13. Kyle wants to use the common multiple 18 to make like units. Trevor wants to use the common multiple 54 to make like units. Who do you agree with and why?

Either student is correct. I prefer Kyle's way because I think 18 is a little easier to think about.

Name: KEY

1. **Make like units. Then add.**

$\frac{1}{3} + \frac{7}{9}$

$\frac{1 \times 3}{3 \times 3} = \frac{3}{9}$

$\frac{3}{9} + \frac{7}{9}$

$\frac{10}{9}$ OR $1\frac{1}{9}$

$\frac{11}{8} + \frac{3}{4}$

$\frac{3 \times 2}{4 \times 2} = \frac{6}{8}$

$\frac{11}{8} + \frac{6}{8} = \frac{17}{8}$ OR $2\frac{1}{8}$

2. **Make like units. Then add.**

$\frac{2}{3} + \frac{7}{11}$

$\frac{2 \times 11}{3 \times 11} = \frac{22}{33}$

$\frac{7 \times 3}{11 \times 3} = \frac{21}{33}$

$\frac{22}{33} + \frac{21}{33} = \frac{43}{33}$ OR $1\frac{10}{33}$

$\frac{5}{6} + \frac{3}{4}$

$\frac{5 \times 2}{6 \times 2} = \frac{10}{12}$

$\frac{3 \times 3}{4 \times 3} = \frac{9}{12}$

$\frac{10}{12} + \frac{9}{12} = \frac{19}{12}$ OR $1\frac{7}{12}$

3. **Make like units. Then add.**

$1\frac{1}{10} + \frac{1}{4}$

$1\frac{1}{10} \times \frac{2}{2} = 1\frac{2}{20}$

$\frac{1}{4} \times \frac{5}{5} = \frac{5}{20}$

$1\frac{2}{20} + \frac{5}{20}$

$1\frac{7}{20}$

$\frac{2}{7} + 1\frac{1}{5}$

$\frac{2}{7} \times \frac{5}{5} = \frac{10}{35}$

$1\frac{1}{5} \times \frac{7}{7} = 1\frac{7}{35}$

$\frac{10}{35} + 1\frac{7}{35}$

$1\frac{17}{35}$

4. **The two students below tried to solve the same problem. Look at their work. Who is correct? How do you know?**

BRAD

$\frac{1}{6} + \frac{1}{4} = ?$

$\downarrow \quad \downarrow$

$\frac{2}{12} + \frac{3}{12} = \frac{5}{12}$

AMBER

$\frac{1}{6} + \frac{1}{4} = ?$

$\downarrow \quad \downarrow$

$\frac{4}{24} + \frac{6}{24} = \frac{10}{24}$

They are both correct. They just used a different like unit. Brad used twelfths and Amber used 24ths. The sums are equivalent.

G5 U3 Lesson 9

Add fractions with sums greater than 2

CITYTUTOR DC

G5 U3 Lesson 9 - Students will add fractions with sums greater than 2

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): In previous lessons, we've worked to add and subtract with fractions. Today, we'll use what we know to add fractions where our sums, or totals, are greater than 2.

Let's Talk (Slide 3): Think about the two addition expressions shown here. What is the same? What is different? Possible Student Answers, Key Points:

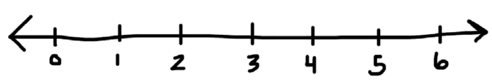
- They both involve units of sixths and units of fourths. They both have the same fractional parts. They both involve addition.
- They're different colors. The green one shows mixed numbers. The green one involves fractions and whole numbers. The green one is going to be a bigger total.

These two expressions are very similar. They both involve adding, they both involve ⅚ and ¼, but the second expression shows mixed numbers. Knowing what we've done in previous lessons to add fractions with unlike units, what strategies do you think might help us find the total of two mixed numbers? Possible Student Answers, Key Points:

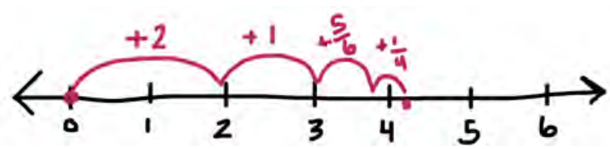
- We'll need to make like units, so maybe we can draw area models or use multiplication to write equivalent fractions with common denominators.
- We've decomposed mixed numbers before to add the whole numbers together. Maybe we can do that today.

Let's see how we can use what we know to add fractions with sums greater than 2.

Let's Think (Slide 4): For our first problem, let's actually evaluate the expression we just talked about. We'll find the sum of 2 ⅚ and 1 ¼. To start, let's estimate using a number line.



Just by looking at the whole numbers, I know I don't need to make my number line too long, so I'll make a number line from 0 to 6. I can always adjust it later if I need to. *(draw and label a number line from 0 to 6)*



Let's add the whole numbers first. *(hop and label as you narrate)* I'll make a hop of 2 and a hop of 1 to show that the sum of the whole numbers is 3. Now we can eyeball or estimate the fractional parts. ⅚ is really close to a whole, so from the 3, I'll make a hop that's *almost* 1 whole. *(hop to just before the 4 and label as +⅚)* I'm now a little before the 4 on my number line, because I know ⅚ is ⅙ away from 1 whole jump. Our last jump is ¼. I know ¼ is going to push me a little past the 4. I know this because I'm ⅙ away from the 4, and I need to jump ¼. ¼ is bigger than ⅙, so I'll make my hop go just a little beyond the 4. We don't know the exact value yet, but what does estimating on the number line tell me about what the actual sum should be? Possible Student Answers, Key Points:

- The actual sum should be between 4 wholes and 5 wholes.
- We landed close to the 4, so our answer should be about 4 and a little more. It looks like it should be smaller than 4 ½.

Let's now find the actual sum, and we can check to see if what we get is reasonable based on our estimate. Just like we've done in previous lessons, and just like we did when we estimated, let's break apart or decompose each mixed number into whole numbers and fractions.

$$2\frac{5}{6} + 1\frac{1}{4}$$

$$2 + \frac{5}{6} + 1 + \frac{1}{4}$$

$$2 + 1 + \frac{5}{6} + \frac{1}{4}$$

(write 2 + ⅚ + 1 + ¼ as you explain, color coding as shown) We can think of 2 ⅚ as 2 + ⅚. We can add that to 1 ¼, and we'll think of 1 ¼ as 1 + ¼. Now our original expression is decomposed into parts. Let's quickly rearrange those parts so we can add whole numbers together and fractions together. *(write 2 + 1 + ⅚ + ¼ maintaining the colors)* What do you notice about the expression I just wrote? Possible Student Answers, Key Points:

- It's the same, but just in a different order.
- You brought the whole numbers next to each other and the fractions next to each other.

Let's add like units. I know 2 + 1 is 3, that's easy. What will I need to do to add ⅚ and ¼? (They need to be like units like twelfths or twenty-fourths) You can use an area model to find like units, but we also learned multiplication can work. Let's use multiplication, but know that when you work, you can choose the strategy that works best for you.

How can I use multiplication to write ⅚ as an equivalent fraction using units of twelfths? (multiply the numerator and denominator by 2)

$$\frac{5\times2}{6\times2}=\frac{10}{12}$$

Let's show that we're multiplying both parts of our fraction by 2. *(write equation as shown)* We can think of ⅚ as being equivalent to 10/12.

How can I use multiplication to write ¼ as an equivalent fraction using units of twelfths? *(multiply the numerator and denominator by 3)* Let's show that we're multiplying both parts of our fraction by 3. *(write equation as shown)* We can think of ¼ as being equivalent to 3/12.

$$\underbrace{2+1}+\frac{5}{6}+\frac{1}{4}$$
$$3+\left(\frac{10}{12}+\frac{3}{12}\right)=3\frac{13}{12}$$

(rewrite underneath the decomposed equation as you narrate) We already said that 2 + 1 is 3. We also just rewrote our fractional parts as equivalent fractions using twelfths. If we add those parts together, we can see that our sum is 3 and 13/12. We did it! We added fractions with a sum greater than 2.

Before we close out this problem, do you notice anything about our answer? Possible Student Answers, Key Points:

- I notice that we have a fraction greater than 1 as part of the mixed number. That kind of looks strange.
- I notice our estimate said our answer should be greater than 4, but our mixed number shows a 3 as the whole number.

$$3\frac{13}{12}=4\frac{1}{12}$$
$$1 \qquad \frac{1}{12}$$

Let's rewrite the mixed number so that we can think of our sum just as a whole number and a fraction less than 1. I know 13/12 is 1 whole, or 12/12, plus 1 extra twelfth. *(use a number bond to show 1 whole and 1/12 underneath 13/12)* If I combine the 1 whole with the 3 wholes, our final answer can be 4 1/12. *(write answer)*

How do I know that our answer is reasonable? Possible Student Answers, Key Points:

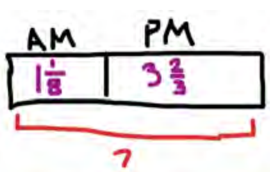
- 4 1/12 is between 4 and 5, like our number line showed.
- Our sum is a little bit more than 4, just like we thought it would be when we estimated.

Job well done!

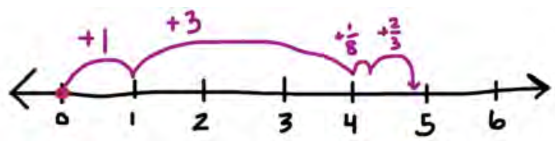
Let's Think (Slide 5): Let's look at a story problem. *(read the problem)* Now, re-read the problem to yourself. When you're finished, retell the story in your own words. Possible Student Answers, Key Points:

- She read a little in the morning and a lot in the evening, and we're trying to find how much she read altogether for the day.
- It's asking us to combine the hours she read at two different points during the day.

To help me think about the story and how the numbers are related, I can sketch a quick tape diagram. I know she read some in the morning and some in the evening, so I can draw a rectangle partitioned into two parts and label them morning and evening. *(draw a rectangle as described, and write AM and PM above corresponding parts)*



(continue labeling as you narrate) I can fill in the values for how much she read in the morning and afternoon, and the story named that the unknown is how much she read in all. I can represent that with a question mark. This tape diagram makes it clear that we need to add these two values to find the total amount of hours Destini read.



Let's estimate the sum using a number line. *(sketch and label number line from 0 to 6)* If I think about the whole numbers first, I can show a hop of 1 and a hop of 3, which lands us at 4. I'm not done. I need to estimate the fractional parts too. What do I know about the size of the fractions ⅛ and ⅔? Possible Student Answers, Key Points:

- ⅛ is pretty small, and ⅔ is bigger. ⅔ is bigger than half.
- I know a hop of ⅛ and a hop of ⅔ would be less than 1 whole.

I'll show a small hop to represent ⅛ since it's only an eighth of a whole. Then I'll show a slightly bigger hop to represent ⅛ I won't go an entire whole jump to 5, because ⅛ plus ⅛ is not quite a whole. I know ⅛ and ⅛ would be a whole, so ⅛ and a smaller eighth won't make it all the way to 5.

Based on our estimate, I know the sum should be between 4 and 5. It should probably be *almost* 5, but no bigger than 5.

$$1\tfrac{1}{8} + 3\tfrac{2}{3}$$

$$1 + \tfrac{1}{8} + 3 + \tfrac{2}{3}$$

Let's test it out by doing the actual computation. *(write 1 ⅛ + 3 ⅛ using different colors for each addend)* Just like our last example, we can decompose each mixed number into a whole number and a fraction. *(write decomposed expression underneath using similar color coding)* To make it easier on ourselves, let's rearrange the addends so our fractions are next to each other. *(rearrange as shown, maintaining color coding)* Now we can easily see that our whole number sum will be 4, and we can figure out the sum of our fractional parts.

$$\frac{1 \times 3}{8 \times 3} = \frac{3}{24}$$

$$\frac{2 \times 8}{3 \times 8} = \frac{16}{24}$$

What can I do to add these fractions with unlike units? (We can multiply to find like units. They can both be written as fractions with 24 pieces.) *(complete each equation as you narrate)* Let's multiply the numerator and denominator of ⅛ by 3. We'll get an equivalent fraction of 3/24. What can we multiply ⅛ by to make an equivalent fraction with like units? (8/8) If we multiply 2 and 3 each by 8, we can see our equivaelnt fraction is 16/24.

$$\underbrace{1 + 3}_{4} + \tfrac{1}{8} + \tfrac{2}{3}$$

$$4 + \left(\tfrac{3}{24} + \tfrac{16}{24}\right) = 4\tfrac{19}{24} \text{ hr.}$$

Now let's add our whole numbers together and our fractions together. I know 1 and 3 makes 4. I know 3/24 and 16/24 makes 19/24. I know Destini read for 4 19/24 hours in all. We didn't need to rewrite this mixed number, because it didn't have a fraction greater than 1.

Is our answer reasonable? Possible Student Answers, Key Points:
- Yes, it's between 4 and 5.
- Yes, we said our answer should be almost 5. 4 19/24 is close to being 5 wholes.

We just completed two addition problems where our sum was greater than 2. If you were to explain how to add fractions with sums greater than 2 to a friend who was new to this, what would you say to them? Possible Student Answers, Key Points:
- It's not too different from adding other fractions with smaller sums. You still need to find like units to add the fractional parts.
- To add with mixed numbers, it can help to decompose the mixed numbers. This helps you focus on the whole numbers and the fractional parts separately.

Let's Try it (Slides 6 - 7): Now let's work on adding fractions with sums greater than 2 together. In most cases, we'll want to estimate first using a number line or other strategy. Once we have an idea of what our answer should be close to, we can use decomposition to help us work with the whole numbers and the fractions separately. Let's try it out.

WARM WELCOME

Today we will add fractions with sums greater than 2.

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Let's Talk: What's the same? What's different?

$$\frac{5}{6} + \frac{1}{4}$$

$$2\frac{5}{6} + 1\frac{1}{4}$$

Let's Think: Estimate, then find the sum.

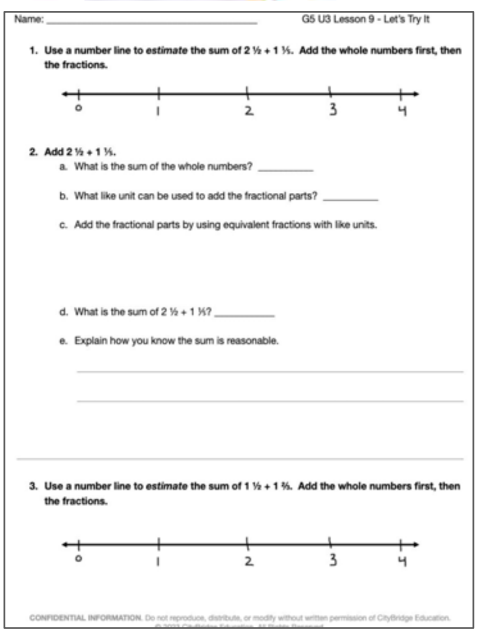
$$2\frac{5}{6} + 1\frac{1}{4}$$

Let's Think:

Destini reads for $1\frac{1}{8}$ hours in the morning and $3\frac{2}{3}$ hours in the evening. How many total hours does Destini ready?

Let's Try It:

Let's explore adding fractions with sums greater than 2 together.


Name: ______________________ G5 U3 Lesson 9 - Let's Try It

1. **Use a number line to *estimate* the sum of $2\frac{1}{2} + 1\frac{1}{3}$. Add the whole numbers first, then the fractions.**

0 1 2 3 4

2. **Add $2\frac{1}{2} + 1\frac{1}{3}$.**
   a. What is the sum of the whole numbers? ________
   b. What like unit can be used to add the fractional parts? ________
   c. Add the fractional parts by using equivalent fractions with like units.
   d. What is the sum of $2\frac{1}{2} + 1\frac{1}{3}$? ________
   e. Explain how you know the sum is reasonable.

3. **Use a number line to *estimate* the sum of $1\frac{1}{2} + 1\frac{2}{3}$. Add the whole numbers first, then the fractions.**

0 1 2 3 4

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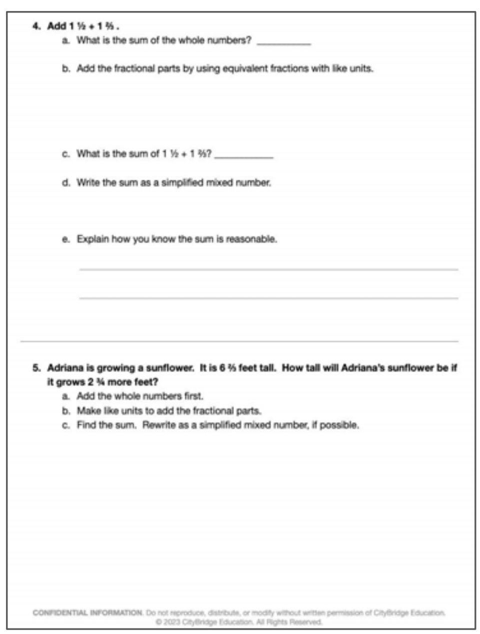
4. **Add $1\frac{1}{2} + 1\frac{2}{3}$.**
   a. What is the sum of the whole numbers? ________
   b. Add the fractional parts by using equivalent fractions with like units.
   c. What is the sum of $1\frac{1}{2} + 1\frac{2}{3}$? ________
   d. Write the sum as a simplified mixed number.
   e. Explain how you know the sum is reasonable.

5. **Adriana is growing a sunflower. It is $6\frac{2}{3}$ feet tall. How tall will Adriana's sunflower be if it grows $2\frac{3}{4}$ more feet?**
   a. Add the whole numbers first.
   b. Make like units to add the fractional parts.
   c. Find the sum. Rewrite as a simplified mixed number, if possible.

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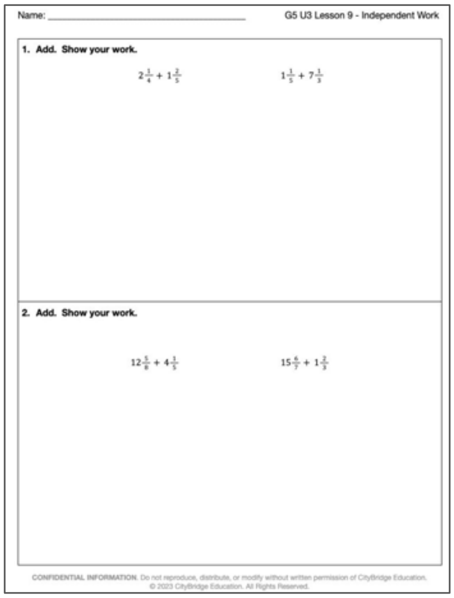
On your Own:

Now it's time to explore adding fractions with sums greater than 2 on your own.



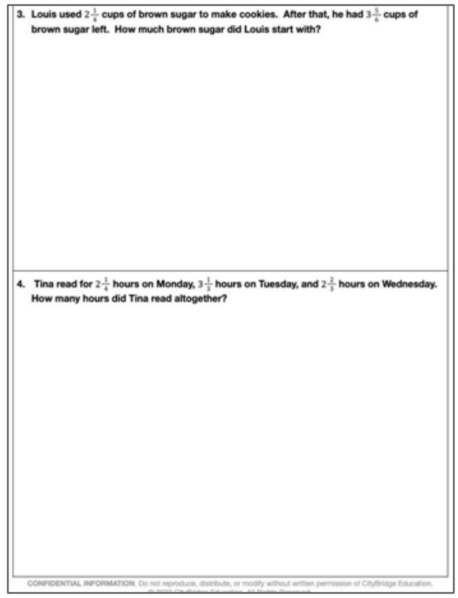
Name: ______________________ G5 U3 Lesson 9 - Independent Work

1. Add. Show your work.

$2\frac{1}{4} + 1\frac{2}{5}$ $1\frac{1}{5} + 7\frac{1}{3}$

2. Add. Show your work.

$12\frac{5}{8} + 4\frac{1}{5}$ $15\frac{6}{7} + 1\frac{2}{3}$

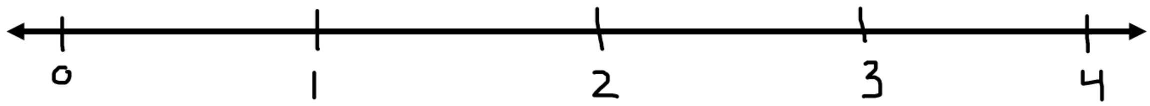


3. Louis used $2\frac{1}{4}$ cups of brown sugar to make cookies. After that, he had $3\frac{5}{6}$ cups of brown sugar left. How much brown sugar did Louis start with?

4. Tina read for $2\frac{1}{4}$ hours on Monday, $3\frac{1}{3}$ hours on Tuesday, and $2\frac{2}{3}$ hours on Wednesday. How many hours did Tina read altogether?

Name: ____ G5 U3 Lesson 9 - Let's Try It

1. Use a number line to *estimate* the sum of 2 ½ + 1 ⅕. Add the whole numbers first, then the fractions.

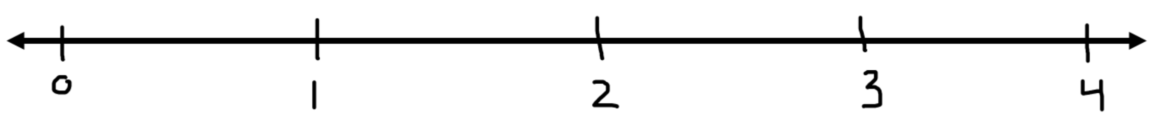


2. Add 2 ½ + 1 ⅕.
   a. What is the sum of the whole numbers? ____________
   b. What like unit can be used to add the fractional parts? ____________
   c. Add the fractional parts by using equivalent fractions with like units.
   d. What is the sum of 2 ½ + 1 ⅕? ____________
   e. Explain how you know the sum is reasonable.

____

____

3. Use a number line to *estimate* the sum of 1 ½ + 1 ⅔ Add the whole numbers first, then the fractions.



4. Add 1 ½ + 1 ⅔
   a. What is the sum of the whole numbers? ____________
   b. Add the fractional parts by using equivalent fractions with like units.

c. What is the sum of 1 ½ + 1 ⅔? ______________

d. Write the sum as a simplified mixed number.

e. Explain how you know the sum is reasonable.

---

5. Adriana is growing a sunflower. It is 6 ⅔ feet tall. How tall will Adriana's sunflower be if it grows 2 ¾ more feet?
   a. Add the whole numbers first.
   b. Make like units to add the fractional parts.
   c. Find the sum. Rewrite as a simplified mixed number, if possible.

1. Add. Show your work.

$2\frac{1}{4} + 1\frac{2}{5}$

$1\frac{1}{5} + 7\frac{1}{3}$

2. Add. Show your work.

$12\frac{5}{8} + 4\frac{1}{5}$

$15\frac{6}{7} + 1\frac{2}{3}$

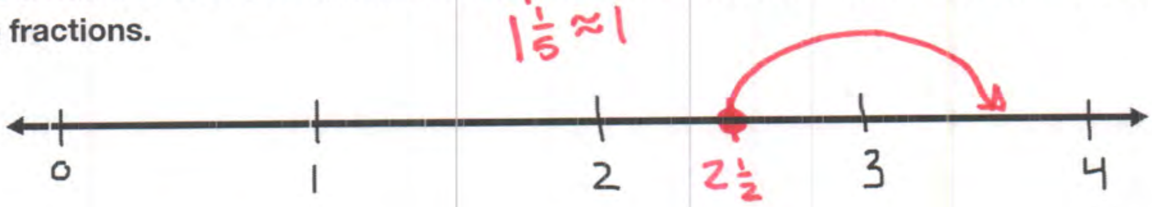
3. Louis used $2\frac{1}{4}$ cups of brown sugar to make cookies. After that, he had $3\frac{5}{6}$ cups of brown sugar left. How much brown sugar did Louis start with?

4. Tina read for $2\frac{1}{4}$ hours on Monday, $3\frac{1}{3}$ hours on Tuesday, and $2\frac{2}{3}$ hours on Wednesday. How many hours did Tina read altogether?

Name: KEY

1. **Use a number line to *estimate* the sum of 2 ½ + 1 ⅕. Add the whole numbers first, then the fractions.**

$1\frac{1}{5} \approx 1$



2. **Add 2 ½ + 1 ⅕.**
   a. What is the sum of the whole numbers? $1+2=3$
   b. What like unit can be used to add the fractional parts? tenths
   c. Add the fractional parts by using equivalent fractions with like units.

   $\frac{1\times5}{2\times5}=\frac{5}{10}$

   $\frac{1\times2}{5\times2}=\frac{2}{10}$

   $\frac{5}{10}+\frac{2}{10}=\frac{7}{10}$

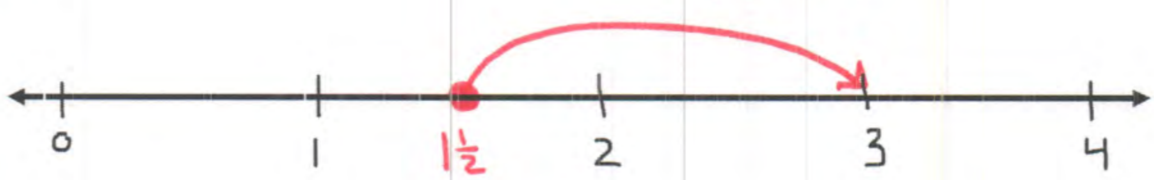
   d. What is the sum of 2 ½ + 1 ⅕? $3\frac{7}{10}$
   e. Explain how you know the sum is reasonable.

   I estimated that the sum should be about $3\frac{1}{2}$. $3\frac{7}{10}$ is pretty close.

---

3. **Use a number line to *estimate* the sum of 1 ½ + 1 ⅔. Add the whole numbers first, then the fractions.**

$1\frac{2}{3} \approx 1\frac{1}{2}$



4. **Add 1 ½ + 1 ⅔ .**

a. What is the sum of the whole numbers? $1+1=2$

b. Add the fractional parts by using equivalent fractions with like units.

$\frac{1\times3}{2\times3}=\frac{3}{6}$

$\frac{2\times2}{3\times2}=\frac{4}{6}$

$\frac{3}{6}+\frac{4}{6}=\frac{7}{6}$

c. What is the sum of 1 ½ + 1 ⅔? $2\frac{7}{6}$

d. Write the sum as a simplified mixed number.

$2\frac{7}{6}$ 1 $\frac{1}{6}$

$3\frac{1}{6}$

e. Explain how you know the sum is reasonable.

I estimated the sum to be about 3, and $3\frac{1}{6}$ is close to that.

---

5. **Adriana is growing a sunflower. It is 6 ⅔ feet tall. How tall will Adriana's sunflower be if it grows 2 ¾ more feet?**

a. Add the whole numbers first.

b. Make like units to add the fractional parts.

c. Find the sum. Rewrite as a simplified mixed number, if possible.

ⓐ $6+2=8$

ⓑ $\frac{2\times4}{3\times4}=\frac{8}{12}$, $\frac{3\times3}{4\times3}=\frac{9}{12}$ $>$ $\frac{17}{12}$

ⓒ $8\frac{17}{12}$ 1 $\frac{5}{12}$

$9\frac{5}{12}$ feet

Name: KEY

1. Add. Show your work.

$2\frac{1}{4} + 1\frac{2}{5}$

$2+1=3$

$\frac{1\times5}{4\times5}=\frac{5}{20}$

$\frac{2\times4}{5\times4}=\frac{8}{20}$

$\frac{13}{20}$

$3\frac{13}{20}$

$1\frac{1}{5} + 7\frac{1}{3}$

$1+7=8$

$\frac{1\times3}{5\times3}=\frac{3}{15}$

$\frac{1\times5}{3\times5}=\frac{5}{15}$

$\frac{8}{15}$

$8\frac{8}{15}$

2. Add. Show your work.

$12\frac{5}{8} + 4\frac{1}{5}$

$12+4=16$

$\frac{5\times5}{8\times5}=\frac{25}{40}$

$\frac{1\times8}{5\times8}=\frac{8}{40}$

$\frac{33}{40}$

$16\frac{33}{40}$

$15\frac{6}{7} + 1\frac{2}{3}$

$15+1=16$

$\frac{6\times3}{7\times3}=\frac{18}{21}$

$\frac{2\times7}{3\times7}=\frac{14}{21}$

$\frac{32}{21}$

$\frac{21}{21}$ $\frac{11}{21}$

1

$17\frac{11}{21}$

3. **Louis used $2\frac{1}{4}$ cups of brown sugar to make cookies. After that, he had $3\frac{5}{6}$ cups of brown sugar left. How much brown sugar did Louis start with?**

used	left
$2\frac{1}{4}$	$3\frac{5}{6}$

?

$2 + 3 = 5$

$\frac{1\times3}{4\times3} = \frac{3}{12}$

$\frac{5\times2}{6\times2} = \frac{10}{12}$

$\frac{13}{12}$

$1 \quad \frac{1}{12}$

$6\frac{1}{12}$ cups

4. **Tina read for $2\frac{1}{4}$ hours on Monday, $3\frac{1}{3}$ hours on Tuesday, and $2\frac{2}{3}$ hours on Wednesday. How many hours did Tina read altogether?**

M	T	W
$2\frac{1}{4}$	$3\frac{1}{3}$	$2\frac{2}{3}$

?

$2 + 3 + 2 = 7$

$\frac{1\times3}{4\times3} = \frac{3}{12}$

$\frac{1\times4}{3\times4} = \frac{4}{12}$

$\frac{2\times4}{3\times4} = \frac{8}{12}$

$\frac{15}{12}$

$1 \quad \frac{3}{12}$

$8\frac{3}{12}$ hours OR $8\frac{1}{4}$ hours

G5 U3 Lesson 10

Subtract fractions making like units numerically

CITYTUTOR DC

G5 U3 Lesson 10 - Students will subtract fractions making like units numerically

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): Recently, we've been working to add fractions with unlike units by making like units numerically, without always having to draw a model. Today, we're going to switch gears just a bit and think about how we can apply that same thinking to subtraction. We don't always need an area model to think about subtracting with unlike units; we can reason numerically when we subtract similar to how we reason numerically when we add fractions.

Let's Talk (Slide 3): Look at the two expressions shown here. If you had to choose the easier of the two expressions, which expression would you choose to work with and why? Possible Student Answers, Key Points:

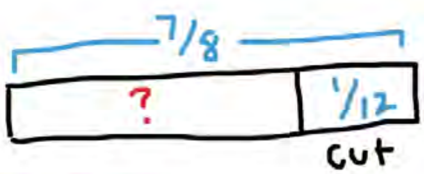
- The first expression doesn't have like units, so I'd prefer to evaluate the second expression.
- The second expression is easier. It's just 10 units minus 3 units, which I can do in my head. I already know the answer is 7 units or 7/12.

Let's see how we can use what we know to add fractions with sums greater than 2.

Let's Think (Slide 4): Today's first problem is a story problem. *(read the problem)* Now, re-read it to yourself. When you've finished, retell the story in your own words. Possible Student Answers, Key Points:

- We have a piece of yarn, and we're cutting some off to see what is left.
- We know his total amount of yarn and the part that he's cutting off. The leftover part is unknown.

I can make sure I understand the story by drawing a quick tape diagram. This helps make sure I can make sense of what is going, and it helps me see the relationship between the numbers in the story. *(draw a rectangular tape diagram as you narrate)* I can draw a rectangular bar to represent the whole piece of yarn. I know he's cutting off a piece, so I'll partition the rectangle and label the piece that is cut off.



I'll label the tape diagram with what I know from the story. *(label 7/8 with a bracket across the tape diagram, and fill in the partitioned piece as 1/12)* The unknown is what is left, so I'll label that piece with a question mark. What does this tape diagram tell us about how we can go about solving the problem? (I can subtract the 1/12 from the total of 7/8 to find the missing part)

$\frac{7}{8} - \frac{1}{12} =$

(write 7/8 - 1/12 =) We need to subtract 7/8 minus 1/12. We can't subtract these two fractions right away, because they have unlike units. Let's think about a common denominator that can help us subtract easily.

(list out multiples of 8 to 48 and multiples of 12 to 48, highlight or circle 24 and 48 in both lists) I listed out multiples and found that 8 and 12 have a lot of common multiples I can consider. From this list, which option do you think will be most efficient and why? Possible Student Answers, Key Points:

8, 16, 24, 32, 40, 48

12, 24, 36, 48

- I think 24, because it's easier to work with smaller numbers.
- Either will work to find a like unit, but 48 would be a lot of pieces to think about.

$\frac{7 \times 3}{8 \times 3} = \frac{21}{24}$

Let's use 24 as the common denominator. Our like unit will be 24ths. What can I multiply eighths by to write an equivalent fraction using 24ths? (3/3) Let's multiply the numerator of 7 and the denominator of 8 each by 3. *(write equation as shown)* 7/8 is equivalent to 21/24.

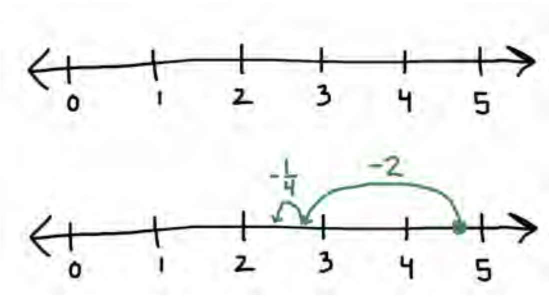
$\frac{1 \times 2}{12 \times 2} = \frac{2}{24}$

What about 1/12? What can I do to write 1/12 as twenty-fourths? (Multiply 1 x 2 to get a numerator of 2. Multiply 12 x 2 to get a denominator of 24) We can multiply 1/12 x 2/2 to find the equivalent fraction in twenty-fourths. *(write equation as shown)* We see that 1/12 is equivalent to 2/24.

$$\frac{21}{24} - \frac{2}{24} = \boxed{\frac{19}{24}\text{ ft.}}$$

(rewrite the original equation using the equivalent fractions with like units) What is 21/24 take away 2/24? (19/24) Frank has 19/24 foot of yarn left after cutting off the piece. We just solved a subtraction problem with fractions by finding like units numerically. No area model required!

Let's Think (Slide 5): Let's try another problem. This one involves subtracting mixed numbers with unlike units. *(read problem)*



We will start by estimating, just to make sure the final answer we get is reasonable. To help us estimate, we'll use a number line. *(draw number line partitioned from 0 to 5)*

(draw and label hops as you narrate) Our total is 4 ⅚, so I'll mark that as being pretty close to 5 wholes. We'll subtract 2 wholes first, which means we'll be at 2 ⅚so pretty close to 3 wholes. Then, we just have to subtract ¼. Should I draw a big hop or a little hop to subtract ¼? (¼ is not that much, so a small hop back will make the most sense) We ended up between 2 and 3 wholes. When we get our final, actual answer, we can use our estimate to check our thinking.

Now we'll find the actual answer. I know I can't subtract automatically. We still need like units. How can I find like units for these two mixed numbers? Possible Student Answers, Key Points:

- We can ignore the whole numbers for a moment, and find a like unit for the fractional parts. The whole numbers will stay the same when we rewrite them as equivalent fractions with like units.
- We can think of multiples of 4 and 6 to help us find a common denominator. I know 12 is the least common multiple of 4 and 6, so we can think of each mixed number in terms of twelfths.

$$\frac{5 \times 2}{6 \times 2} = \frac{10}{12}$$

Great thinking. For now, let's look just at the fractional parts and rewrite them as fractions with like units of twelfths. *(write equation as shown as you narrate)* I know I can multiply ⅚ x 2/2 to rewrite it as 10/12. That means 4 ⅚ is equivalent to 4 and 10/12.

$$\frac{1 \times 3}{4 \times 3} = \frac{3}{12}$$

I know I can multiply ¼ by 3/3 to rewrite it as 3/12. That means 1 ¼ is equivalent to 1 3/12. Notice how in both mixed numbers, we left the whole number intact, since we only needed to make adjustments to the fractional units.

$$4\frac{10}{12} - 2\frac{3}{12} = 2\frac{7}{12}$$

(rewrite equation with equivalent mixed numbers as shown) What is the answer, and how do you know? Possible Student Answers, Key Points:

- I know 4 minus 2 is 2. The whole number will be 2.
- I know 10 twelfths minus 3 twelfths is 7 twelfths. The answer is 2 wholes and 7/12, or 2 7/12 written as a mixed numbers.

Nicely done! I know our answer is reasonable, because when we estimated on the number line, we figured our answer would be between 2 and 3.

It's okay to use area models to think about like units when subtracting, but as we saw today, it's not always necessary. We can use multiplication to show equivalent fractions numerically instead.

Let's Try it (Slides 6 - 7): Now let's work together on subtracting fractions making like units numerically. Even though we can use area models to partition fractions into like units, it is often more efficient to use multiplication to write equivalent fractions numerically. Once we get a common denominator with each fraction, we're able to easily subtract. Let's go for it.

WARM WELCOME

Today we will subtract fractions making like units numerically.

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Let's Talk:

$$\frac{5}{6} - \frac{1}{4} \qquad\qquad \frac{10}{12} - \frac{3}{12}$$

Which expression is easier to evaluate?

Let's Think:

Frank is making friendship bracelets. A piece of yarn is 7/8 ft long. He cuts off 1/12 ft. How long is the yarn now?

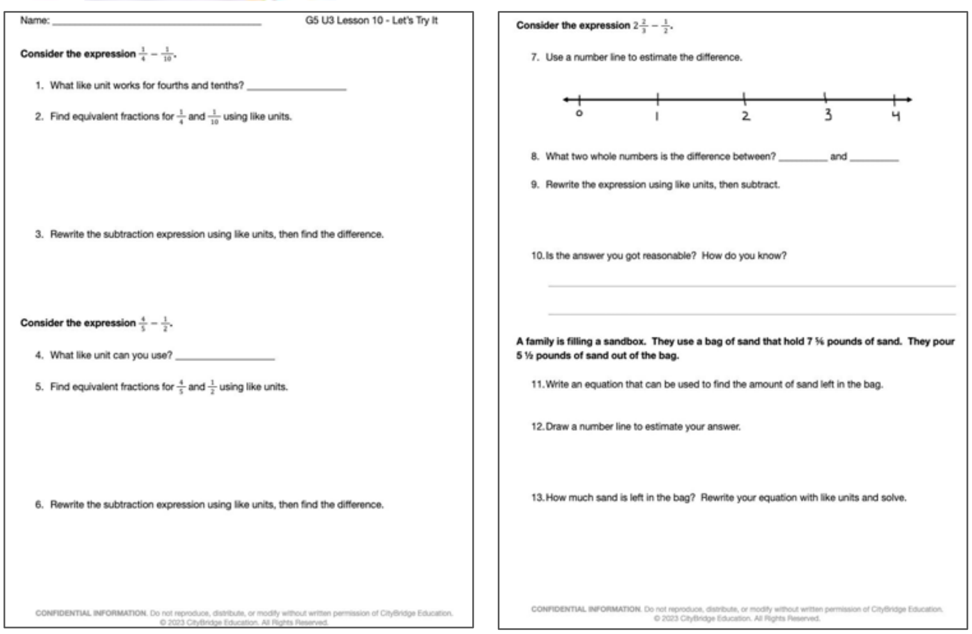
Let's Think:

Estimate, then solve.

$$4\frac{5}{6} - 2\frac{1}{4} = ?$$

Let's Try It:

Let's explore subtracting fractions making like units numerically together.



Name: ______________________ G5 U3 Lesson 10 - Let's Try It

Consider the expression $\frac{1}{4} - \frac{1}{10}$.

1. What like unit works for fourths and tenths? ____________
2. Find equivalent fractions for $\frac{1}{4}$ and $\frac{1}{10}$ using like units.
3. Rewrite the subtraction expression using like units, then find the difference.

Consider the expression $\frac{4}{5} - \frac{1}{2}$.

4. What like unit can you use? ____________
5. Find equivalent fractions for $\frac{4}{5}$ and $\frac{1}{2}$ using like units.
6. Rewrite the subtraction expression using like units, then find the difference.

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Consider the expression $2\frac{2}{3} - \frac{1}{2}$.

7. Use a number line to estimate the difference.

0 1 2 3 4

8. What two whole numbers is the difference between? ________ and ________
9. Rewrite the expression using like units, then subtract.
10. Is the answer you got reasonable? How do you know?

A family is filling a sandbox. They use a bag of sand that hold 7 ⅝ pounds of sand. They pour 5 ½ pounds of sand out of the bag.

11. Write an equation that can be used to find the amount of sand left in the bag.
12. Draw a number line to estimate your answer.
13. How much sand is left in the bag? Rewrite your equation with like units and solve.

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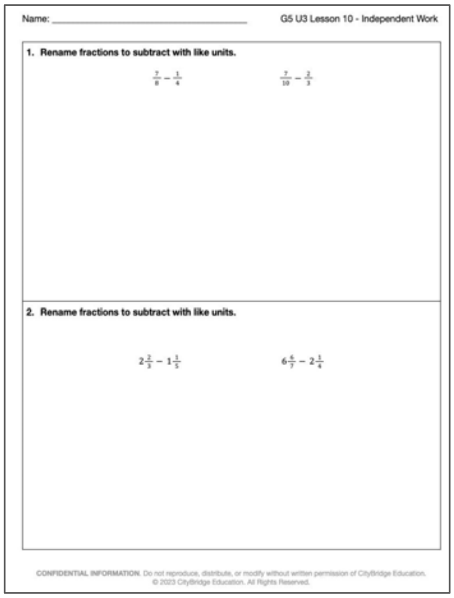
On your Own:

Now it's time to explore subtracting fractions making like units numerically on your own.



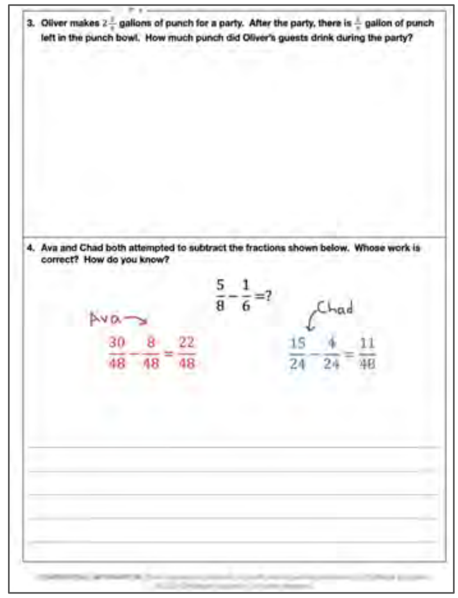
Name: ____________________ G5 U3 Lesson 10 - Independent Work

1. Rename fractions to subtract with like units.

$\frac{7}{8} - \frac{1}{4}$ $\frac{7}{10} - \frac{2}{3}$

2. Rename fractions to subtract with like units.

$2\frac{2}{3} - 1\frac{1}{5}$ $6\frac{6}{7} - 2\frac{1}{4}$



3. Oliver makes 2 [illegible] gallons of punch for a party. After the party, there is [illegible] gallon of punch left in the punch bowl. How much punch did Oliver's guests drink during the party?

4. Ava and Chad both attempted to subtract the fractions shown below. Whose work is correct? How do you know?

$\frac{5}{8} - \frac{1}{6} = ?$

Ava

$\frac{30}{48} - \frac{8}{48} = \frac{22}{48}$

Chad

$\frac{15}{24} - \frac{4}{24} = \frac{11}{48}$

Consider the expression $\frac{1}{4} - \frac{1}{10}$.

1. What like unit works for fourths and tenths? ______________________

2. Find equivalent fractions for $\frac{1}{4}$ and $\frac{1}{10}$ using like units.

3. Rewrite the subtraction expression using like units, then find the difference.

Consider the expression $\frac{4}{5} - \frac{1}{2}$.

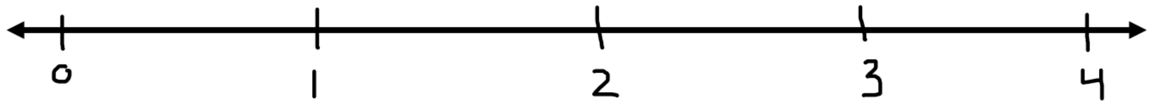
4. What like unit can you use? ______________________

5. Find equivalent fractions for $\frac{4}{5}$ and $\frac{1}{2}$ using like units.

6. Rewrite the subtraction expression using like units, then find the difference.

Consider the expression $2\frac{2}{3} - \frac{1}{2}$.

7. Use a number line to estimate the difference.



8. What two whole numbers is the difference between? ___________ and ___________

9. Rewrite the expression using like units, then subtract.

10. Is the answer you got reasonable? How do you know?

A family is filling a sandbox. They use a bag of sand that hold 7 ⅚ pounds of sand. They pour 5 ½ pounds of sand out of the bag.

11. Write an equation that can be used to find the amount of sand left in the bag.

12. Draw a number line to estimate your answer.

13. How much sand is left in the bag? Rewrite your equation with like units and solve.

1. Rename fractions to subtract with like units.

$\frac{7}{8} - \frac{1}{4}$

$\frac{7}{10} - \frac{2}{3}$

2. Rename fractions to subtract with like units.

$2\frac{2}{3} - 1\frac{1}{5}$

$6\frac{6}{7} - 2\frac{1}{4}$

3. Oliver makes $2\frac{5}{6}$ gallons of punch for a party. After the party, there is $\frac{1}{4}$ gallon of punch left in the punch bowl. How much punch did Oliver's guests drink during the party?

4. Ava and Chad both attempted to subtract the fractions shown below. Whose work is correct? How do you know?

$$\frac{5}{8} - \frac{1}{6} = ?$$

Ava

$$\frac{30}{48} - \frac{8}{48} = \frac{22}{48}$$

Chad

$$\frac{15}{24} - \frac{4}{24} = \frac{11}{24}$$

Name: KEY

Consider the expression $\frac{1}{4} - \frac{1}{10}$.

1. What like unit works for fourths and tenths? twentieths

2. Find equivalent fractions for $\frac{1}{4}$ and $\frac{1}{10}$ using like units.

$\frac{1 \times 5}{4 \times 5} = \frac{5}{20}$ $\frac{1 \times 2}{10 \times 2} = \frac{2}{20}$

3. Rewrite the subtraction expression using like units, then find the difference.

$\frac{5}{20} - \frac{2}{20} = \frac{3}{20}$

Consider the expression $\frac{4}{5} - \frac{1}{2}$.

4. What like unit can you use? tenths

5. Find equivalent fractions for $\frac{4}{5}$ and $\frac{1}{2}$ using like units.

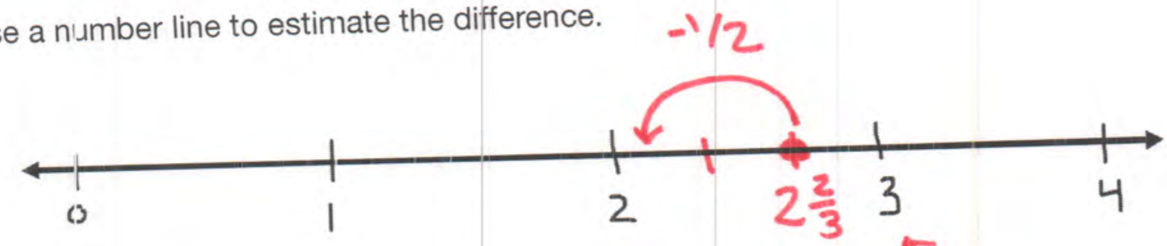
$\frac{4 \times 2}{5 \times 2} = \frac{8}{10}$ $\frac{1 \times 5}{2 \times 5} = \frac{5}{10}$

6. Rewrite the subtraction expression using like units, then find the difference.

$\frac{8}{10} - \frac{5}{10} = \frac{3}{10}$

Consider the expression $2\frac{2}{3} - \frac{1}{2}$.

7. Use a number line to estimate the difference.



8. What two whole numbers is the difference between? ___2___ and ___3___

9. Rewrite the expression using like units, then subtract.

$\frac{2\times2}{3\times2} = \frac{4}{6}$

$\frac{1\times3}{2\times3} = \frac{3}{6}$

$2\frac{4}{6} - \frac{3}{6} = 2\frac{1}{6}$

10. Is the answer you got reasonable? How do you know?

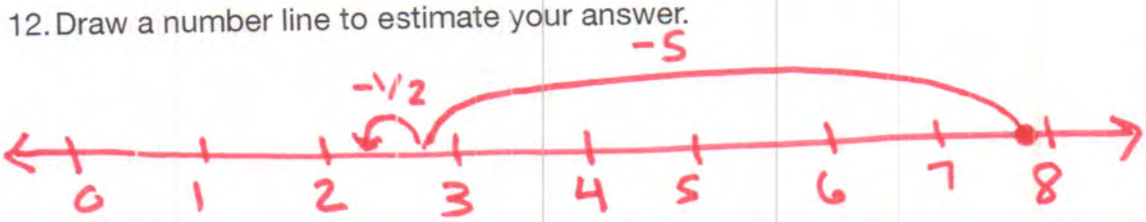
Yes! I estimated that the answer would be a little greater than 2.

A family is filling a sandbox. They use a bag of sand that hold 7 ⅚ pounds of sand. They pour 5 ½ pounds of sand out of the bag.

11. Write an equation that can be used to find the amount of sand left in the bag.

$7\frac{5}{6} - 5\frac{1}{2} = ?$

12. Draw a number line to estimate your answer.



13. How much sand is left in the bag? Rewrite your equation with like units and solve.

$\frac{1\times3}{2\times3} = \frac{3}{6}$

$7\frac{5}{6} - 5\frac{3}{6} = 2\frac{2}{6}$ lb. or $2\frac{1}{3}$ lb.

Name: KEY

1. Rename fractions to subtract with like units.

$\frac{7}{8} - \frac{1}{4}$

$\frac{1 \times 2}{4 \times 2} = \frac{2}{8}$

$\frac{7}{8} - \frac{2}{8} = \frac{5}{8}$

$\frac{7}{10} - \frac{2}{3}$

$\frac{7 \times 3}{10 \times 3} = \frac{21}{30}$

$\frac{2 \times 10}{3 \times 10} = \frac{20}{30}$

$\frac{21}{30} - \frac{20}{30} = \frac{1}{30}$

2. Rename fractions to subtract with like units.

$2\frac{2}{3} - 1\frac{1}{5}$

$\frac{2 \times 5}{3 \times 5} = \frac{10}{15}$

$\frac{1 \times 3}{5 \times 3} = \frac{3}{15}$

$2\frac{10}{15} - 1\frac{3}{15} = 1\frac{7}{15}$

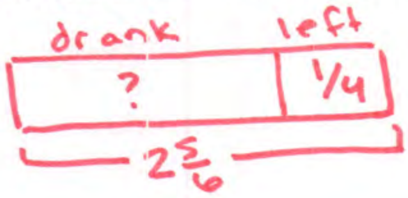
$6\frac{6}{7} - 2\frac{1}{4}$

$\frac{6 \times 4}{7 \times 4} = \frac{24}{28}$

$\frac{1 \times 7}{4 \times 7} = \frac{7}{28}$

$6\frac{24}{28} - 2\frac{7}{28} = 4\frac{17}{28}$

3. **Oliver makes $2\frac{5}{6}$ gallons of punch for a party. After the party, there is $\frac{1}{4}$ gallon of punch left in the punch bowl. How much punch did Oliver's guests drink during the party?**



$$\frac{5\times 2}{6\times 2}=\frac{10}{12}$$

$$\frac{1\times 3}{4\times 3}=\frac{3}{12}$$

$$2\frac{10}{12}-\frac{3}{12}=2\frac{7}{12}$$

gallons

4. **Ava and Chad both attempted to subtract the fractions shown below. Whose work is correct? How do you know?**

$$\frac{5}{8}-\frac{1}{6}=?$$

Ava

$$\frac{30}{48}-\frac{8}{48}=\frac{22}{48}$$

Chad

$$\frac{15}{24}-\frac{4}{24}=\frac{11}{\cancel{48}\ 24}$$

They are both correct. They just used different common denominators. Their answers, $\frac{22}{48}$ and $\frac{11}{24}$, are equivalent fractions.

G5 U3 Lesson 11

Subtract fractions greater than or equal to 1

Warm Welcome (Slide 1): Tutor choice

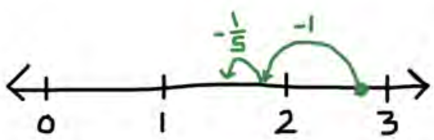
Frame the Learning/Connect to Prior Learning (Slide 2): In our previous lesson, we saw how we can rewrite subtraction problems with unlike units numerically to make equivalent fractions. Today, we'll use the same thinking. The only difference is that the problems will involve numbers greater than 1, and we may find it useful to decompose mixed numbers or rename mixed numbers as fractions greater than 1 in some instances. I'll show you what I mean when we get to that!

Let's Talk (Slide 3): Look at the two expressions shown here. Which expression would say is easier to evaluate and why? Possible Student Answers, Key Points:

- I'm not sure. They both have like units, and I know like units help me subtract.
- I think the first expression is easier. I can decompose and subtract the whole numbers to think about 2 - 1. Then the fractions would just be ¾ - ¼. In the other expression, the fraction parts would be ¼ - ¾, which seems trickier.

Let's see how we can use what we know to subtract fractions greater than or equal to 1.

Let's Think (Slide 4): This problem wants us to subtract 2 ¾ minus 1 ⅕. Let's use a number line to estimate before we calculate the actual difference.



(sketch and label number line from 0 to 3, and model subtraction while narrating) The total is 2 ¾, so I'll start by marking a point close to 3 wholes. I'm thinking of 1 ⅕ decomposed into 1 and a fractional part of ⅕. I'll make a hop back of 1, so now I'm around 2 ¾. Then I'll make a hop back of ⅕. ⅕ is a relatively small piece, so I'll only hop a little bit. I know I won't make it all the way back to the 1 on the number line. What does our number line estimate tell us about our answer? Possible Student Answers, Key Points:

- The answer should be about 1 ½.
- The answer will be between 1 whole and 2 wholes.

Let's calculate, and hopefully we end up with an answer that is reasonable based on our estimate. What's a common unit we can use to help us subtract 1 ⅕ from 2 ¾? (twentieths) I know 20 is a multiple of both denominators, so I can think of fifths and fourths as being partitioned into 20 pieces. Let's write equivalent fractions numerically. I won't bother with the whole number in each mixed number for now.

$$\frac{3 \times 5}{4 \times 5} = \frac{15}{20}$$

$$\frac{1 \times 4}{5 \times 4} = \frac{4}{20}$$

Starting with ¾, I know I can multiply the numerator by 5 and the denominator by 5 to represent an equivalent fraction partitioned into 20 pieces. *(write equation as shown)* What is ¾ as an equivalent fraction with a denominator of 20? (15/20) For ⅕, I can multiply both the numerator and denominator by what? (4, I know 5 x 4 makes 20) So ⅕ in terms of twentieths would be what? (4/20) *(write equation as shown)* ⅕ partitioned into twentieths is 4/20.

$$2\frac{15}{20} - 1\frac{4}{20} = 1\frac{11}{20}$$

(rewrite original equation using equivalent fractions) Now we can think of our problem as being 2 15/20 minus 1 4/20. Our difference is 1 and 11/20. Is this answer reasonable? Possible Student Answers, Key Points:

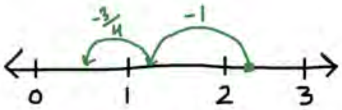
- Yes, on our number line we estimated that our answer would be between 1 and 2, or close to 1 ½. 1 and 11/20 matches our estimate.

Nice work! We just subtracted fractions greater than or equal to 1.

Let's Think (Slide 5): Take a look at this problem. What do you notice is the same or different compared to the previous problem? Possible Student Answers, Key Points:

- It's subtraction. It involves two mixed numbers. The whole numbers are the same as last time.
- I notice the fractional parts are just switched. The total now has a smaller fractional part than what we're subtracting. We can still use twentieths.

Excellent noticings. This problem looks similar, and in a lot of ways it is. We're going to notice something different about this problem in a couple minutes, and I'll show you two different ways we can think about it.



First, let's estimate like we did with the previous problem. *(draw and label a number line from 0 to 3, and model the subtraction as you narrate)* We'll start at 2 ⅕, which means I'll mark a point a little bit beyond 2 wholes. I'll subtract 1 ¾ in parts. I can hop back 1 whole, which I know lands me at 1 ⅕. Then I'll hop back ¾. What should that hop look like? Possible Student Answers, Key Points:

- ¾ is almost a whole, so it should be about the same size as our first hop, but a little less.
- You should hop over the 1 tick mark. We're only ⅕ away from that tick mark, and ¾ is more than ⅕. We'll want to cross over the 1 and land between 0 and 1.

We'll hop ¾, which will move us over the 1 whole tick mark. Our estimate for this problem looks like it's between 0 and 1, and maybe somewhere close to ½. Let's actually do the math and figure out if our answer is reasonable.

This problem doesn't have like units, so we know we'll need to make like units. The nice thing is, we've actually already converted these fractions into fractions with like units or common denominators. We don't need to do that work again, since we did it on the previous problem. How can I rewrite this problem with like units of twentieths? Keep in mind, the fractions are on different whole numbers than before. (2 4/20 minus 1 15/20) *(write the expression)*

$2\frac{4}{20} - 1\frac{15}{20}$

If I pause to think about this, I notice something different about this problem. I know I can subtract 2 - 1, that's no big deal. Look at the fractional parts. I can't subtract 4/20 minus 15/20, because I don't have enough to subtract. The first fractional part is smaller than the part I'm trying to take away. Don't worry! We can work with this. Let me show you two ways to think about it.

If I notice that my fractional parts cannot be subtracted because the fractional part on my total is smaller than the fractional part I'm trying to subtract, I can subtract the fractional part from the *whole number* instead of subtracting it from the fractional part. Let me show you what I mean.

$2\frac{1}{5} - 1\frac{3}{4}$

$2 \quad \frac{1}{5}$

$2 - 1\frac{3}{4} = \frac{1}{4}$

I'm going to go back to our original problem before we found equivalent fractions. *(write 2 ⅕ 1 ¾)* I'll decompose the 2 ⅕ into 2 and ⅕ using a number bond. *(show number bond)* Now, I'm going to think about 2 wholes - 1 ¾.

What is 2 - 1 ¾? *(2 - 1 ¾ =)* Possible Student Answers, Key Points:

- I can think of it as 2 - 1 - ¾. 2 minus 1 is 1. Then 1 - ¾ is ¼.
- I know 1 ¾ is only ¼ away from 2. So 2 - 1 ¾ is ¼.

$\frac{1}{4} + \frac{1}{5}$

$\frac{5}{20} + \frac{4}{20} = \frac{9}{20}$

We took everything we needed to away from the whole number. 2 - 1 ¾ leaves us with ¼. We can't forget that we also have ⅕ left that we didn't use to subtract. So to find our answer, we just have to add ¼ with the leftover ⅕. *(write ¼ + ⅕)* What is ¼ and ⅕ if we think of them with like units? Use your pencil and paper if that helps. (¼ is 5/20 and ⅕ is 4/20) *(write 5/20 + 4/20 =)* Great, so our answer is 5/20 + 4/20 = 9/20.

If we don't have enough fractional parts to subtract with, we can subtract from the whole number instead.

Let me show you one other way to think about a situation like this, that way you have options when you run into this same thing on your own. *(rewrite 2 ⅕ 1 ¾, and consider a different color for this strategy)*

$2\frac{1}{5} - 1\frac{3}{4}$

We know by now that the fractional unit in our total is too small to subtract the fractional unit in 1 ¾. Another strategy we can use in this case, is we can rewrite each mixed number as a fraction greater than 1, or improper fraction. When we write mixed numbers as fractions greater than 1, or improper fractions, it shows us how many fractional units are in the *entire* mixed number, which makes it easy to subtract.

$2\frac{1}{5}$: $\frac{10}{5} \quad \frac{1}{5}$

$1\frac{3}{4}$: $\frac{4}{4} \quad \frac{3}{4}$

Let's think about 2 ⅕ first. How many fifths are in 2 wholes? (10 fifths, 10/5 = 2) 10/5 is the same as 2 wholes. *(write number bond showing 10/5 and ⅕)* So, we can think of 2 ⅕ as being 10/5 and ⅕ which means 2 ⅕ is the same as 11/5. What about 1 ¾? I know 1 whole is the same as 4/4. I can think of 1 ¾ as being 4/4 and ¼ *(write number bond showing 4/4 and ¾)* *1 ¾ is the same as 7/4.*

We can rewrite our problem now using the improper fractions, or fractions greater than 1, instead of the mixed numbers. *(write 11/5 - 7/4)* Now, I don't have to worry about having enough fractional units, because I put each entire mixed number into a fraction showing all the fractional units in the mixed number. How can I subtract 11/5 - 7/4 now? Use pencil and paper if that helps before you explain. Possible Student Answers, Key Points:

$$\frac{11}{5} - \frac{7}{4}$$

$$\frac{44}{20} - \frac{35}{20}$$

$$\frac{9}{20}$$

- I know I need to get a like unit of 20. I can multiply 11/5 by 4/4 to make an equivalent fraction of 44/20. I can multiply 7/4 by 5/5 to make an equivalent fraction of 35/20. Once I have like units, I can subtract.

(write 44/20 - 35/20) 11/5 is equivalent to 44/20. 7/4 is equivalent to 35/20. 44 twentieths minus 35 twentieths is 9 twentieths or 9/20. That's the same answer we got when we used the other strategy.

When we're subtracting with mixed numbers, and the fractional unit we're subtracting from doesn't have enough units to subtract with, we can either subtract from the whole in our mixed number, OR we can rewrite both mixed numbers as fractions greater than 1. Either strategy works, so I encourage you to try both at some point during our practice to see which one you like best. You might find it depends on the problem.

Keep in mind, like we saw in our first problem today, the two strategies we just explored aren't always necessary. Sometimes you have enough fractional units to subtract without needing any additional steps. Stop and think about your solution pathway before you tackle each problem moving forward.

Let's Try it (Slides 6 - 7): Now let's work together on subtracting fractions greater than or equal to 1. To make sure our work makes sense, we can always estimate using a number line first. If we don't have enough fractional units to subtract, we know we can subtract the fractional unit from a whole *or* we can rewrite mixed numbers as fractions greater than 1. Either strategy will make sure we have enough fractional pieces to subtract with. Let's keep all this in mind and work carefully to complete a few more problems.

WARM WELCOME

Today we will subtract fractions greater than or equal to 1.

Let's Talk:

Which expression is easier to evaluate?

$$2\frac{3}{4} - 1\frac{1}{4}$$

$$2\frac{1}{4} - 1\frac{3}{4}$$

Let's Think:

Estimate, then evaluate.

$$2\frac{3}{4} - 1\frac{1}{5}$$

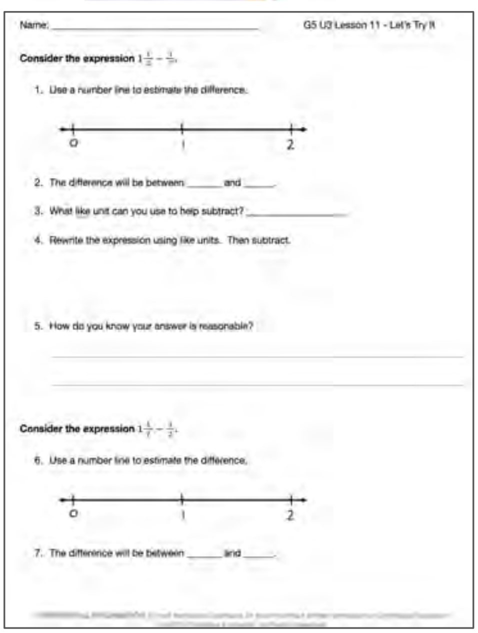
Let's Think:

Estimate, then evaluate.

$$2\frac{1}{5} - 1\frac{3}{4}$$

Let's Try It:

Let's explore subtracting fractions greater than or equal to 1 together.



Name: ______________________ G5 U3 Lesson 11 - Let's Try It

Consider the expression [illegible].

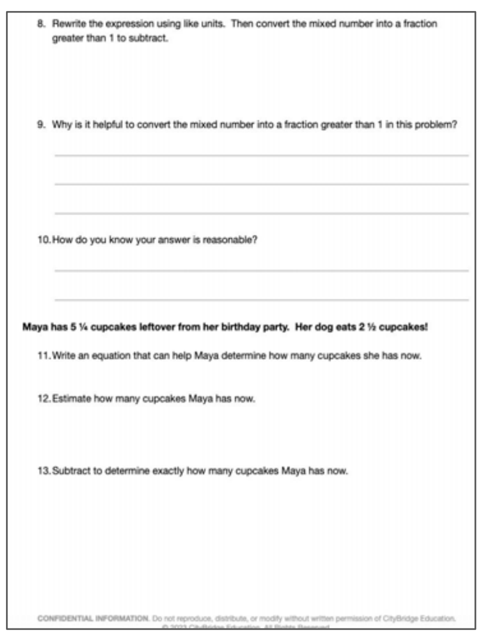
1. Use a number line to estimate the difference.

2. The difference will be between ______ and ______.
3. What like unit can you use to help subtract? ______________
4. Rewrite the expression using like units. Then subtract.
5. How do you know your answer is reasonable?

Consider the expression [illegible].

6. Use a number line to estimate the difference.

7. The difference will be between ______ and ______.



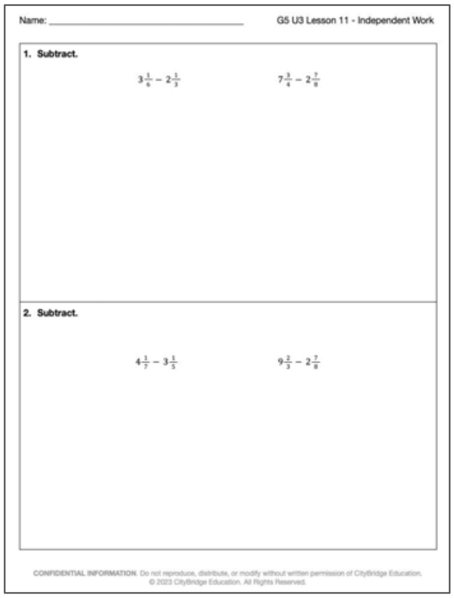
8. Rewrite the expression using like units. Then convert the mixed number into a fraction greater than 1 to subtract.
9. Why is it helpful to convert the mixed number into a fraction greater than 1 in this problem?
10. How do you know your answer is reasonable?

Maya has 5 ¼ cupcakes leftover from her birthday party. Her dog eats 2 ½ cupcakes!

11. Write an equation that can help Maya determine how many cupcakes she has now.
12. Estimate how many cupcakes Maya has now.
13. Subtract to determine exactly how many cupcakes Maya has now.

On your Own:

Now it's time to explore subtracting fractions greater than or equal to 1 on your own.



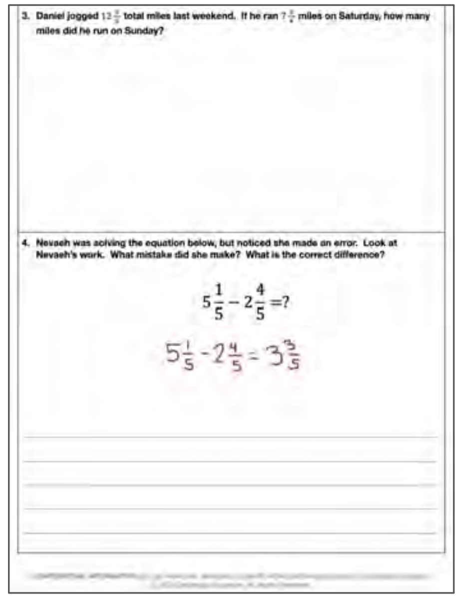
Name: ______________________ G5 U3 Lesson 11 - Independent Work

1. Subtract.

$3\frac{1}{6} - 2\frac{1}{3}$ $\quad$ $7\frac{3}{4} - 2\frac{7}{8}$

2. Subtract.

$4\frac{1}{7} - 3\frac{1}{5}$ $\quad$ $9\frac{2}{3} - 2\frac{7}{8}$



3. Daniel jogged 12 [illegible] total miles last weekend. If he ran 7 [illegible] miles on Saturday, how many miles did he run on Sunday?

4. Nevaeh was solving the equation below, but noticed she made an error. Look at Nevaeh's work. What mistake did she make? What is the correct difference?

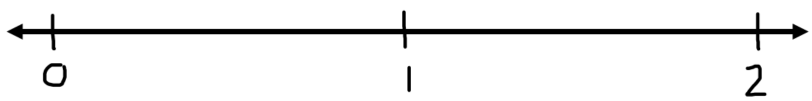
$$5\frac{1}{5} - 2\frac{4}{5} = ?$$

$5\frac{1}{5} - 2\frac{4}{5} = 3\frac{3}{5}$

Name: ____ G5 U3 Lesson 11 - Let's Try It

Consider the expression $1\frac{1}{2} - \frac{1}{7}$.

1. Use a number line to *estimate* the difference.



2. The difference will be between ________ and _______.

3. What like unit can you use to help subtract? _______________________

4. Rewrite the expression using like units. Then subtract.

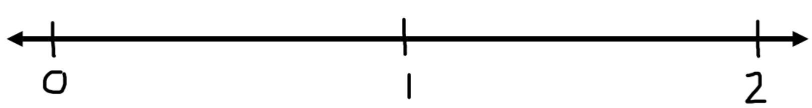
5. How do you know your answer is reasonable?

____

____

Consider the expression $1\frac{1}{7} - \frac{1}{2}$.

6. Use a number line to *estimate* the difference.



7. The difference will be between ________ and _______.

8. Rewrite the expression using like units. Then convert the mixed number into a fraction greater than 1 to subtract.

9. Why is it helpful to convert the mixed number into a fraction greater than 1 in this problem?

10. How do you know your answer is reasonable?

Maya has $5\frac{1}{4}$ cupcakes leftover from her birthday party. Her dog eats $2\frac{1}{2}$ cupcakes!

11. Write an equation that can help Maya determine how many cupcakes she has now.

12. Estimate how many cupcakes Maya has now.

13. Subtract to determine exactly how many cupcakes Maya has now.

1. Subtract.

$3\frac{1}{6} - 2\frac{1}{3}$ $7\frac{3}{4} - 2\frac{7}{8}$

2. Subtract.

$4\frac{1}{7} - 3\frac{1}{5}$ $9\frac{2}{3} - 2\frac{7}{8}$

3. Daniel jogged $12\frac{3}{5}$ total miles last weekend. If he ran $7\frac{3}{4}$ miles on Saturday, how many miles did he run on Sunday?

4. Nevaeh was solving the equation below, but noticed she made an error. Look at Nevaeh's work. What mistake did she make? What is the correct difference?

$$5\frac{1}{5} - 2\frac{4}{5} = ?$$

$$5\frac{1}{5} - 2\frac{4}{5} = 3\frac{3}{5}$$

Name: KEY

Consider the expression $1\frac{1}{2} - \frac{1}{7}$.

1. Use a number line to *estimate* the difference.

2. The difference will be between 1 and 2.

3. What like unit can you use to help subtract? fourteenths

4. Rewrite the expression using like units. Then subtract.

$\frac{1\times7}{2\times7} = \frac{7}{14}$

$\frac{1\times2}{7\times2} = \frac{2}{14}$

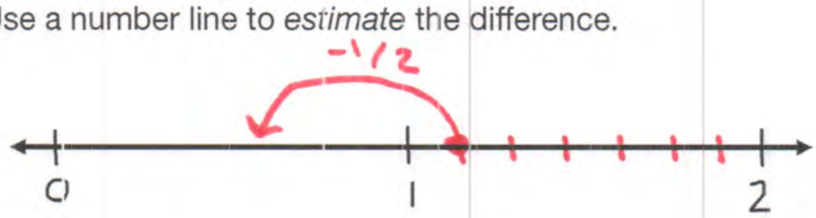
$1\frac{7}{14} - \frac{2}{14} = 1\frac{5}{14}$

5. How do you know your answer is reasonable?

I estimated my answer would be a little more than 1, but less than $1\frac{1}{2}$.

Consider the expression $1\frac{1}{7} - \frac{1}{2}$.

6. Use a number line to *estimate* the difference.



7. The difference will be between 0 and 1.

8. Rewrite the expression using like units. Then convert the mixed number into a fraction greater than 1 to subtract.

$\frac{1}{7}=\frac{2}{14}$

$\frac{1}{2}=\frac{7}{14}$

$1\frac{2}{14}-\frac{7}{14} \longrightarrow \frac{16}{14}-\frac{7}{14}=\frac{9}{14}$

$\frac{14}{14}$ $\frac{2}{14}$

9. Why is it helpful to convert the mixed number into a fraction greater than 1 in this problem?

When I made like units, I didn't have enough 14ths in the fractional part to take $\frac{7}{14}$ away. Rewriting as a fraction >1 fixed that!

10. How do you know your answer is reasonable?

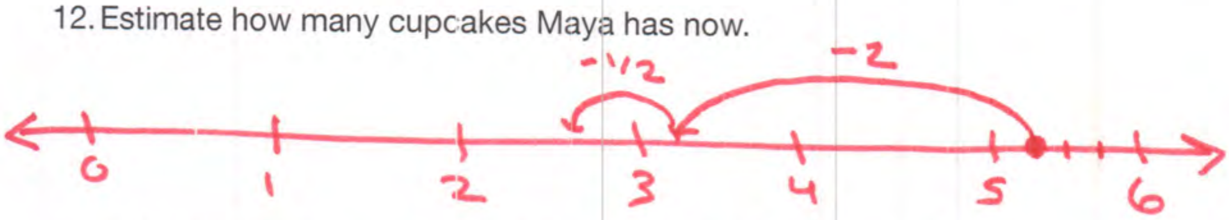
My number line estimate was about 1/2, so 9/14 is close.

Maya has 5 ¼ cupcakes leftover from her birthday party. Her dog eats 2 ½ cupcakes!

11. Write an equation that can help Maya determine how many cupcakes she has now.

$5\frac{1}{4}-2\frac{1}{2}=?$

12. Estimate how many cupcakes Maya has now.



13. Subtract to determine exactly how many cupcakes Maya has now.

$\frac{1\times2}{2\times2}=\frac{2}{4}$

$5\frac{1}{4}-2\frac{2}{4}$

4 $\frac{4}{4}$

$4\frac{5}{4}-2\frac{2}{4}=2\frac{3}{4}$

Name: KEY

1. Subtract.

$3\frac{1}{6} - 2\frac{1}{3}$

$\frac{1\times2}{3\times2} = \frac{2}{6}$

$3\frac{1}{6} - 2\frac{2}{6}$

$2\frac{6}{6}$

$2\frac{7}{6} - 2\frac{2}{6} = 0\frac{5}{6}$

$\frac{5}{6}$

$7\frac{3}{4} - 2\frac{7}{8}$

$\frac{3\times2}{4\times2} = \frac{6}{8}$

$7\frac{6}{8} - 2\frac{7}{8}$

$6\frac{8}{8}$

$6\frac{14}{8} - 2\frac{7}{8}$

$4\frac{7}{8}$

2. Subtract.

$4\frac{1}{7} - 3\frac{1}{5}$

$\frac{1\times5}{7\times5} = \frac{5}{35}$

$\frac{1\times7}{5\times7} = \frac{7}{35}$

$4\frac{5}{35} - 3\frac{7}{35}$

$3\frac{35}{35}$

$3\frac{40}{35} - 3\frac{7}{35} = 0\frac{33}{35}$

$\frac{33}{35}$

$9\frac{2}{3} - 2\frac{7}{8}$

$\frac{2\times8}{3\times8} = \frac{16}{24}$

$\frac{7\times3}{8\times3} = \frac{21}{24}$

$9\frac{16}{24} - 2\frac{21}{24}$

$8\frac{24}{24}$

$8\frac{40}{24} - 2\frac{21}{24} = 6\frac{19}{24}$

3. **Daniel jogged $12\frac{3}{5}$ total miles last weekend. If he ran $7\frac{3}{4}$ miles on Saturday, how many miles did he run on Sunday?**

Sat	Sun
7 3/4	?

$12\frac{3}{5}$

$\frac{3\times4}{5\times4}=\frac{12}{20}$

$\frac{3\times5}{4\times5}=\frac{15}{20}$

$12\frac{3}{5}-7\frac{3}{4}$

$12\frac{12}{20}-7\frac{15}{20}$

$11\frac{20}{20}$

$11\frac{32}{20}-7\frac{15}{20}$

$4\frac{17}{20}$ miles

4. **Nevaeh was solving the equation below, but noticed she made an error. Look at Nevaeh's work. What mistake did she make? What is the correct difference?**

$$5\frac{1}{5}-2\frac{4}{5}=?$$

$5\frac{1}{5}-2\frac{4}{5}=3\frac{3}{5}$

$4\frac{5}{5}$

$4\frac{6}{5}-2\frac{4}{5}=2\frac{2}{5}$

Nevaeh subtracted even though she didn't have enough fifths. She should rewrite $5\frac{1}{5}$ as $4\frac{6}{5}$ so she has enough to subtract $\frac{4}{5}$. The actual answer is $2\frac{2}{5}$.

G5 U3 Lesson 12

Use fraction benchmark numbers to assess reasonableness of addition and subtraction equations

CITYTUTOR DC

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): We've been adding and subtracting fractions for several lessons now, and our skills are really growing. As we've added and subtracted, we've often used number lines to estimate sums and differences and to assess the reasonableness of our answers. Today we'll think about how we can use benchmark numbers like 0, halves, and wholes to estimate and quickly compare sums and differences.

Let's Talk (Slide 3): To get your brain warmed up, take a second and look at these expressions. Which expressions here would be greater than 1 whole? I don't want you to solve. You can use what you know about units. You can picture a visual model or a number line to help you. Use your best judgment and reason about which expressions are greater than 1 whole. Possible Student Answers, Key Points:

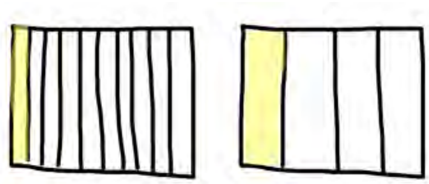
- I know ⅝ + ¾ would be greater than 1, because both addends are more than ½.
- ⅚ + ⅝ would be more than 1 whole, because both the addends are already close to 1 whole.
- 2 - 5/7 would be a whole, because 5/7 is less than 1. If I picture a number line, I'd start at 2 and I'd hop back less than 1 whole, so I know the difference would be greater than 1 whole.

NOTE: If the student misses an expression or selects an incorrect expression, that's okay at this point. You can use the reasoning below or something similar to clarify.

-½ + 3/10 would be less than 1 whole. 3/10 is less than ½. If I add ½ with something less than ½, I won't quite make a whole.
-⅝ + ¾ is greater than 1 whole, because ⅝ is greater than ½ and ¾ is greater than ½. If I combined them, I'll have more than 1 whole.
-1 ½ - ⅝ would be less than 1 whole. ⅝ is more than the ½. If I picture a number line, I'd start at 1 ½, then I'd have to hop back more than ½ which would put me at a point less than 1 whole.
-⅚ + ⅞ would be more than 1 whole, since both fractions are already close to being 1 whole.
-2 - 5/7 is more than 1 whole. I know 2 - 1 would be 1, so 2 minus something less than 1 will be a little more than 1 whole.

Let's use some of this thinking to help us answer a couple questions that involve using benchmark fractions to estimate.

Let's Think (Slide 4): Here we have two expressions. We are asked to determine whether each expression would be greater than, less than, or equal to ½. We could actually calculate each sum or difference, but today we'll focus on using estimation. Let's think about the first expression.



We need to think about whether 1/10 + ¼ is greater than, less than, or equal to ½. I can start by picturing each fraction in my head or with a quick sketch. I'll sketch what I'm picturing in my head, since you can't see what I'm thinking. *(sketch an area model showing 1/10 and another showing ¼)* I know 1/10 would be 1 piece out of 10. I know ¼ would be 1 piece out of 4. By picturing the units, I can already get a sense that if I put them together, this would be less than ½.

If I'm not sure, I can use this mental picture to help me consider benchmarks. What do you notice about the size of these two fractions? Possible Student Answers, Key Points:

- They're both unit fractions. They're both pretty small compared to a whole. 1/10 is almost 0.

$\frac{1}{10} \approx 0$

$0 + \frac{1}{4} = \frac{1}{4}$

If I'm thinking about fraction benchmarks, I know that 1/10 is not a lot. I can think of it as being almost 0. *(write 1/10 ≈ 0)* Thinking of 1/10 as being approximately 0, can help me mentally calculate an estimate.

I can think of the original expression as being about 0 + ¼. 0 + ¼ = ¼, so I know the sum would be close to ¼. *(write 0 + ¼ = ¼)* By estimating, I can see that the sum would be less than ½. I didn't need to calculate it exactly to answer the question.

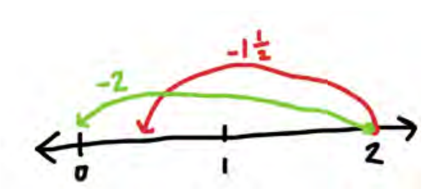
Based on what I just did, can you describe how we used a benchmark number to estimate the sum? Possible Student Answers, Key Points:

- We thought about both fractions we were adding and pictured them. When I pictured them, I knew that 1/10 was really close to 0. We thought of 1/10 as being 0, which made it easy to estimate our sum as being about 0 + ¼.

Let's try using similar thinking to consider the second expression, 2 - 1 ⅝ Let's start by thinking about both our numbers. The first number is 2. I can just leave that as 2, since 2 is a friendly benchmark number when dealing with fractions. Now I need to think about a benchmark that is close to 1 ⅝ I know I can think of 1 ⅝as being pretty close to 1 ½, and I can also think of 1 ⅝as being 1 piece away from 2 wholes. So 1 ⅝s close to a benchmark of 1 ½ or 2. *(write 1 ⅝≈ 1 ½ or 2)*

$1\frac{2}{3} \approx 1\frac{1}{2}$ OR 2

Last time we visualized using area models. For this one, let's visualize a number line instead. I'm thinking about this problem using benchmarks in my head, but since you can't see what I'm thinking, I'll draw what I'm picturing. *(draw and label number line from 0 to 2)*



I can think of this problem as being about 2 - 2 or about 2 - 1 ½. I know 2 - 2 would be 0. *(draw -2 on the number line using one color)* If I used my other benchmark and thought of 1 ⅝ as 1 ½, I can picture starting at 2 and hopping back 1 then ½. I know 2 - 1 ½ would be ½. *(draw -1 ½ on the number line in a different color)* How can I use these estimates to determine whether the answer would be more or less than ½? Possible Student Answers, Key Points:

- If 2 - 2 = 0 and 2 - 1 ½ = ½. I can think of 0 as being a low estimate and ½ as being a high estimate, so my actual answer should be somewhere between those. That means the actual answer is going to be less than ½.

Our benchmark estimates made it easy to do some close calculations in our heads. We knew the answer would be about 0 or about ½ without needing to calculate it exactly. So 2 - 1 ⅝will be less than ½.

Benchmark fractions are a helpful way to get us thinking about what our actual answer will be close to.

Let's Think (Slide 5): This next problem shows us two expressions. It wants us to use estimation to determine whether the first expression is less than, greater than, or equal to the other expression. Let's use benchmark numbers to help us think about each expression. The first expression shows 5 9/10 minus 2 ⅝ Picture each fraction in your mind as an area model or on a number line.

What benchmark fraction or whole number is really close to 5 9/10? How do you know? Possible Student Answers, Key Points:

- It's really close to 6.
- 5 and 9/10 is one small piece away from being 6 wholes.

$5\frac{9}{10} \approx 6$

$2\frac{1}{8} \approx 2$

$6 - 2 = 4$

We can think of 5 9/10 as being approximately 6 wholes. *(write 5 9/10 ≈ 6)* What benchmark fraction or whole number is really close to 2 1/8? How do you know? Possible Student Answers, Key Points:

- It's really close to 2.
- 2 ⅝s just one small piece more than 2. It's a little bit past 2 on a number line.

We can think of 2 1/8 as being approximately 2 wholes. *(write 2 1/8 ≈ 2)* So, using our benchmarks, we can estimate that the difference between 5 9/10 and 2 ⅝will be about the same as 6 - 2. The value should be about 4. *(write 6 - 2 = 4)*

Let's look at the other expression. This expression is asking for the sum of 1 ½ and 1 5/7. Let's leave 1 ½ alone, since halves are typically easy benchmarks to picture and think about. *(write 1 ½ and put a check by it)*

$1\frac{1}{2}$ ✓

What benchmark fraction or whole number is really close to 1 5/7? How do you know? Possible Student Answers, Key Points:

- It's close to 1 ½, because it's almost in the middle of 1 and 2 when I picture it on a number line.
- It's close to 2, because it's only 2 sevenths away from that being 2 wholes.

$1\frac{5}{7} \approx 2$

1 5/7 is close to 1 ½ and it's close to 2. Either benchmark would be appropriate. Let's use 2 for right now. *(write 1 5/7 ≈ 2)* Thinking of the expression in terms of benchmarks, I can think of it as being about 1 ½ + 2. What is 1 ½ + 2? (3 ½) Without calculating exactly, I know this expression is equal to about 3 ½.

$1\frac{1}{2} + 2 = 3\frac{1}{2}$

We didn't calculate either expression's exact value, but using benchmark numbers, we are able to compare them with some degree of certainty. Based on our estimation, I know 4 is greater than 3 ½. So I know the first expression is greater than the second expression. *(fill in comparison with > symbol)*

Benchmark numbers help us get a close sense of a value without having to perform every calculation. They allow us to use mental math to get an idea of a sum or difference.

Let's Try it (Slides 6 - 7): Now let's work together on using fraction benchmark numbers to assess the reasonableness of addition and subtraction expressions. We'll think about whole numbers and halves that each fraction is close to. Picturing an area model or a number line can be a good way to find a close benchmark if you're not immediately sure which benchmark to use. You seem ready to give it a try!

WARM WELCOME

Today we will use fraction benchmark numbers to assess the reasonableness of addition and subtraction equations.

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Let's Talk:

Without solving, which expressions would be greater than 1 whole?

$$\frac{1}{2} + \frac{3}{10}$$

$$\frac{5}{8} + \frac{3}{4}$$

$$1\frac{1}{2} - \frac{2}{3}$$

$$\frac{5}{6} + \frac{7}{8}$$

$$2 - \frac{5}{7}$$

Let's Think:

Determine whether each expression below is greater than, less than, or equal to a half.

$$\frac{1}{10} + \frac{1}{4}$$

$$2 - 1\frac{2}{3}$$

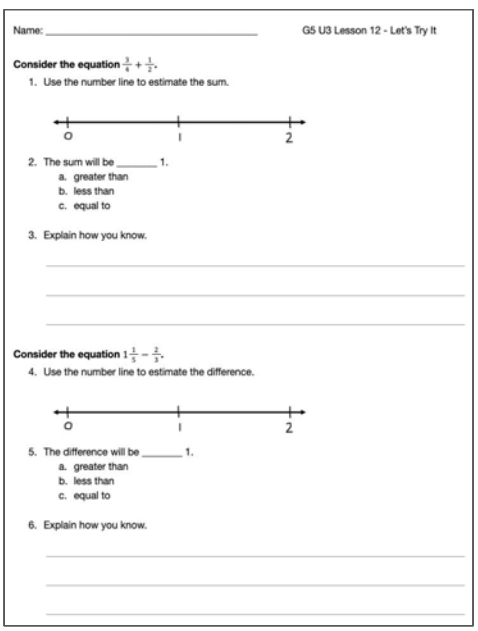
Let's Think:

Estimate the value of each expression to compare using <, >, or =.

$$5\frac{9}{10} - 2\frac{1}{8} \_\_\_\_\_ 1\frac{1}{2} + 1\frac{5}{7}$$

Let's Try It:

Let's explore using fraction benchmark numbers to assess the reasonableness of addition and subtraction equations together.



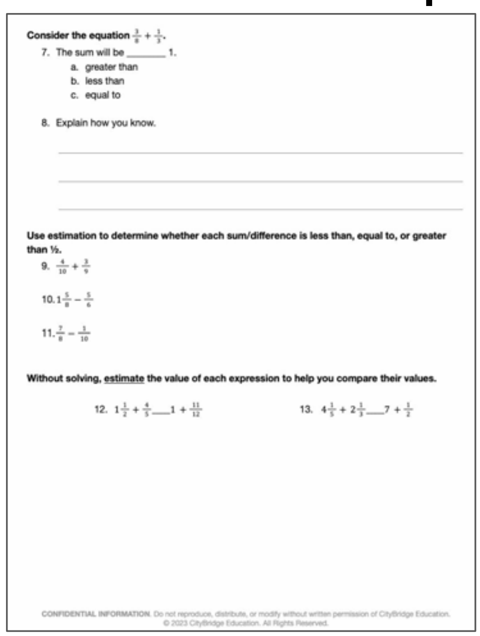
Name: ______________________ G5 U3 Lesson 12 - Let's Try It

Consider the equation $\frac{3}{4} + \frac{1}{2}$.

1. Use the number line to estimate the sum.
2. The sum will be _______ 1.
   a. greater than
   b. less than
   c. equal to
3. Explain how you know.

Consider the equation $1\frac{1}{5} - \frac{2}{3}$.

4. Use the number line to estimate the difference.
5. The difference will be _______ 1.
   a. greater than
   b. less than
   c. equal to
6. Explain how you know.



Consider the equation $\frac{3}{8} + \frac{1}{3}$.

7. The sum will be _______ 1.
   a. greater than
   b. less than
   c. equal to
8. Explain how you know.

Use estimation to determine whether each sum/difference is less than, equal to, or greater than ½.

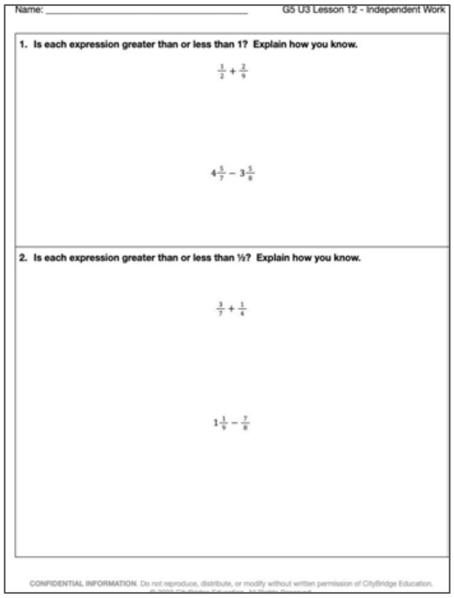
9. $\frac{4}{10} + \frac{3}{9}$
10. $1\frac{5}{8} - \frac{5}{6}$
11. $\frac{7}{8} - \frac{1}{10}$

Without solving, estimate the value of each expression to help you compare their values.

12. $1\frac{1}{2} + \frac{4}{5}$ ___ $1 + \frac{11}{12}$
13. $4\frac{1}{5} + 2\frac{1}{3}$ ___ $7 + \frac{1}{2}$

On your Own:

Now it's time to explore using fraction benchmark numbers to assess the reasonableness of addition and subtraction equations on your own.



Name: ______________________ G5 U3 Lesson 12 - Independent Work

1. Is each expression greater than or less than 1? Explain how you know.

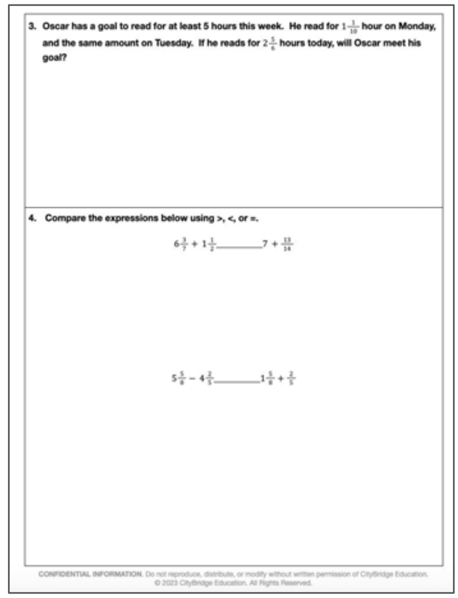
$\frac{1}{2} + \frac{2}{9}$

$4\frac{5}{7} - 3\frac{5}{8}$

2. Is each expression greater than or less than ½? Explain how you know.

$\frac{3}{7} + \frac{1}{4}$

$1\frac{1}{9} - \frac{7}{8}$



3. Oscar has a goal to read for at least 5 hours this week. He read for $1\frac{1}{10}$ hour on Monday, and the same amount on Tuesday. If he reads for $2\frac{5}{6}$ hours today, will Oscar meet his goal?

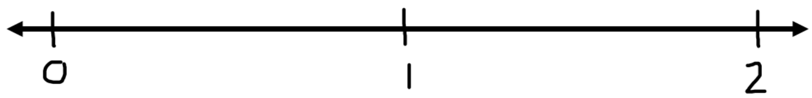
4. Compare the expressions below using >, <, or =.

$6\frac{3}{7} + 1\frac{1}{2}$ ________ $7 + \frac{13}{14}$

$5\frac{5}{8} - 4\frac{2}{5}$ ________ $1\frac{5}{8} + \frac{2}{5}$

Consider the equation $\frac{3}{4} + \frac{1}{2}$.

1. Use the number line to estimate the sum.



2. The sum will be _________ 1.
    a. greater than
    b. less than
    c. equal to

3. Explain how you know.

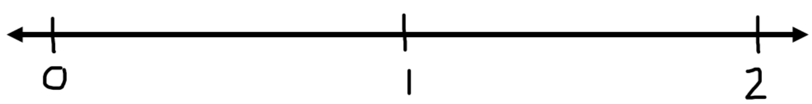
____

____

____

Consider the equation $1\frac{1}{5} - \frac{2}{3}$.

4. Use the number line to estimate the difference.



5. The difference will be _________ 1.
    a. greater than
    b. less than
    c. equal to

6. Explain how you know.

____

____

____

Consider the equation $\frac{3}{8} + \frac{1}{3}$.

7. The sum will be _________ 1.
    a. greater than
    b. less than
    c. equal to

8. Explain how you know.

Use estimation to determine whether each sum/difference is less than, equal to, or greater than ½.

9. $\frac{4}{10} + \frac{3}{9}$

10. $1\frac{5}{8} - \frac{5}{6}$

11. $\frac{7}{8} - \frac{1}{10}$

Without solving, <u>estimate</u> the value of each expression to help you compare their values.

12. $1\frac{1}{2} + \frac{4}{5}$ ____ $1 + \frac{11}{12}$

13. $4\frac{1}{5} + 2\frac{1}{3}$ ____ $7 + \frac{1}{2}$

1. Is each expression greater than or less than 1? Explain how you know.

$$\frac{1}{2}+\frac{2}{9}$$

$$4\frac{5}{7}-3\frac{5}{8}$$

2. Is each expression greater than or less than ½? Explain how you know.

$$\frac{3}{7}+\frac{1}{4}$$

$$1\frac{1}{9}-\frac{7}{8}$$

3. Oscar has a goal to read for at least 5 hours this week. He read for $1\frac{1}{10}$ hour on Monday, and the same amount on Tuesday. If he reads for $2\frac{5}{6}$ hours today, will Oscar meet his goal?

4. Compare the expressions below using >, <, or =.

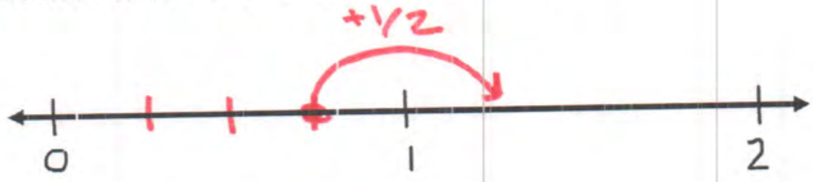
$$6\frac{3}{7} + 1\frac{1}{2} \_\_\_\_\_\_\_\_\_\_ 7 + \frac{13}{14}$$

$$5\frac{5}{8} - 4\frac{2}{5} \_\_\_\_\_\_\_\_\_\_ 1\frac{5}{8} + \frac{2}{5}$$

Name: KEY

Consider the equation $\frac{3}{4} + \frac{1}{2}$.

1. Use the number line to estimate the sum.



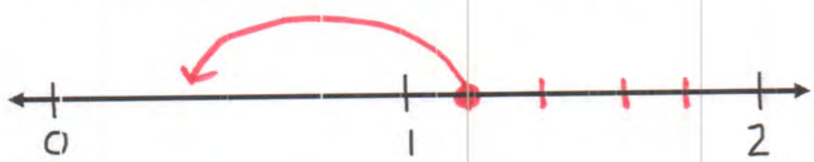
2. The sum will be ________ 1.
   a. greater than
   b. less than
   c. equal to

3. Explain how you know.

3/4 is almost 1 whole. I know if I add 1/2, I'll end up with a sum that's a little greater than 1.

Consider the equation $1\frac{1}{5} - \frac{2}{3}$.

4. Use the number line to estimate the difference.



5. The difference will be ________ 1.
   a. greater than
   b. less than
   c. equal to

6. Explain how you know.

$\frac{2}{3}$ is more than $\frac{1}{5}$, so if I'm 1/5 greater than 1 and I take away $\frac{2}{3}$, my answer will be less than 1.

Consider the equation $\frac{3}{8} + \frac{1}{3}$.

7. The sum will be ________ 1.
   a. greater than
   b. less than
   c. equal to

8. Explain how you know.

3/8 and 1/3 are both less than $\frac{1}{2}$.
I know $\frac{1}{2} + \frac{1}{2} = 1$, so adding two fractions
that are $< \frac{1}{2}$ will result in a total < 1.

Use estimation to determine whether each sum/difference is less than, equal to, or greater than ½.

9. $\frac{4}{10} + \frac{3}{9}$ $> \frac{1}{2}$

10. $1\frac{5}{8} - \frac{5}{6}$ $> 1/2$

11. $\frac{7}{8} - \frac{1}{10}$ $> 1/2$

Without solving, estimate the value of each expression to help you compare their values.

12. $1\frac{1}{2} + \frac{4}{5}$ $>$ $1 + \frac{11}{12}$

$\frac{4}{5} \approx 1$

$1\frac{1}{2} + 1 = 2\frac{1}{2}$

< 2

13. $4\frac{1}{5} + 2\frac{1}{3}$ $<$ $7 + \frac{1}{2}$

$4\frac{1}{5} + 2\frac{1}{3}$ will be a little more than 6

$7\frac{1}{2}$

Name: KEY

1. Is each expression greater than or less than 1? Explain how you know.

$\frac{1}{2} + \frac{2}{9}$ LESS

$\frac{2}{9} < \frac{1}{2}$

$4\frac{5}{7} - 3\frac{5}{8}$ GREATER

$\frac{5}{8} < \frac{5}{7}$

so our answer would be a little more than 1

2. Is each expression greater than or less than ½? Explain how you know.

$\frac{3}{7} + \frac{1}{4}$ GREATER

$\frac{3}{7}$ is already really close to $\frac{1}{2}$

$1\frac{1}{9} - \frac{7}{8}$ LESS

$\frac{7}{8} \approx 1$

so $1\frac{1}{9} - 1 = \frac{1}{9}$

3. **Oscar has a goal to read for at least 5 hours this week. He read for $1\frac{1}{10}$ hour on Monday, and the same amount on Tuesday. If he reads for $2\frac{5}{6}$ hours today, will Oscar meet his goal?**

$1\frac{1}{10}$	$1\frac{1}{10}$	$2\frac{5}{6}$
M	T	today

$2\frac{2}{10}$

or

$2\frac{1}{5}$

$2\frac{1}{5} + 2\frac{5}{6}$

4

this will be >1 since $\frac{1}{5}$ is more than the $\frac{1}{6}$ needed to make a whole

Yes! He will meet his goal.

4. **Compare the expressions below using >, <, or =.**

$$6\frac{3}{7} + 1\frac{1}{2} \;\underline{=}\; 7 + \frac{13}{14}$$

$6\frac{6}{14} + 1\frac{7}{14}$ $\qquad$ $7\frac{13}{14}$

$7\frac{13}{14}$

$$5\frac{5}{8} - 4\frac{2}{5} \;\underline{<}\; 1\frac{5}{8} + \frac{2}{5}$$

$5\frac{25}{40} - 4\frac{16}{40}$ $\qquad$ $1\frac{25}{40} + \frac{16}{40}$

$1\frac{9}{40}$ $\qquad$ $1\frac{41}{40}$

$2\frac{1}{40}$

G5 U3 Lesson 13

Strategize to solve multi-term problems

CITYTUTOR DC

G5 U3 Lesson 13 - Students will strategize to solve multi-term problems

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): There are only a couple more lessons left in our unit about adding and subtracting fractions. We'll use this lesson and the next one to pull all that we've learned together and apply it to multi-step problems and real-world application problems. The great thing is, you already know everything you ned to be successful when adding and subtracting fractions. Our goal today will be to think *strategically* about the problems we're given so that we can solve them in the most efficient way that works for us.

Let's Talk (Slide 3): A student, Wallace, was working on a math problem. I don't have all of his work, but I have his first step shown here. Take a second and review his first step. Don't worry about finding the answer. (*pause)* What do you notice he did? Why do you think he chose to do this first? Possible Student Answers, Key Points:

- He rearranged his addends. He moved halves next to halves and ninths next to ninths.
- He probably did this so his like units were next to each other, since we know it is easy to add with like units.

When I said our goal today was to think *strategically*, this is a great example of what I meant. We want to think about the problem we're given, and plan out a solution pathway that makes the math as easy as possible. Moving these addends so that he can think about like units is a simple, strategic move to make finding the answer more manageable. Wallace was thinking *strategically*. We'll use thinking similar to this throughout today's lesson.

Let's Think (Slide 4): For our first problem, let's actually work to solve Wallace's problem we just looked at. We'll strategize to solve this multi-term problem. Each fraction in this expression is a term, so how many terms does Wallace have to think about? (4 terms) Yes, this expression has 4 terms. Let's rearrange them like Wallace did so that our terms with like units are next to each other. We can do this, because the commutative property states that we can add in any order.

$$\underbrace{4\tfrac{1}{2} + \tfrac{1}{2}}_{4\frac{2}{2}} + \underbrace{\tfrac{4}{9} + 2\tfrac{5}{9}}_{2\frac{9}{9}}$$

$$5 + 3$$

$$8$$

(rewrite expression similar to Wallace using a different color or highlighter to emphasize terms with like units) Now, I see the two terms with halves and the two terms with ninths next to each other.

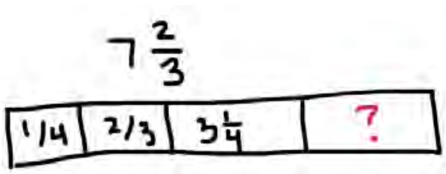
Let's think about the terms with halves. What is 4 ½ + ½? (4 2/2 or 5) If we add the fractional parts, we get a sum of 4 2/2. *(write 4 2/2 underneath the terms)* Since 2/2 is a whole, we can think of these two terms as having a sum of 5. *(write 5 underneath 4 2/2)*

Now, we can tackle the two terms with ninths. What is 4/9 plus 2 5/9? (2 9/9 or 3) If we add the fractional parts, we get a sum of 2 9/9. *(write 2 9/9 underneath the terms)* Since 9/9 is a whole, we can think of these two terms as having a sum of 3. *(write 3 underneath 2 9/9)*

Two of our terms added up to 5. The other two added up to 3. So the sum of all four terms is 5 + 3. The four terms add up to 8. Because we thought strategically, we were able to group parts of the problem in a way that made our math easier than if we had simply calculated from left to right. We didn't even have to make equivalent fractions with like units in this case. How cool is that? Thinking strategically can save a lot of time and energy.

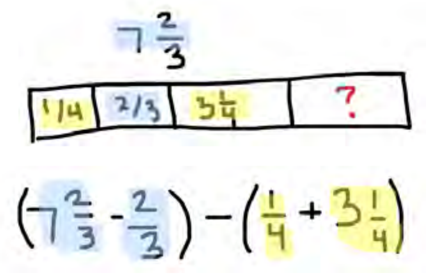
Let's Think (Slide 5): Take a look at our second problem. What do you notice about this problem? Possible Student Answers, Key Points:

- This problem involves subtraction.
- I see some terms with like units of thirds and some terms with like units of fourths. I think we can rearrange them to think strategically.



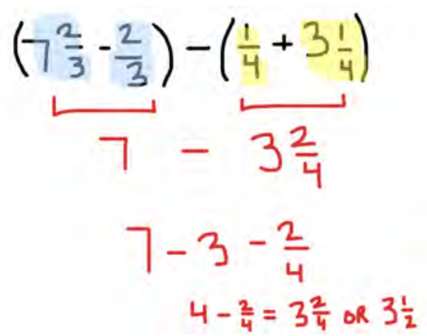
Time to be strategic. Let's picture this problem with a tape diagram to help us out. What is the total amount based on this tape diagram? (7 ⅔ I'll draw a rectangle and label the entire rectangle 7 ⅔ *(draw and label the rectangle, and partition it into 4 sections)* I know we're going to need to subtract ¼, ⅔and 3 ¼ *(fill each number in one section of the tape diagram)*, and then what's leftover will be our unknown. I'll write a question mark in the last section to represent the unknown. How can I be strategic when subtracting these values from 7 ⅔ Student Answers, Key Points:

- You can subtract the ⅔ first since the total already involves thirds.
- We can combine terms that have similar units. For example, we could combine the 3 ¼ with the ¼.



We should absolutely focus on terms that have like units, because we know like units make it easy to add and subtract. *(highlight terms with thirds in one color and terms with fourths in another)*

Considering this tape diagram, I know I could subtract out the part that is ⅔ first. That should be simple, because the total already involves thirds. Then I could subtract out the other two pieces. Rather than subtract them one at a time from the total, I could combine them before I subtract since they have like units. Here's how that expression might look if we rewrote it to match our strategy. *(write expression as shown, continuing to color-code the terms with like units)* I used parentheses to help me think about how I'm grouping the terms.



Let's do the math, now that we have an efficient plan. What is 7 ⅔ minus ⅔? (7) *(write 7 with a bracket under the corresponding terms)*

What is ¼ + 3 ¼? (3 2/4 or 3 ½) *(write 3 2/4 with a bracket under the corresponding terms)*

Now we just need to subtract 7 - 3 2/4. Let's think of it as 7 - 3 - 2/4. *(rewrite the expression)* 7 minus 3 is 4. 4 minus 2/4 is 3 2/4. Our answer is 3 2/4 or 3 ½.

Think back to both the problems we strategized around. How did thinking about the terms ahead of time and rearranging the terms help us efficiently arrive at our answers? Student Answers, Key Points:

- Looking at our terms ahead of time helped us to think about how the numbers are related and which terms had similar units.
- Rearranging each expression helped us to group terms with like units which meant we were able to do many steps using mental math or quick computation.

Let's Try it (Slides 6 - 7): Now let's work together to solve multi-term problems strategically. There is no one correct way to strategize around a problem, but a few key moves can be useful under many circumstances. As we work, I encourage you to look for ways you can rearrange terms so that you can work easily with similar units. It can also be helpful to draw a model to help you think about how the numbers are related to one another. Let's get ready to strategize!

WARM WELCOME

Today we will strategize to solve multi-term problems.

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Let's Talk:

Wallace was trying to find the total. His first step is shown. Why do you think he did this?

$$4\frac{1}{2}+\frac{4}{9}+\frac{1}{2}+2\frac{5}{9} \longrightarrow 4\frac{1}{2}+\frac{1}{2}+\frac{4}{9}+2\frac{5}{9}$$

Let's Think:

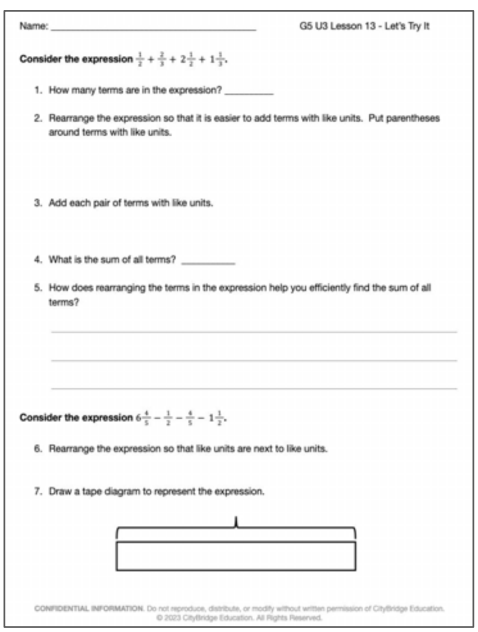
Strategize to find the sum.

$$4\frac{1}{2}+\frac{4}{9}+\frac{1}{2}+2\frac{5}{9}$$

Let's Think: Strategize to solve.

$$7\frac{2}{3}-\frac{1}{4}-\frac{2}{3}-3\frac{1}{4}=?$$

Let's Try It: Let's explore strategizing to solve multi-term problems together.



Name: ____________________ G5 U3 Lesson 13 - Let's Try It

Consider the expression $\frac{1}{2}+\frac{2}{3}+2\frac{1}{2}+1\frac{1}{3}$.

1. How many terms are in the expression? ________
2. Rearrange the expression so that it is easier to add terms with like units. Put parentheses around terms with like units.
3. Add each pair of terms with like units.
4. What is the sum of all terms? ________
5. How does rearranging the terms in the expression help you efficiently find the sum of all terms?

Consider the expression $6\frac{4}{5}-\frac{1}{2}-\frac{4}{5}-1\frac{1}{2}$.

6. Rearrange the expression so that like units are next to like units.
7. Draw a tape diagram to represent the expression.

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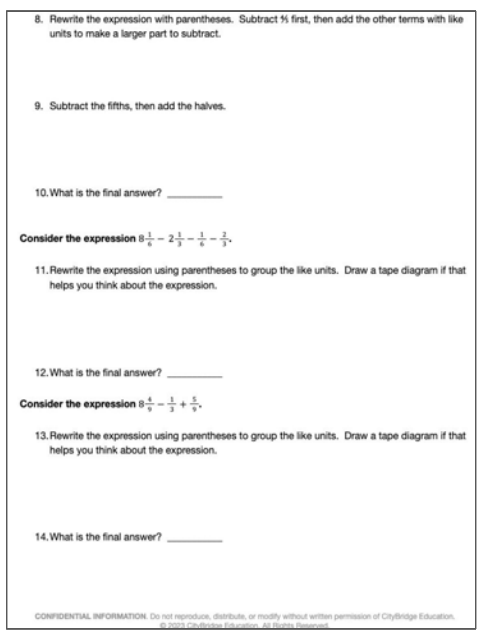

8. Rewrite the expression with parentheses. Subtract $\frac{4}{5}$ first, then add the other terms with like units to make a larger part to subtract.
9. Subtract the fifths, then add the halves.
10. What is the final answer? ________

Consider the expression $8\frac{1}{6}-2\frac{1}{3}-\frac{1}{6}-\frac{2}{3}$.

11. Rewrite the expression using parentheses to group the like units. Draw a tape diagram if that helps you think about the expression.
12. What is the final answer? ________

Consider the expression $8\frac{4}{9}-\frac{1}{3}+\frac{5}{9}$.

13. Rewrite the expression using parentheses to group the like units. Draw a tape diagram if that helps you think about the expression.
14. What is the final answer? ________

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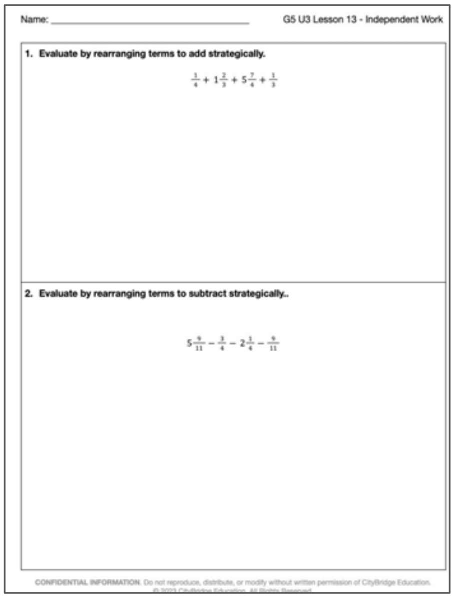
On your Own:

Now it’s time to strategize to solve multi-term problems on your own.



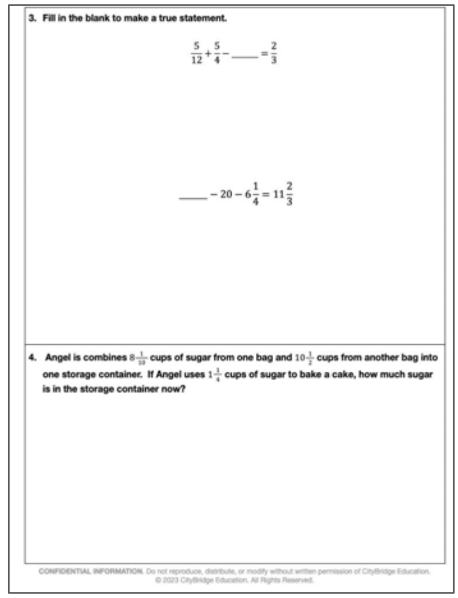
Name: ______________________ G5 U3 Lesson 13 - Independent Work

1. Evaluate by rearranging terms to add strategically.

$$\frac{1}{4} + 1\frac{2}{3} + 5\frac{7}{4} + \frac{1}{3}$$

2. Evaluate by rearranging terms to subtract strategically..

$$5\frac{9}{11} - \frac{3}{4} - 2\frac{1}{4} - \frac{9}{11}$$



3. Fill in the blank to make a true statement.

$$\frac{5}{12} + \frac{5}{4} - \_\_\_\_ = \frac{2}{3}$$

$$\_\_\_\_ - 20 - 6\frac{1}{4} = 11\frac{2}{3}$$

4. Angel is combines $8\frac{1}{10}$ cups of sugar from one bag and $10\frac{1}{2}$ cups from another bag into one storage container. If Angel uses $1\frac{1}{4}$ cups of sugar to bake a cake, how much sugar is in the storage container now?

Name: ______________________________ G5 U3 Lesson 13 - Let's Try It

Consider the expression $\frac{1}{2} + \frac{2}{3} + 2\frac{1}{2} + 1\frac{1}{3}$.

1. How many terms are in the expression? __________

2. Rearrange the expression so that it is easier to add terms with like units. Put parentheses around terms with like units.

3. Add each pair of terms with like units.

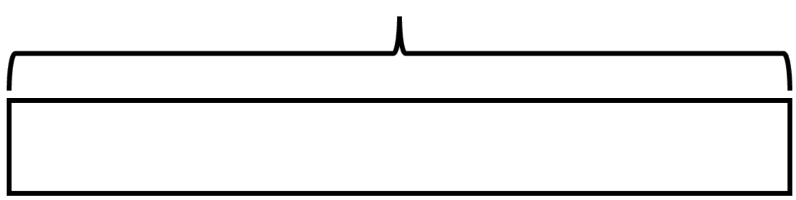
4. What is the sum of all terms? __________

5. How does rearranging the terms in the expression help you efficiently find the sum of all terms?

Consider the expression $6\frac{4}{5} - \frac{1}{2} - \frac{4}{5} - 1\frac{1}{2}$.

6. Rearrange the expression so that like units are next to like units.

7. Draw a tape diagram to represent the expression.



8. Rewrite the expression with parentheses. Subtract $\frac{4}{5}$ first, then add the other terms with like units to make a larger part to subtract.

9. Subtract the fifths, then add the halves.

10. What is the final answer? ____________

Consider the expression $8\frac{1}{6} - 2\frac{1}{3} - \frac{1}{6} - \frac{2}{3}$.

11. Rewrite the expression using parentheses to group the like units. Draw a tape diagram if that helps you think about the expression.

12. What is the final answer? ____________

Consider the expression $8\frac{4}{9} - \frac{1}{3} + \frac{5}{9}$.

13. Rewrite the expression using parentheses to group the like units. Draw a tape diagram if that helps you think about the expression.

14. What is the final answer? ____________

1. Evaluate by rearranging terms to add strategically.

$$\frac{1}{4} + 1\frac{2}{3} + 5\frac{7}{4} + \frac{1}{3}$$

2. Evaluate by rearranging terms to subtract strategically..

$$5\frac{9}{11} - \frac{3}{4} - 2\frac{1}{4} - \frac{9}{11}$$

3. Fill in the blank to make a true statement.

$$\frac{5}{12} + \frac{5}{4} - \underline{\qquad} = \frac{2}{3}$$

$$\_\_\_\_\_\_ - 20 - 6\frac{1}{4} = 11\frac{2}{3}$$

4. Angel is combines $8\frac{1}{10}$ cups of sugar from one bag and $10\frac{1}{2}$ cups from another bag into one storage container. If Angel uses $1\frac{1}{4}$ cups of sugar to bake a cake, how much sugar is in the storage container now?

Name: KEY

Consider the expression $\frac{1}{2} + \frac{2}{3} + 2\frac{1}{2} + 1\frac{1}{3}$.

1. How many terms are in the expression? 4

2. Rearrange the expression so that it is easier to add terms with like units. Put parentheses around terms with like units.

$$\left(\frac{1}{2} + 2\frac{1}{2}\right) + \left(\frac{2}{3} + 1\frac{1}{3}\right)$$

3. Add each pair of terms with like units.

$$3 + 2$$

4. What is the sum of all terms? 5

5. How does rearranging the terms in the expression help you efficiently find the sum of all terms?

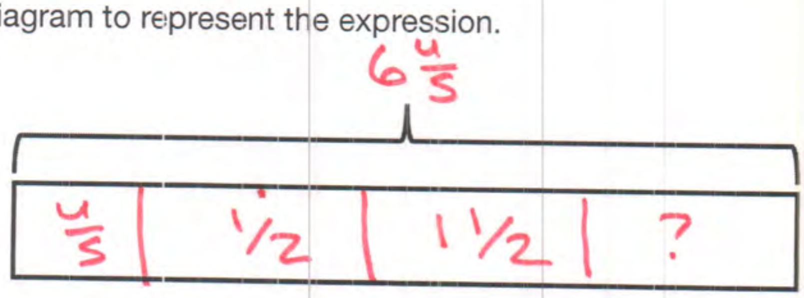
Rearranging the terms made it easy to combine terms that were related. In this case, we didn't even need to make like units!

Consider the expression $6\frac{4}{5} - \frac{1}{2} - \frac{4}{5} - 1\frac{1}{2}$.

6. Rearrange the expression so that like units are next to like units.

$$6\frac{4}{5} - \frac{4}{5} - \frac{1}{2} - 1\frac{1}{2}$$

7. Draw a tape diagram to represent the expression.



8. Rewrite the expression with parentheses. Subtract $\frac{4}{5}$ first, then add the other terms with like units to make a larger part to subtract.

$\left(6\frac{4}{5} - \frac{4}{5}\right) - \left(\frac{1}{2} + 1\frac{1}{2}\right)$

9. Subtract the fifths, then add the halves.

$6 - 2$

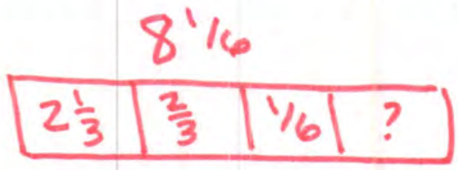
10. What is the final answer? 4

Consider the expression $8\frac{1}{6} - 2\frac{1}{3} - \frac{1}{6} - \frac{2}{3}$.

11. Rewrite the expression using parentheses to group the like units. Draw a tape diagram if that helps you think about the expression.

$\left(8\frac{1}{6} - \frac{1}{6}\right) - \left(2\frac{1}{3} + \frac{2}{3}\right)$

$8 - 3$



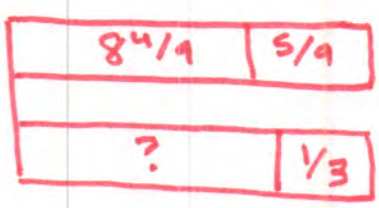
12. What is the final answer? 5

Consider the expression $8\frac{4}{9} - \frac{1}{3} + \frac{5}{9}$.

13. Rewrite the expression using parentheses to group the like units. Draw a tape diagram if that helps you think about the expression.

$\left(8\frac{4}{9} + \frac{5}{9}\right) - \frac{1}{3}$

$9 - \frac{1}{3}$



14. What is the final answer? $8\frac{2}{3}$

Name: KEY

1. Evaluate by rearranging terms to add strategically.

$$\frac{1}{4} + 1\frac{2}{3} + 5\frac{7}{4} + \frac{1}{3}$$

$$\left(1\frac{2}{3} + \frac{1}{3}\right) + \left(\frac{1}{4} + 5\frac{7}{4}\right)$$

$$1\frac{3}{3} + 5\frac{8}{4}$$

$$2 + 7$$

$$9$$

2. Evaluate by rearranging terms to subtract strategically..

$$5\frac{9}{11} - \frac{3}{4} - 2\frac{1}{4} - \frac{9}{11}$$

$$\left(5\frac{9}{11} - \frac{9}{11}\right) - \left(\frac{3}{4} + 2\frac{1}{4}\right)$$

$$5 - 3$$

$$2$$

3. **Fill in the blank to make a true statement.**

$$\frac{5}{12} + \frac{5}{4} - \_\_\_\_ = \frac{2}{3}$$

$$\frac{5}{12} + \frac{15}{12}$$

$$\frac{20}{12} - \_\_\_\_ = \frac{8}{12}$$

$$\frac{12}{12} \text{ OR } 1$$

$$\_\_\_\_ - 20 - 6\frac{1}{4} = 11\frac{2}{3}$$

?

20	$6\frac{1}{4}$	$11\frac{2}{3}$

$$20 + 6\frac{3}{12} + 11\frac{8}{12}$$

$$26\frac{3}{12} + 11\frac{8}{12}$$

$$37\frac{11}{12}$$

4. **Angel is combines $8\frac{1}{10}$ cups of sugar from one bag and $10\frac{1}{2}$ cups from another bag into one storage container. If Angel uses $1\frac{1}{4}$ cups of sugar to bake a cake, how much sugar is in the storage container now?**

$$\left(8\frac{1}{10} + 10\frac{1}{2}\right) - 1\frac{1}{4}$$

$$\left(8\frac{1}{10} + 10\frac{5}{10}\right) - 1\frac{1}{4}$$

$$18\frac{7}{10} - 1\frac{1}{4} \longrightarrow 18\frac{14}{20} - 1\frac{5}{20} = 17\frac{9}{20} \text{ cups}$$

G5 U3 Lesson 14

Solve multi-step word problems; assess reasonableness of solutions using benchmark numbers

CITYTUTOR DC

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): Today is our last lesson of our unit that's been all about adding and subtracting fractions. What are some things that stand out to you about what we've been learning? What have you learned about adding and subtracting with fractions? Possible Student Answers, Key Points:

- It's important to add and subtract with like units. That means we have to sometimes find equivalent fractions.
- We can model adding and subtracting on number lines or with area models.
- We can use benchmark fractions to help us estimate sums and differences.
- It is sometimes helpful to add or subtract in parts. For instance, we can break apart mixed numbers into wholes and fractions. Or we can strategically rearrange expressions to add or subtract efficiently.

Those are all great takeaways. We're actually not going to learn anything brand new today. Instead, we're going to use everything we've been learning about and apply it to solve multi-step word problems about the world around us. Let's try a few out!

Let's Talk (Slide 3): Take a moment to look at this picture. What do you notice? Possible Student Answers, Key Points:

- I notice the person has $20. I notice the person is at the circus. It looks like they are trying to pay for items. The circus has popcorn, cotton candy, and souvenir cups for sale.

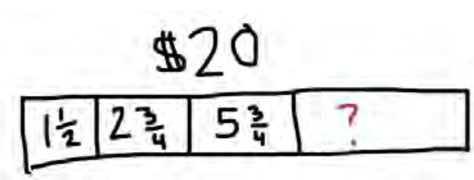
What math questions could we ask based on this picture? Possible Student Answers, Key Points:

- How much does it cost to buy all the items?
- How much money does the person need to buy certain items?
- How much money does the person have after buying certain items?

Today, we'll solve real-world problems involving fractions. Our first problem involves the information you see here. Let's take a look.

Let's Think (Slide 4): Let's read the problem all the way through once. *(read it)* Now, read it again to yourself. Once you're done, I want you to retell the story in your own words. Possible Student Answers, Key Points:

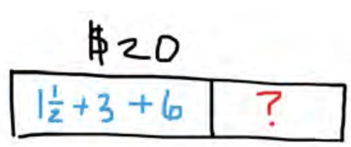
- Marcus is going to buy one of each item on the sign. He's going to pay with his twenty-dollar bill, and we want to know how much is left after he pays.



Let's visualize the story with a tape diagram, so we can see how the numbers are related and so we can be strategic about how we solve the problem. *(draw tape diagram as you narrate)* I know he has $20 in all, so I'll draw a long rectangle labeled as $20. I know part of his money goes toward cotton candy, part of his money goes toward popcorn, part goes toward a cup, and part will be leftover. I'll label each part with the amount he'll spend, and I'll put a question mark for the part that he has left. That's our unknown.

Now that we have a better picture of what is happening in the story, let's estimate using benchmark numbers. What benchmarks are each of our mixed numbers close to? Possible Student Answers, Key Points:

- 1 ½ is already a benchmark. 2 ¾ is close to 3, and 5 ¾ is close to 6.



$20 - 10\frac{1}{2}$

$20 - 10 - \frac{1}{2}$

We can use these benchmarks to estimate an answer. If we think of each item's cost as a benchmark, we know that the items will cost 1 ½ + 3 + 6 dollars. *(redraw tape diagram using benchmark numbers as shown)*

What is the sum of the benchmark numbers? (10 ½) To find the leftover amount, we can subtract 20 - 10 ½. *(write expression)* I know 20 - 10 is 10, and then I can subtract the remaining ½. *(write 20 - 10 - ½, then 10 - ½ under that)* What is 10 - ½? (9 ½) Our answer should end up being close to 9 ½ dollars. This quick estimation will ensure our answer is reasonable.

$$20 - \left(2\frac{3}{4} + 5\frac{3}{4} + 1\frac{1}{2}\right)$$

Now, let's calculate the exact answer. Let's add the three items together and subtract them from the 20-dollar bill. We can think of this as 20 minus the sum of all three items. *(write expression as shown)* What do you notice about how I wrote the expression? Possible Student Answers, Key Points:

- Your equation shows the 20 dollars minus the three items. You used parentheses to group the three items.
- I notice you rearranged the addends so that terms with like units were next to each other.

$$20 - \left(7\tfrac{6}{4} + 1\tfrac{1}{2}\right)$$

$$20 - \left(8\tfrac{2}{4} + 1\tfrac{1}{2}\right)$$

$$20 - 10 = \$10$$

We will add 2 ¾ plus 5 ¾ first. What is that sum? (7 6/4) *(rewrite expression to show 7 6/4)* That mixed number has a fraction greater than 1 whole, so we can decompose to make a new whole from four of the fourths. 7 6/4 is the same as 8 and 2/4, or 8 and ½. *(rewrite expression to show 8 2/4)*

Let's keep adding the parts in parentheses. What is 8 2/4 or 8 ½ plus 1 ½? (10) This means the total cost of all three items is $10. All we have left to do is determine Marcus's change. If he pays with a $20 bill, how much money will Marcus get back? *(write 20 - 10)* Correct! He'll get $10 back after buying all three items. Is this answer reasonable?

Possible Student Answers, Key Points:

- Our estimate was 9 ½ dollars, and our actual answer was $10. Since our actual answer is close to our estimate, then our answer is reasonable.

We just used a lot of what we learned this unit to estimate and then solve a multi-step problem. Well done!

Not every problem we see today will follow the same exact steps, but we can always draw a tape diagram and estimate to make sense of the story before attempting to solve.

Let's Try it (Slides 5 - 6): Now let's work together to solve multi-step word problems and assess the reasonableness of solutions using benchmark numbers. We'll draw models to help us visualize each story. Models also help us see how numbers in the story are related so that we can find an efficient solution pathway. We'll also use benchmarks like whole numbers and halves to make sure the answers we get are reasonable. Let's dive in.

WARM WELCOME

Today we will solve multi-step problems and assess the reasonableness of solutions using benchmark numbers.

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Let's Talk:

What do you notice?

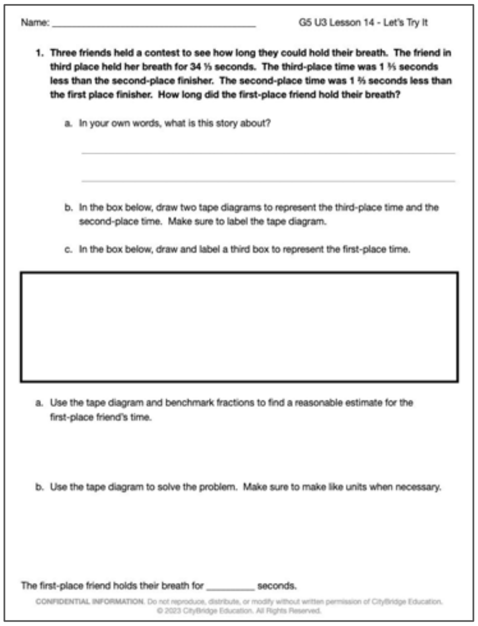
What math questions could we ask?

Let's Think:

Marcus buys a cotton candy, a popcorn, and a souvenir soda cup from the circus. If he pays with a $10-bill, how much money does Marcus have left?

Let's Try It:

Let's explore solving multi-step problems together.



Name: ______________________ G5 U3 Lesson 14 - Let's Try It

1. Three friends held a contest to see how long they could hold their breath. The friend in third place held her breath for 34 $\frac{1}{5}$ seconds. The third-place time was 1 $\frac{3}{5}$ seconds less than the second-place finisher. The second-place time was 1 $\frac{2}{5}$ seconds less than the first place finisher. How long did the first-place friend hold their breath?

a. In your own words, what is this story about?

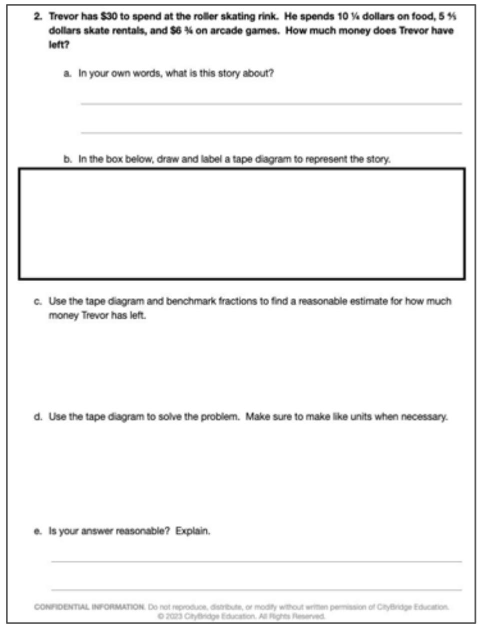
b. In the box below, draw two tape diagrams to represent the third-place time and the second-place time. Make sure to label the tape diagram.

c. In the box below, draw and label a third box to represent the first-place time.

a. Use the tape diagram and benchmark fractions to find a reasonable estimate for the first-place friend's time.

b. Use the tape diagram to solve the problem. Make sure to make like units when necessary.

The first-place friend holds their breath for ________ seconds.



2. Trevor has $30 to spend at the roller skating rink. He spends 10 $\frac{1}{4}$ dollars on food, 5 $\frac{3}{5}$ dollars skate rentals, and $6 $\frac{3}{4}$ on arcade games. How much money does Trevor have left?

a. In your own words, what is this story about?

b. In the box below, draw and label a tape diagram to represent the story.

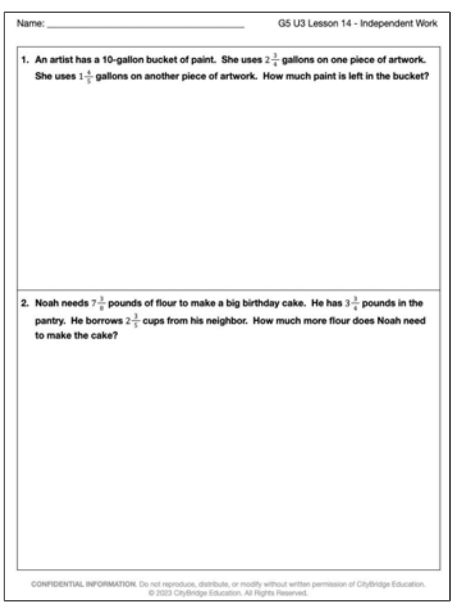
c. Use the tape diagram and benchmark fractions to find a reasonable estimate for how much money Trevor has left.

d. Use the tape diagram to solve the problem. Make sure to make like units when necessary.

e. Is your answer reasonable? Explain.

On your Own:

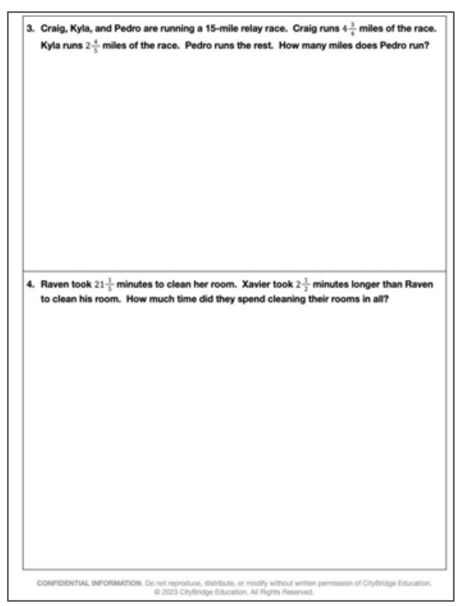
Now it's time to solve multi-step problems on your own.



Name: ______________________ G5 U3 Lesson 14 - Independent Work

1. An artist has a 10-gallon bucket of paint. She uses $2\frac{3}{4}$ gallons on one piece of artwork. She uses $1\frac{4}{5}$ gallons on another piece of artwork. How much paint is left in the bucket?

2. Noah needs $7\frac{3}{8}$ pounds of flour to make a big birthday cake. He has $3\frac{3}{4}$ pounds in the pantry. He borrows $2\frac{3}{5}$ cups from his neighbor. How much more flour does Noah need to make the cake?



3. Craig, Kyla, and Pedro are running a 15-mile relay race. Craig runs $4\frac{3}{4}$ miles of the race. Kyla runs $2\frac{4}{5}$ miles of the race. Pedro runs the rest. How many miles does Pedro run?

4. Raven took $21\frac{1}{5}$ minutes to clean her room. Xavier took $2\frac{1}{2}$ minutes longer than Raven to clean his room. How much time did they spend cleaning their rooms in all?

1. Three friends held a contest to see how long they could hold their breath. The friend in third place held her breath for 34 ⅛ seconds. The third-place time was 1 ⅗ seconds less than the second-place finisher. The second-place time was 1 ⅛ seconds less than the first place finisher. How long did the first-place friend hold their breath?

   a. In your own words, what is this story about?

   ____

   ____

   b. In the box below, draw two tape diagrams to represent the third-place time and the second-place time. Make sure to label the tape diagram.

   c. In the box below, draw and label a third box to represent the first-place time.

a. Use the tape diagram and benchmark fractions to find a reasonable estimate for the first-place friend's time.

b. Use the tape diagram to solve the problem. Make sure to make like units when necessary.

The first-place friend holds their breath for __________ seconds.

2. Trevor has $30 to spend at the roller skating rink. He spends 10 ¼ dollars on food, 5 ⅘ dollars skate rentals, and $6 ¾ on arcade games. How much money does Trevor have left?

   a. In your own words, what is this story about?

   ____

   ____

b. In the box below, draw and label a tape diagram to represent the story.

c. Use the tape diagram and benchmark fractions to find a reasonable estimate for how much money Trevor has left.

d. Use the tape diagram to solve the problem. Make sure to make like units when necessary.

e. Is your answer reasonable? Explain.

1. An artist has a 10-gallon bucket of paint. She uses $2\frac{3}{4}$ gallons on one piece of artwork. She uses $1\frac{4}{5}$ gallons on another piece of artwork. How much paint is left in the bucket?

2. Noah needs $7\frac{3}{8}$ pounds of flour to make a big birthday cake. He has $3\frac{3}{4}$ pounds in the pantry. He borrows $2\frac{3}{5}$ cups from his neighbor. How much more flour does Noah need to make the cake?

3. Craig, Kyla, and Pedro are running a 15-mile relay race. Craig runs $4\frac{3}{4}$ miles of the race. Kyla runs $2\frac{4}{5}$ miles of the race. Pedro runs the rest. How many miles does Pedro run?

4. Raven took $21\frac{1}{5}$ minutes to clean her room. Xavier took $2\frac{1}{2}$ minutes longer than Raven to clean his room. How much time did they spend cleaning their rooms in all?

Name: KEY

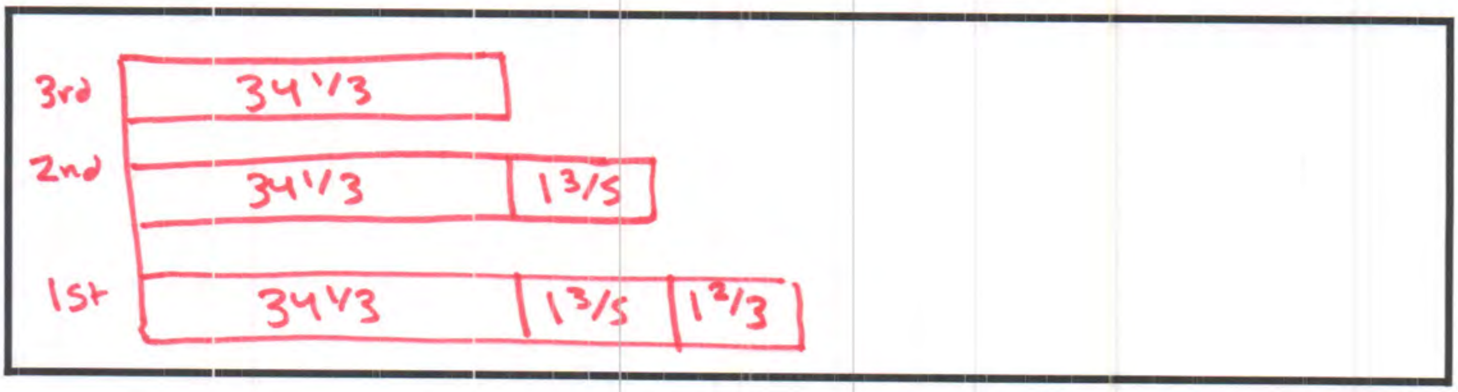
1. Three friends held a contest to see how long they could hold their breath. The friend in third place held her breath for 34 ⅓ seconds. The third-place time was 1 ⅗ seconds less than the second-place finisher. The second-place time was 1 ⅔ seconds less than the first place finisher. How long did the first-place friend hold their breath?

a. In your own words, what is this story about?

Three friends were holding their breath, and we are trying to find the winner's time.

b. In the box below, draw two tape diagrams to represent the third-place time and the second-place time. Make sure to label the tape diagram.

c. In the box below, draw and label a third box to represent the first-place time.



a. Use the tape diagram and benchmark fractions to find a reasonable estimate for the first-place friend's time.

$34\frac{1}{3} \approx 34$ $\quad 1\frac{2}{3} \approx 1\frac{1}{2}$

$1\frac{3}{5} \approx 1\frac{1}{2}$

$34 + 1\frac{1}{2} + 1\frac{1}{2}$

$34 + 3$

≈ 37 sec

b. Use the tape diagram to solve the problem. Make sure to make like units when necessary.

$\left(34\frac{1}{3} + 1\frac{2}{3}\right) + 1\frac{3}{5}$

$35\frac{3}{3} + 1\frac{3}{5}$

$36 + 1\frac{3}{5}$

The first-place friend holds their breath for $37\frac{3}{5}$ seconds.

2. **Trevor has $30 to spend at the roller skating rink. He spends 10 ¼ dollars on food, 5 ⅘ dollars skate rentals, and $6 ¾ on arcade games. How much money does Trevor have left?**

a. In your own words, what is this story about?

Trevor bought 3 items with his money, and we want to know how much he has left.

b. In the box below, draw and label a tape diagram to represent the story.

$30

$10\frac{1}{4}$	$5\frac{4}{5}$	$6\frac{3}{4}$	?
food	rental	games	left

c. Use the tape diagram and benchmark fractions to find a reasonable estimate for how much money Trevor has left.

$10\frac{1}{4} \approx 10$

$5\frac{4}{5} \approx 6$

$6\frac{3}{4} \approx 7$

$\underbrace{10+6+7}_{23}$

$30 - 23 = 7$

≈ 7 dollars

d. Use the tape diagram to solve the problem. Make sure to make like units when necessary.

$30 - (\underbrace{10\frac{1}{4} + 6\frac{3}{4}} + 5\frac{4}{5})$

$30 - (17 + 5\frac{4}{5})$

$30 - 22\frac{4}{5}$

$30 - 22 - \frac{4}{5}$

$8 - \frac{4}{5}$

$\$7\frac{1}{5}$

e. Is your answer reasonable? Explain.

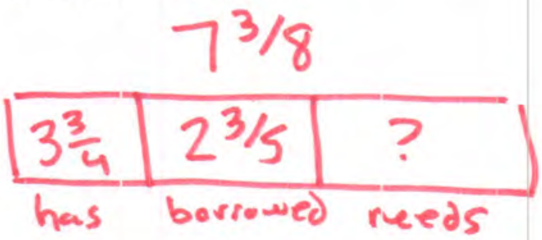
Yes! $7\frac{1}{5}$ is close to my estimate of 7.

Name: KEY

1. **An artist has a 10-gallon bucket of paint. She uses $2\frac{3}{4}$ gallons on one piece of artwork. She uses $1\frac{4}{5}$ gallons on another piece of artwork. How much paint is left in the bucket?**

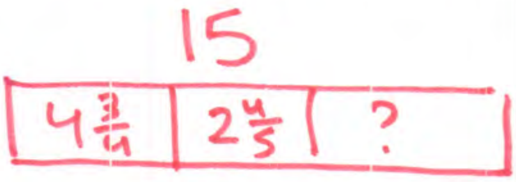
$$10-\left(2\frac{3}{4}+1\frac{4}{5}\right)=?$$
$$10-\left(2\frac{15}{20}+1\frac{16}{20}\right)=?$$
$$10-\left(3\frac{31}{20}\right)$$
$$10-4\frac{11}{20}$$
$$10-4-\frac{11}{20}$$
$$6-\frac{11}{20}=5\frac{9}{20}\text{ gallons}$$

2. **Noah needs $7\frac{3}{8}$ pounds of flour to make a big birthday cake. He has $3\frac{3}{4}$ pounds in the pantry. He borrows $2\frac{3}{5}$ cups from his neighbor. How much more flour does Noah need to make the cake?**



$$7\frac{3}{8}-\left(3\frac{3}{4}+2\frac{3}{5}\right)$$
$$7\frac{3}{8}-\left(3\frac{15}{20}+2\frac{12}{20}\right)$$
$$7\frac{3}{8}-5\frac{27}{20}$$
$$7\frac{3}{8}-6\frac{7}{20}$$
$$7\frac{15}{40}-6\frac{14}{40}$$
$$1\frac{1}{40}\text{ cup}$$

3. **Craig, Kyla, and Pedro are running a 15-mile relay race. Craig runs $4\frac{3}{4}$ miles of the race. Kyla runs $2\frac{4}{5}$ miles of the race. Pedro runs the rest. How many miles does Pedro run?**



$15 - 4\frac{3}{4} - 2\frac{4}{5}$

$15 - 4 - \frac{3}{4} - 2\frac{4}{5}$

$11 - \frac{3}{4} - 2\frac{4}{5}$

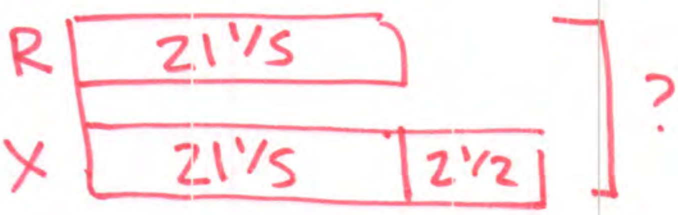
$10\frac{1}{4} - 2\frac{4}{5}$

$10\frac{5}{20} - 2\frac{16}{20}$

$9\frac{25}{20} - 2\frac{16}{20}$

$7\frac{9}{20}$ miles

4. **Raven took $21\frac{1}{5}$ minutes to clean her room. Xavier took $2\frac{1}{2}$ minutes longer than Raven to clean his room. How much time did they spend cleaning their rooms in all?**



$\underbrace{21\frac{1}{5} + 21\frac{1}{5}} + 2\frac{1}{2}$

$42\frac{2}{5} + 2\frac{1}{2}$

$42\frac{4}{10} + 2\frac{5}{10}$

$44\frac{9}{10}$ min

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G5 Unit 4:

Multiply and Divide Fractions

G5 U4 Lesson 1

Interpret fractions as division

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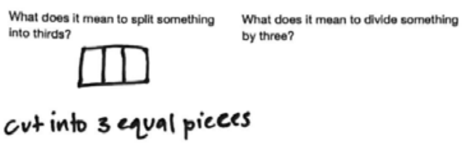
G1 U4 Lesson 1 - Today we will interpret fractions as division.

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): Today we will interpret fractions as division. This is going to be great because it is going to help us understand how multiplying and dividing fractions working in future lessons.

Let's Review (Slide 3): Let's review what we already know about fractions and division. What does it mean to split something into thirds? Possible Student Answers, Key Points:

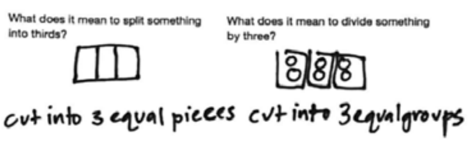
- Draw a circle with three slices.
- It means to cut something into three equal pieces.



Note: This is your chance to hear students' initial thoughts. Take 3 ideas then draw a picture and offer your own wording, which you should write down, "cut into three equal pieces."

What does it mean to divide something by three? Possible Student Answers, Key Points:

- It means do 3 times something to make a number.
- It is the opposite of multiplication.
- It means to see how many times you can take away three.
- It means to split something into three equal groups.



Note: This is your chance to hear students' initial thoughts. Take 3 ideas then draw a picture and offer your own wording, which you should write down, "cut into three equal groups." So, we already see that taking a fraction and dividing are very similar, don't we. Both involve splitting and both have equal pieces or equal groups.

Let's Talk (Slide 4): Now let's see how fractions and division can mean the same thing in a division story problem. I'll read it: Jeffrey has 1 big cookie. He wants to split it between his 3 sisters. How much cookie should each sister get? What would make us think this is a division story problem? Possible Student Answers, Key Points:

- They are splitting the cookie.
- Jeffrey has to divide the cookie.

$1 \div 3$

Jeffrey wants to split the cookie or divide the cookie between the 3 sisters. It's a sharing story. We can think of this as 1 divided by 3. We have to write it like this.

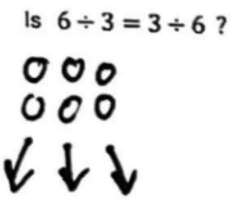
$1 \div 3$  $\frac{1}{3}$

Now let's draw a picture. I need 1 big cookie. Then I am going to split it into 3 equal pieces for the 3 sisters. It's one third! We have to write it like this.

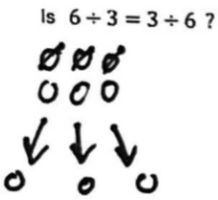
$1 \div 3$  $\frac{1}{3}$ $\div$

1 divided by 3 and 1 over 3 are the same! It's like this line in the middle is a division symbol!

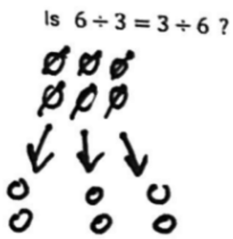
Let's Think (Slide 5): Now that we have connected these two important ideas, it helps us realize a big idea about both of them - if we switch the order of the numbers in division OR fractions, we will change the answer. Let's explore.



Here we see 6 divided by 3 and 3 divided by 6. Can someone give me a story for 6 divided by 3. Possible Student Answers, Key Points:
John has 6 cookies that he wants to share between 3 friends. How many cookies can each friend get?
Troy has 6 books and he wants to put 3 on a shelf. How may shelves can he fill?
Lisa has 6 stickers that she wants to put on 3 pages. How many stickers can she put on each page?



Imagine it was 6 cookies shared by 3 people. That story would look like this. I am going to draw 6 cookies. Now I will draw 3 arrows to show them getting handed out to 3 people. Time to deal them out! I give one and one and one.



I can keep going. One more and one more and one more. That's 6 divided by 3. That's 6 cookies shared by 3 people, each person gets 2 cookies.

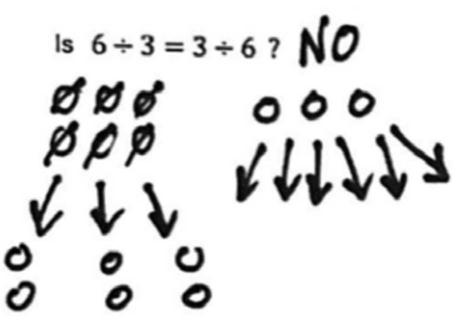
Now, what would that same story using cookies and people be for 3 divided by 6. It's not the same. Possible Student Answers, Key Points:

- 3 cookies dealt out to 6 people.
- John has 3 cookies that he wants to share between 6 friends. How many cookies can each friend get?

The numbers are in a different order so now 6 is not getting split into 3 equal amounts. 3 is getting split into 6 equal amounts. The story has to be that there are 3 cookies that have to be shared by 6 people. Whoa! Hold up! That's gonna be tricky! What do you think is going to happen? Can we still do it? Possible Student Answers, Key Points:

- You can do it.
- You don't have enough cookies so you will have to cut them.

Note: You may hear a range of right and wrong answers here. That is fine. Check to see if anyone understands and then give your own clear answer.



Let's draw a picture. 3 divided by 6 means there are 3 cookies. Since I want to split them between 6 people, I need 6 arrows coming from the cookies. There is not enough cookies for each person to get 1. I will have to cut these cookies in order to share them. We don't need to get an answer right now.

The most important thing for you to understand is that you cannot switch the order of the numbers in division and get the same answer. Is 6 divided by 3 the same as 3 divided by 6? NO!

Let's explore this next question - is 6 over 3 the same as 3 over 6? Our slide says that if we switch the order of the numbers in division or fractions, we will change the answer. I am going to draw a picture. 6 over 3 means I have thirds. This is what thirds look like - one whole cut into 3 pieces.

But I need 6 thirds. Let's count and I'll write - 1 third, 2 thirds, 3 thirds.

Uh-oh! I don't have enough. Let's draw some more thirds - 4 thirds, 5 thirds, 6 thirds. What do I end up with here? Possible Student Answers, Key Points:

- 2 wholes

- 2 circles

Now let's draw 3 over 6. I need sixths. This is what sixths look like - one whole cut into 6 pieces. I need 3 sixths. Let's count and I'll write - 1 sixth, 2 sixths, 3 sixths. Is that the same as 6 thirds? No! Is that 2 wholes? No! So 6 over 3 is NOT the same as 3 over 6 just like 6 divided by 3 is NOT the same as 3 divided by 6. The way we say this in fancy math language is "division is not commutative." In addition and multiplication, we can do turnaround facts. We can switch the order and we get the same answer. But in division, the order matters. The number before the division symbol is the whole amount that is going to be split up called the dividend. The number after the division symbol is the number it is going to be divided by called the divisor.

Let's Try It (Slide 6): Let's practice writing division and fractions together from stories. I will walk you through step by step and we will make sure we figure out which number is the dividend so it can go before the division sign.

WARM WELCOME

Today we will interpret fractions as division.

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Let's Review: What do you already know about fractions and division?

What does it mean to split something into thirds?

What does it mean to divide something by three?

Let's Talk: Now let's see how fractions and division can mean the same thing in a division story problem.

Jeffrey has 1 big cookie. He wants to split it between his 3 sisters. How much cookie should each sister get?

Let's Think:

If we switch the order of the numbers in division OR fractions, we will change the answer.

Is $6 \div 3 = 3 \div 6$?

Is $\frac{6}{3} = \frac{3}{6}$?

Let's Try It:

Let's practice writing division and fractions together from stories.

Name: ______________________________ G5 U1 Lesson 1 - Let's Try It

Joe brought 2 huge subs to his friend's house for lunch. There are 6 people at the house altogether who all want to get the same amount of sub. What fraction of a sub should they each get?

1. Let's summarize the story with a phrase:

__________________ are being split for __________________

2. Fill in the blanks: __________________ is the dividend.

__________________ is the divisor.

3. Draw a picture.

3. Write the division equation: ____________________

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On your Own:

Now it’s time for you to do it on your own.

Name: ______________________________ G5 U4 Lesson 1 - Independent Work

Remember: The denominator is the divisor.

Read the story. Write the solution as a fraction and an expression. Then use a picture to solve.

1. Lisa brought 5 subs to Science Club. There were 6 students. How much of a sub can each student get? $\frac{\square}{\square}$ ___ ÷ ___ = ___ Picture:	2. Miles and his brother found 3 pan pizzas in the freezer. If the two boys split what they found evenly, how much pizza can he and his brother get? $\frac{\square}{\square}$ ___ ÷ ___ = ___ Picture:
3. Dan needs to take 4 grams of Vitamin D every day. He needs to take it with food so he plans to	4. The Jingle Jangle race is a relay course that must be completed by 3 people who run an

Joe brought 2 huge subs to his friend's house for lunch. There are 6 people at the house altogether who all want to get the same amount of sub. What fraction of a sub should they each get?

1. Let's summarize the story with a phrase:

____________________________ are being split for ____________________________

2. Fill in the blanks: ____________________________ is the dividend.

____________________________ is the divisor.

3. Draw a picture.

3. Write the division equation: _________________________________

4. Write the equivalent fraction:

Keiran wants to put together 3 equal bags of cookies for the school bake sale. He made 12 cookies. How many cookies can he put into each bag?

5. Let's summarize the story with a phrase:

____________________________ are being split for ____________________________

6. Fill in the blanks: ____________________________ is the dividend.

____________________________ is the divisor.

7. Draw a picture.

8. Write the division equation: ________________________________

9. Write the equivalent fraction:

Write $6 \div 5$ as a fraction.

10. Fill in the blanks:________ is the dividend and ________ is the divisor.

11. Draw a picture.

12. Write the equivalent fraction:

Write $\frac{2}{3}$ as a fraction.

13. Fill in the blanks:________ is the dividend and ________ is the divisor.

14. Draw a picture.

15. Write the division equation: ________________________________

Name: ____ G5 U4 Lesson 1 - Independent Work

Remember: The denominator is the divisor.

Read the story. Write the solution as a fraction and an expression. Then use a picture to solve.

1. Lisa brought 5 subs to Science Club. There were 6 students. How much of a sub can each student get? $\frac{\square}{\square}$ ____ ÷ ____ = ____ Picture:	2. Miles and his brother found 3 pan pizzas in the freezer. If the two boys split what they found evenly, how much pizza can he and his brother get? $\frac{\square}{\square}$ ____ ÷ ____ = ____ Picture:
3. Dan needs to take 4 grams of Vitamin D every day. He needs to take it with food so he plans to split it equally over 3 meals. How many grams of Vitamin D should he take with each meal? $\frac{\square}{\square}$ ____ ÷ ____ = ____ Picture:	4. The Jingle Jangle race is a relay course that must be completed by 3 people who run an equal amount. If the relay course is 2 miles long, how much must each person run? $\frac{\square}{\square}$ ____ ÷ ____ = ____ Picture:

Read the story. Write the solution as a fraction and an expression and long division.

5. There are 2 donuts left in the box. 4 kids are standing around the box looking hungry. If they share the donuts fairly, how many donuts can each kid get? $\frac{\square}{\square}$ ____ ÷ ____ = ____ Picture:	6. At Billy's birthday party, there are 6 kids. They each want to get an equal amount of the 2 Liter soda bottle. How many liters of soda can each kid have? $\frac{\square}{\square}$ ____ ÷ ____ = ____ Picture:
7. Janice picked 2 kilograms of apples. She put them evenly in 4 baskets. How many kilograms of apples did she put in each basket? $\frac{\square}{\square}$ ____ ÷ ____ = ____ Picture:	8. For Halloween, Rachel made 3 equal bottles of slime to give to her friends. If the recipe she used made 5 cups of slime, how much slime did Rachel put in each bottle? $\frac{\square}{\square}$ ____ ÷ ____ = ____ Picture:

Name: ANSWER KEY

Joe brought 2 huge subs to his friend's house for lunch. There are 6 people at the house altogether who all want to get the same amount of sub. What fraction of a sub should they each get?

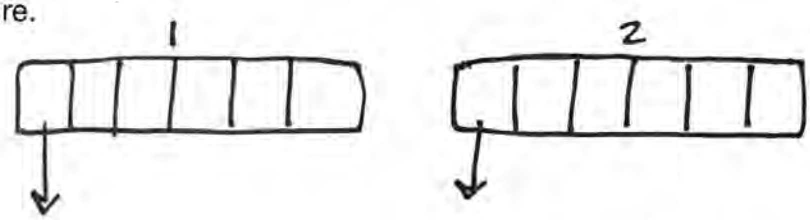
1. Let's summarize the story with a phrase:

subs are being split for people

2. Fill in the blanks: subs is the dividend.

people is the divisor.

3. Draw a picture.



$\frac{1}{6} + \frac{1}{6} = \frac{2}{6}$

3. Write the division equation: $2 \div 6 = \frac{2}{6}$

4. Write the equivalent fraction: $\frac{2}{6}$

Keiran wants to put together 3 equal bags of cookies for the school bake sale. He made 12 cookies. How many cookies can he put into each bag?

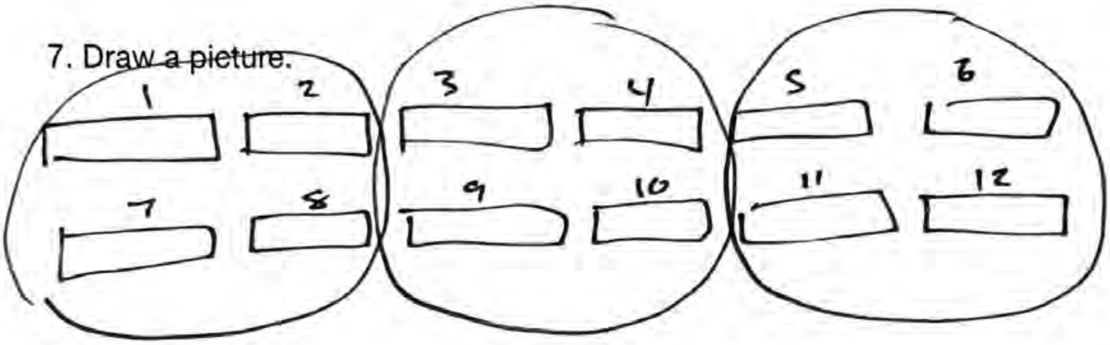
5. Let's summarize the story with a phrase:

cookies are being split for bags

6. Fill in the blanks: cookies is the dividend.

bags is the divisor.

7. Draw a picture.



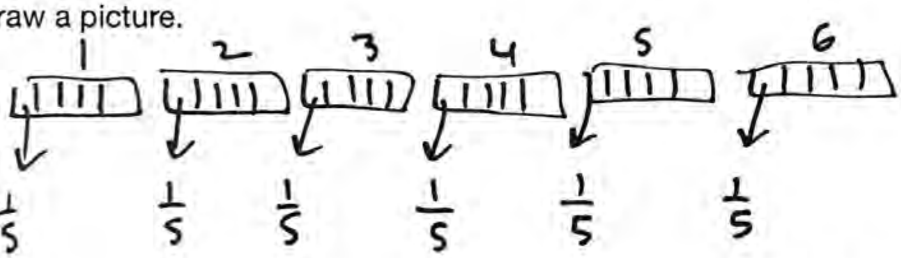
8. Write the division equation: $12 \div 3 = 4$

9. Write the equivalent fraction: $\frac{12}{3} = 4$

Write $6 \div 5$ **as a fraction.**

10. Fill in the blanks: 6 is the dividend and 5 is the divisor.

11. Draw a picture.

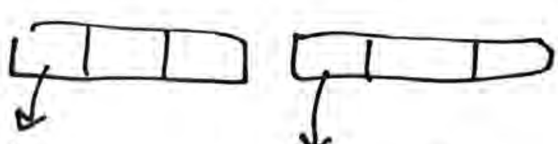


12. Write the equivalent fraction: $\frac{6}{5} = 1\frac{1}{5}$ $\left(\frac{6}{5} \right)$ $\frac{5}{5}$ $\frac{1}{5}$

Write $\frac{2}{3}$ **as a fraction.**

13. Fill in the blanks: 2 is the dividend and 3 is the divisor.

14. Draw a picture.



$\frac{1}{3} + \frac{1}{3} = \frac{2}{3}$

15. Write the division equation: $2 \div 3$

Name: ANSWER KEY

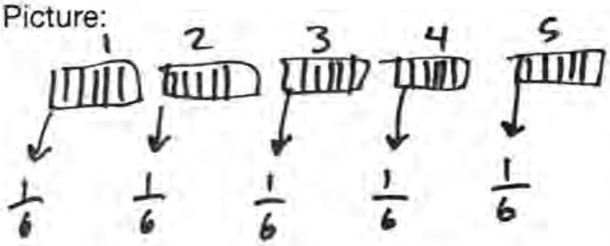
G5 U4 Lesson 1 - Independent Work

Read the story. Write the solution as a fraction and an expression. Then use a picture to solve.

1. Lisa brought 5 subs to Science Club. There were 6 students. How much of a sub can each student get?

$$\frac{\boxed{5}}{\boxed{6}} \qquad 5 \div 6 = \frac{5}{6}$$

Picture:

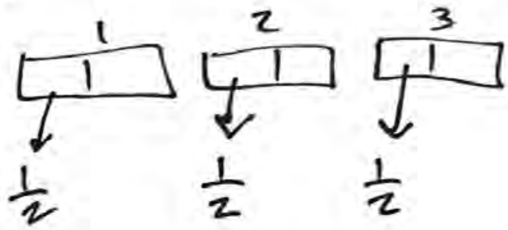


2. Miles and his brother found 3 pan pizzas in the freezer. If the two boys split what they found evenly, how much pizza can he and his brother get?

$$\frac{\boxed{3}}{\boxed{2}} \qquad 3 \div 2 = \frac{3}{2}$$

or $1\frac{1}{2}$

Picture:

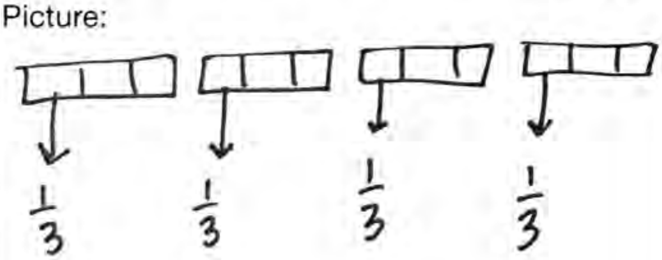


3. Dan needs to take 4 grams of Vitamin D every day. He needs to take it with food so he plans to split it equally over 3 meals. How many grams of Vitamin D should he take with each meal?

$$\frac{\boxed{4}}{\boxed{3}} \qquad 4 \div 3 = \frac{4}{3}$$

or $1\frac{1}{3}$

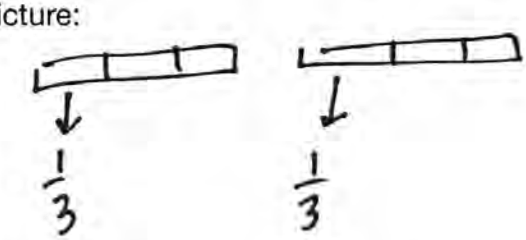
Picture:



4. The Jingle Jangle race is a relay course that must be completed by 3 people who run an equal amount. If the relay course is 2 miles long, how much must each person run?

$$\frac{\boxed{2}}{\boxed{3}} \qquad 2 \div 3 = \frac{2}{3}$$

Picture:

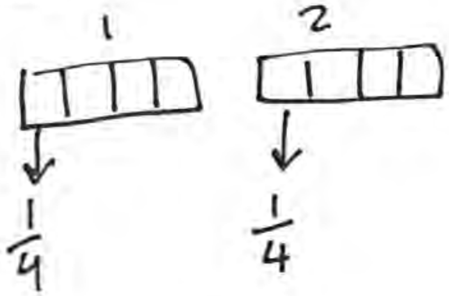


Read the story. Write the solution as a fraction and an expression and long division.

5. There are 2 donuts left in the box. 4 kids are standing around the box looking hungry. If they share the donuts fairly, how many donuts can each kid get?

$\frac{\boxed{2}}{\boxed{4}}$ $2 \div 4 = \frac{2}{4}$

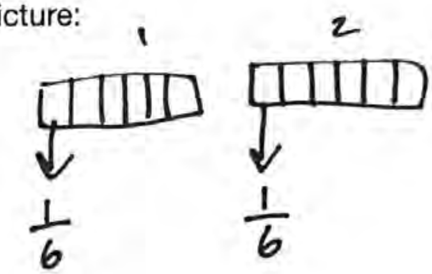
Picture:



6. At Billy's birthday party, there are 6 kids. They each want to get an equal amount of the 2 Liter soda bottle. How many liters of soda can each kid have?

$\frac{\boxed{2}}{\boxed{6}}$ $2 \div 6 = \frac{2}{6}$

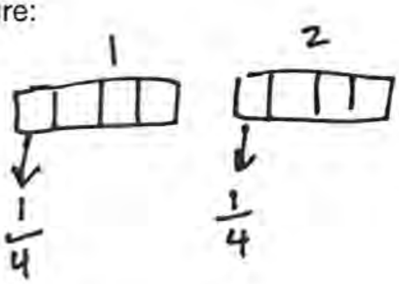
Picture:



7. Janice picked 2 kilograms of apples. She put them evenly in 4 baskets. How many kilograms of apples did she put in each basket?

$\frac{\boxed{2}}{\boxed{4}}$ $2 \div 4 = \frac{2}{4}$

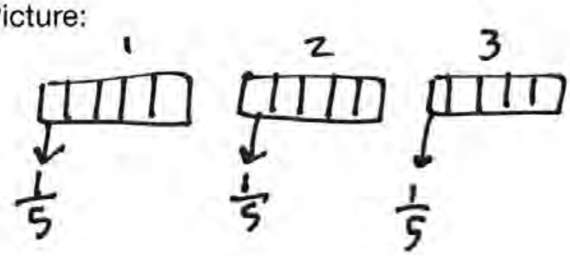
Picture:



8. For Halloween, Rachel made 3 equal bottles of slime to give to her friends. If the recipe she used made 5 cups of slime, how much slime did Rachel put in each bottle?

$\frac{\boxed{3}}{\boxed{5}}$ $3 \div 5 = \frac{3}{5}$

Picture:



G5 U4 Lesson 2

Find a fraction of a set

CITYTUTOR DC

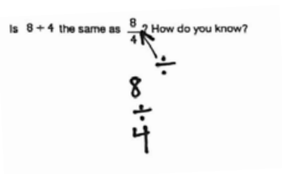
G1 U4 Lesson 2 - Today we will find a fraction of a set.

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): Today we will find a fraction of a set. All of this is going to connect to what we did yesterday with division, and we are going to see how to take everything you learned in 3rd and 4th grade about division and use it to help us with fractions.

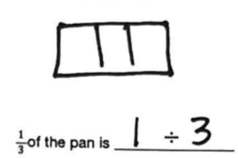
Let's Review (Slide 3): Yesterday we learned about the relationship between division and fractions. Let's review! Is 8 divided by 4 the same as 8 fourths? How do you know? Possible Student Answers, Key Points:

- The 8 is the dividend in both problems.
- The 4 is the divisor in both problems.
- The line in the fraction is like a division symbol.



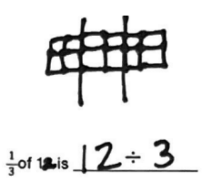
We learned that the dividend comes before the division symbol or it can be the numerator of the fraction. These are the same because the line in the fraction is like a division symbol. Today we are going to see this again. The denominator of the fraction which is the bottom of the fraction is always going to be the divisor.

Let's Talk (Slide 4): This is going to help us finding a fraction of a collection. A collection is just a set of things. Like I could have 10 cookies. That's a collection of 10. I could have 10 books. That's a collection of 10. We're going to draw a picture of both of these problems and see what we can learn about finding a fraction of a collection. Read this first one with your eyes while I read it out loud. *Read the problem while kids listen..*

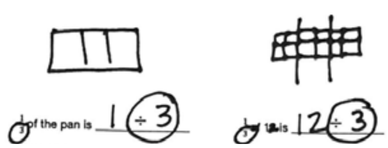


Now let's draw a picture. I am going to draw a pan of brownies. That's one pan. I want to shade one third so I will cut this into three pieces. Those are thirds. Now I shade one. Let's write this as a division problem to find one third of the pan, it was really 1 divided by 3. That's what we learned yesterday. Now let's do the next problem. *Read the problem while kids listen.*

This is a fraction of a collection problem because I want to find one third of the 12 brownies. First, I am going to draw 12 brownies. Count while I draw. *Be sure to draw the brownies so that they look the same as the pan you already drew.*



Now I want one third of the brownies - just like I wanted one third of the pan. Thirds means three equal pieces whether we're finding a fraction of a pan or a fraction of a collection. If I do 4 and 4 and 4, I'll have three groups. I will draw my lines to make 3 equal groups just like 3 equal pieces.

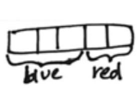


Let's write this as a division problem. To find one third of 12, we really did 12 divided by 3. How are these problems the same? Possible Student Answers, Key Points:

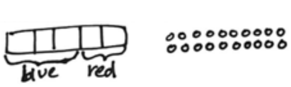
- They are both about brownies.
- They both ate one third.
- They both were divided by 3.

This gets us to the main idea of today, when we take a fraction of something, the denominator is still a divisor. We divide by the bottom number. *Circle the denominators and the divisors.*

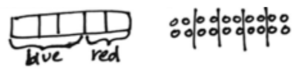
Let's Think (Slide 5): Now we need to find a fraction of a collection when there isn't a 1 in the numerator. Let's read this problem. *Read the problem aloud while the kids listen.*



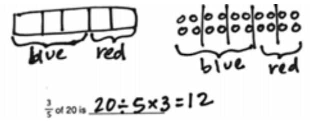
Imagine a picture of three fifths and two fifths. It would be a rectangle cut into 5 pieces for fifths. Three of the fifths would be blue and two of the fifths would be blue.



But I don't have a rectangle. I have 20 beads. I need to divide the beads between these fifths. That's 20 divided by 5. We are still dividing by the denominator! The denominator is still the divisor! 20 divided by 5 is 4 in each of these equal groups.



But the problem said that three of the fifths were blue. So we need three of these groups. That's here! *Shade three of the fifths.* That's three groups of five. That's multiplication. The denominator, which is the bottom number, of the fraction is the divisor and the numerator, that's the top, of the fraction is the multiplier.



Three fifths of 20 is the same as 20 divided by 5 times 3. 20 divided by the denominator times the numerator.

Let's Try it (Slides 6): Let's practice finding a fraction of a collection together! I will help you draw a picture and write an expression.

WARM WELCOME

Today we will find a fraction of a set.

Let's Review:

Yesterday, we learned about the relationship between division and fractions.

Is $8 \div 4$ the same as $\frac{8}{4}$? How do you know?

Let's Talk:

Draw a picture of both problems. How are they the same?

John has a huge pan of brownies. He ate $\frac{1}{3}$ of the pan. Shade the amount that John ate.

Jim has 12 brownies. He ate $\frac{1}{3}$ of the brownies. Shade the amount that John ate.

$\frac{1}{3}$ of the pan is _______ $\div$ _______

$\frac{1}{3}$ of 12 is _______ $\div$ _______

Let's Think: We need to find a fraction of a collection when there isn't a 1 in the numerator.

Rea is making a necklace. $\frac{3}{5}$ of the beads will be blue and $\frac{2}{5}$ of the beads will be red. Rea wants the necklace to have 20 beans. How many of the beads will be blue?

$\frac{3}{5}$ of 20 is ______________

Let's Try It: Let's practice finding a fraction of a collection together.

Name: ______________________________ G5 U4 Lesson 2 - Let's Try It

Represent $\frac{1}{6}$ of a rectangle.

1. Draw a picture.

2. Complete the expression to represent the picture: $\frac{1}{6}$ of a rectangle is the same as ____ ÷ ____

Jen has a book that is 12 pages long. She read $\frac{1}{6}$ of the pages. How many pages did Jen read?

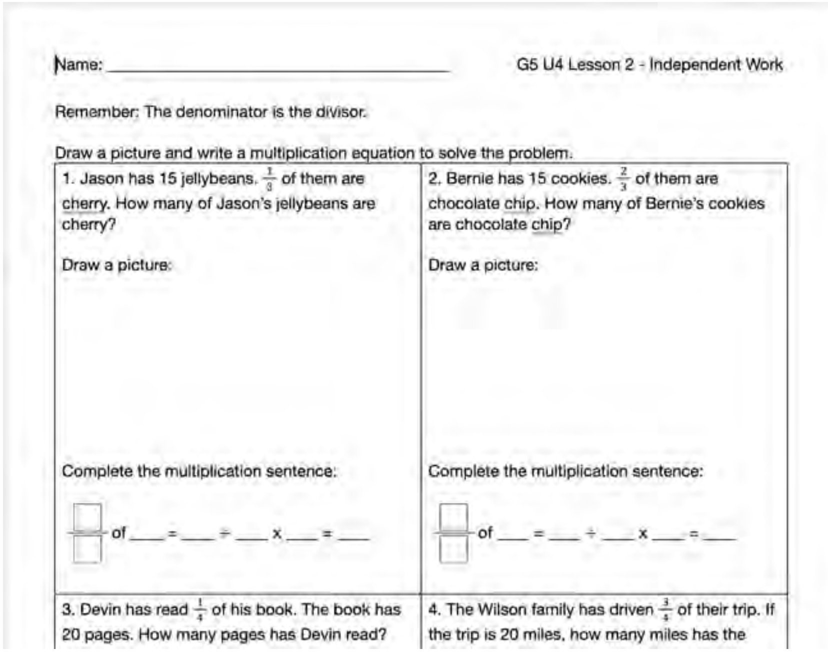
3. Draw a picture.

4. Complete the expression to represent the picture: $\frac{1}{6}$ of 12 is the same as ____ ÷ ____

Kevin also has a book that is 12 pages long. He read $\frac{5}{6}$ of the pages. How many pages did

On your Own:

Now it's time for you to do it on your own.



Name: ______________________ G5 U4 Lesson 2 - Independent Work

Remember: The denominator is the divisor.

Draw a picture and write a multiplication equation to solve the problem.

1. Jason has 15 jellybeans. $\frac{1}{3}$ of them are cherry. How many of Jason's jellybeans are cherry? Draw a picture: Complete the multiplication sentence: $\frac{\square}{\square}$ of ___ = ___ ÷ ___ x ___ = ___	2. Bernie has 15 cookies. $\frac{2}{3}$ of them are chocolate chip. How many of Bernie's cookies are chocolate chip? Draw a picture: Complete the multiplication sentence: $\frac{\square}{\square}$ of ___ = ___ ÷ ___ x ___ = ___
3. Devin has read $\frac{1}{4}$ of his book. The book has 20 pages. How many pages has Devin read?	4. The Wilson family has driven $\frac{3}{4}$ of their trip. If the trip is 20 miles, how many miles has the

Represent $\frac{1}{6}$ of a rectangle.

1. Draw a picture.

2. Complete the expression to represent the picture: $\frac{1}{6}$ of a rectangle is the same as _____÷_____

Jen has a book that is 12 pages long. She read $\frac{1}{6}$ of the pages. How many pages did Jen read?

3. Draw a picture.

4. Complete the expression to represent the picture: $\frac{1}{6}$ of 12 is the same as _____÷_____

Kevin also has a book that is 12 pages long. He read $\frac{5}{6}$ of the pages. How many pages did Kevin read?

5. Draw a picture.

6. Complete the expression to represent the picture: $\frac{5}{6}$ of 12 is the same as _____÷_____×_____

Fill in the blanks:

With a fraction of a collection,

we are really _________________ by the bottom number and _________________ by the top number.

Name: ______________________________________

Remember: The denominator is the divisor.

Draw a picture and write a multiplication equation to solve the problem.

1. Jason has 15 jellybeans. $\frac{1}{3}$ of them are cherry. How many of Jason's jellybeans are cherry?

Draw a picture:

Complete the multiplication sentence:

$\frac{\square}{\square}$ of _____ = _____ ÷ _____ x _____ = _____

2. Bernie has 15 cookies. $\frac{2}{3}$ of them are chocolate chip. How many of Bernie's cookies are chocolate chip?

Draw a picture:

Complete the multiplication sentence:

$\frac{\square}{\square}$ of _____ = _____ ÷ _____ x _____ = _____

3. Devin has read $\frac{1}{4}$ of his book. The book has 20 pages. How many pages has Devin read?

Draw a picture:

Complete the multiplication sentence:

$\frac{\square}{\square}$ of _____ = _____ ÷ _____ x _____ = _____

4. The Wilson family has driven $\frac{3}{4}$ of their trip. If the trip is 20 miles, how many miles has the Wilson family driven so far?

Draw a picture:

Complete the multiplication sentence:

$\frac{\square}{\square}$ of _____ = _____ ÷ _____ x _____ = _____

Draw a picture and write a multiplication equation to solve the problem.

5. The third graders at Abbott Elementary are collecting cans. Their goal is to collect 27 cans. So far they have collected $\frac{2}{3}$ of their goal. How many cans have they collected?

Draw a picture:

Complete the multiplication sentence:

$\frac{\square}{\square}$ of _____ = _____ ÷ _____ x _____ = _____

6. Jamie's math book is 18 pages. So far, he has done $\frac{2}{3}$ of the pages in the book. How many pages has Jamie done?

Draw a picture:

Complete the multiplication sentence:

$\frac{\square}{\square}$ of _____ = _____ ÷ _____ x _____ = _____

7. The TV show is 30 minutes long. Sam has watched $\frac{3}{5}$ of his favorite show. How many minutes has Sam watched?

Draw a picture:

Complete the multiplication sentence:

$\frac{\square}{\square}$ of _____ = _____ ÷ _____ x _____ = _____

8. Matt scored $\frac{1}{10}$ of the points in the basketball game. There were 20 points scored. How many points did Matt score?

Draw a picture:

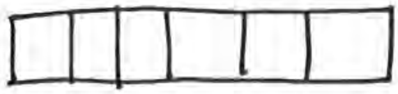
Complete the multiplication sentence:

$\frac{\square}{\square}$ of _____ = _____ ÷ _____ x _____ = _____

Name: ANSWER KEY

Represent $\frac{1}{6}$ of a rectangle.

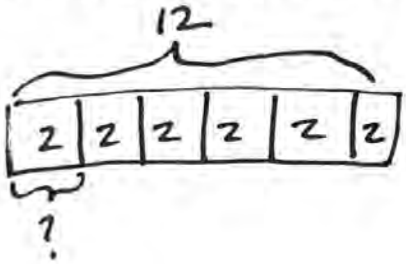
1. Draw a picture.



2. Complete the expression to represent the picture: $\frac{1}{6}$ of a rectangle is the same as 1 ÷ 6

Jen has a book that is 12 pages long. She read $\frac{1}{6}$ of the pages. How many pages did Jen read?

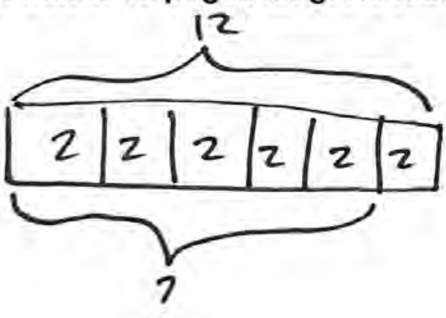
3. Draw a picture.



4. Complete the expression to represent the picture: $\frac{1}{6}$ of 12 is the same as 12 ÷ 6

Kevin also has a book that is 12 pages long. He read $\frac{5}{6}$ of the pages. How many pages did Kevin read?

5. Draw a picture.



6. Complete the expression to represent the picture: $\frac{5}{6}$ of 12 is the same as 12 ÷ 6 × 5

Fill in the blanks:

With a fraction of a collection,

we are really dividing **by the bottom number and** multiplying **by the top number.**

Name: ANSWER KEY

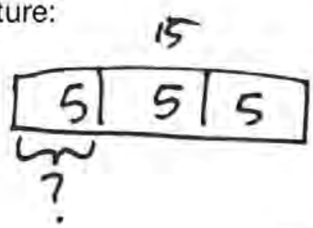
G5 U4 Lesson 2 - Independent Work

Remember: The denominator is the divisor.

Draw a picture and write a multiplication equation to solve the problem.

1. Jason has 15 jellybeans. $\frac{1}{3}$ of them are cherry. How many of Jason's jellybeans are cherry?

Draw a picture:

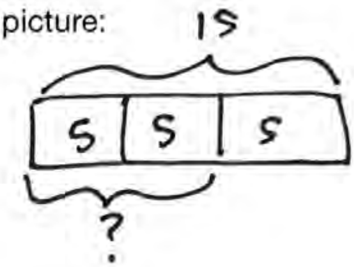


Complete the multiplication sentence:

$\frac{\boxed{1}}{\boxed{3}}$ of 15 = 15 ÷ 3 x 1 = 5

2. Bernie has 15 cookies. $\frac{2}{3}$ of them are chocolate chip. How many of Bernie's cookies are chocolate chip?

Draw a picture:

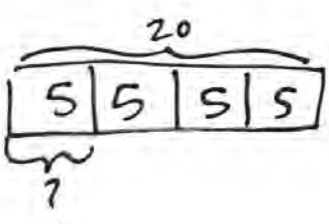


Complete the multiplication sentence:

$\frac{\boxed{2}}{\boxed{3}}$ of 15 = 15 ÷ 3 x 2 = 10

3. Devin has read $\frac{1}{4}$ of his book. The book has 20 pages. How many pages has Devin read?

Draw a picture:

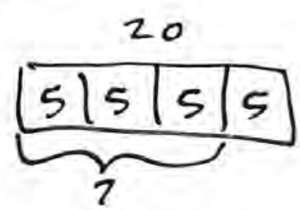


Complete the multiplication sentence:

$\frac{\boxed{1}}{\boxed{4}}$ of 20 = 20 ÷ 4 x 1 = 5

4. The Wilson family has driven $\frac{3}{4}$ of their trip. If the trip is 20 miles, how many miles has the Wilson family driven so far?

Draw a picture:



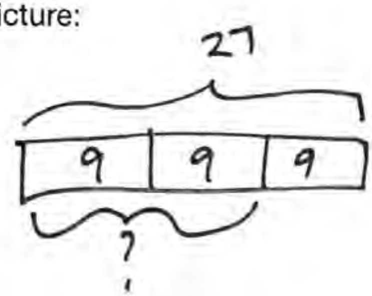
Complete the multiplication sentence:

$\frac{\boxed{3}}{\boxed{4}}$ of 20 = 20 ÷ 4 x 3 = 15

Draw a picture and write a multiplication equation to solve the problem.

5. The third graders at Abbott Elementary are collecting cans. Their goal is to collect 27 cans. So far they have collected $\frac{2}{3}$ of their goal. How many cans have they collected?

Draw a picture:

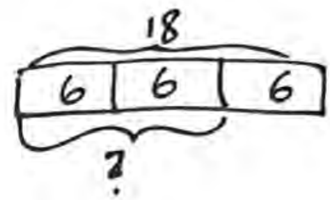


Complete the multiplication sentence:

$\frac{\boxed{2}}{\boxed{3}}$ of 27 = 27 ÷ 3 x 2 = 18

6. Jamie's math book is 18 pages. So far, he has done $\frac{2}{3}$ of the pages in the book. How many pages has Jamie done?

Draw a picture:

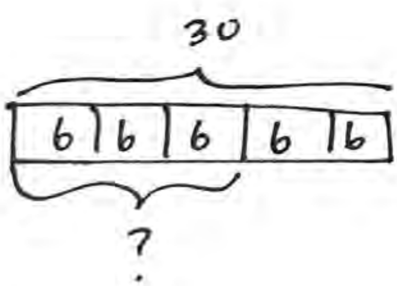


Complete the multiplication sentence:

$\frac{\boxed{2}}{\boxed{3}}$ of 18 = 18 ÷ 3 x 2 = 12

7. The TV show is 30 minutes long. Sam has watched $\frac{3}{5}$ of his favorite show. How many minutes has Sam watched?

Draw a picture:

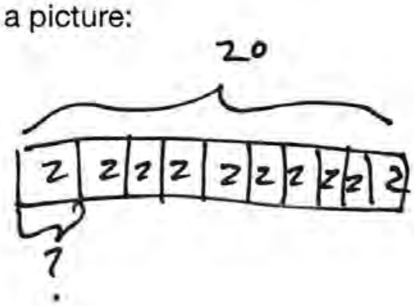


Complete the multiplication sentence:

$\frac{\boxed{3}}{\boxed{5}}$ of 30 = 30 ÷ 5 x 3 = 18

8. Matt scored $\frac{1}{10}$ of the points in the basketball game. There were 20 points scored. How many points did Matt score?

Draw a picture:



Complete the multiplication sentence:

$\frac{\boxed{1}}{\boxed{10}}$ of 20 = 20 ÷ 10 x 1 = 2

G5 U4 Lesson 3

Multiply whole numbers by fractions using tape diagrams

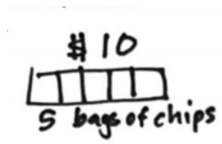
CITYTUTOR DC

G1 U4 Lesson 3 - Today we will multiply whole numbers by fractions using tape diagrams.

Warm Welcome (Slide 1): Tutor choice

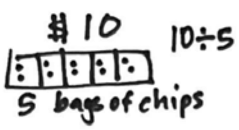
Frame the Learning/Connect to Prior Learning (Slide 2): Today we will multiply whole numbers by fractions using tape diagrams. We did a few drawings yesterday so we are ready for this!

Let's Review (Slide 3): The key to our work today is remembering that division and multiplication work with equal groups or equal units. We have already been using division to find fractions of a collection. Let's review the meaning of division and multiplication with this word problem: At the grocery store, 5 bags of chips cost $10. How much does it cost for 1 bag of chips?

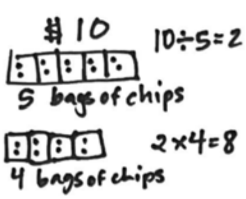


I can draw a tape diagram to show the 5 bags of chips. Altogether, these cost $10 so I will label it like this. Each bag of chips is an equal amount like an equal group or an equal piece or equal units. How would I find the cost of one unit? Possible Student Answers, Key Points:

- I know it's $2 because 5 x 2 makes 10.
- I know it's $2 because $1 each would be $5 and $2 each would be $10.
- I know it's $2 because 10 divided by 5 is 2.



If we know the total for 5 units, we can divide to find the amount for 1 unit. That's like splitting the 10 into 5 equal amounts. Division helps us find the amount of 1 unit. I am going to shade it. It looks like a fraction picture, doesn't it? It looks like one fifth! Remember from our last lesson, that cutting pieces of a fraction is like division.

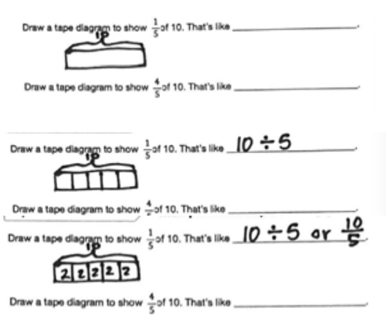


The next part of our problem asks how much does it cost for 4 bags of chips. How would I find the cost of four units? Possible Student Answers, Key Points:

- We can add 2 + 2 + 2 + 2, which is 8.
- We can do 4 x 2, which is 8.

If we know the cost of 1 unit, we can multiply to find the amount for 4 units. That's like putting 4 equal amount of 2 together. Multiplication helps us find the amount of 4 units. I am going to shade those. And again, it looks like a fraction picture. It looks like four fifths. Remember from our last lesson, that shading pieces of a fraction is like multiplication.

Let's Talk (Slide 4): Now we can see how division and multiplication help us multiply fractions! This problem says, "Draw a tape diagram to show one fifth of 10."

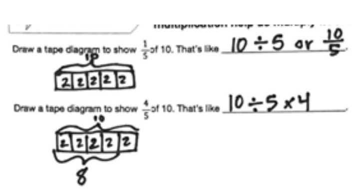


We can draw 10 squares. But to make our life simpler, I am going to draw a rectangle and label it as 10 altogether. This is a collection of 10 or a whole amount of 10.

I want one-fifth of 10. So I cut it into 5 pieces to make fifths. This helps us see that 5 pieces or 5 units are the same as 10. Just like 5 bags of chips cost $10. If I know 5 units, what operation do I use to find 1 unit? Possible Student Answers, Key Points:

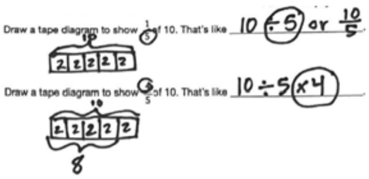
- We can think 5 times what makes 10.
- We can do 10 divided by 5 is 2.

We can write that idea like we learned in our last lesson: 10 divided by 5 and that's the same as 10 over 5. Just like our last lesson, the denominator - that's the bottom of the fraction - is the divisor, the dividing number.



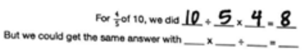
Let's look at the next part, "Draw a tape diagram to show four fifths of 10." That means we want 4 units, right? Like shading 4 parts. If I know 1 unit, what operation do I use to find 4 units? Possible Student Answers, Key Points:

- We can add 2 + 2 + 2 + 2.
- We can do 4 x 2 is 8.

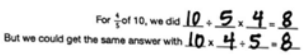


We can write that idea like we learned in our last lesson: 2 x 4. That is the same as what we learned in our last lesson. The numerator, the top number of a fraction is a multiplier, a number we multiply by. *Circle the numbers.*

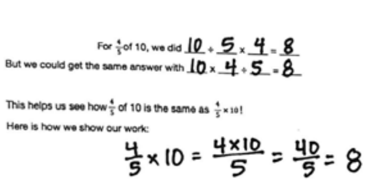
Let's Think (Slide 5): Now we have the big NEW idea for today. The commutative property let's us do these same operations in a different order! Let's fill in these blanks and you'll see what I mean.



For 4 fifths of 10, we did 10 divided by 5 times 4. 10 divided by 5 is 2 and 2 times 4 is 8. But as long as we divide by the divisor and multiply by the multiplier, the order should matter.



We could get the same answer with 10 times 4 divided by 5. 10 times 4 is 40 and 40 divided by 5 is STILL 8! We got the same answer!



This helps us see how 4 fifths of 10 is the same as 4 fifths times 10. Here is how we show our work. The OF is replaced by the multiplication symbol. Then we multiply 4 x 10. The numerator is the multiplier. We write it as 4 x 10 over 5.

That's equal to 40 over 5, which is really 40 divided by 5. That equals 8.

Let's Try it (Slides 6): Let's practice multiplying fractions now that we know multiplication is secretly taking a fraction of a collection. I will help you!

WARM WELCOME

Today we will multiply whole numbers by fractions using tape diagrams.

Let's Review:

The key to our work today is remembering that division and multiplication work with equal groups or equal units.

At the grocery store, 5 bags of chips cost $10.

How much does it cost for 1 bag of chips?

How much does it cost for 4 bags of chips?

Let's Talk:

Now we can see how division and multiplication help us multiply fractions!

Draw a tape diagram to show $\frac{1}{5}$ of 10. That's like ________________________.

Draw a tape diagram to show $\frac{4}{5}$ of 10. That's like ________________________.

Let's Think:

The commutative property let's us do these operations in a different order!

For $\frac{4}{5}$ of 10, we did ____ ÷ ____ x ____ = ____

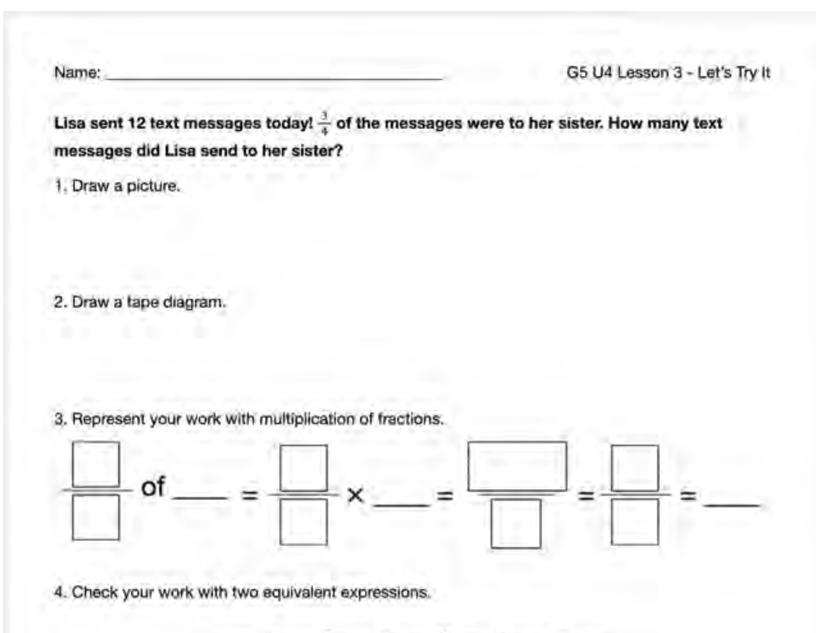
But we could get the same answer with ____ x ____ ÷ ____ = ____

This helps us see how $\frac{4}{5}$ of 10 is the same as $\frac{4}{5} \times 10$!

Here is how we show our work:

Let's Try It:

Let's practice multiplying fractions now that we know multiplication is secretly taking a fraction of a collection. I will help you!



Name: ______________________________ G5 U4 Lesson 3 - Let's Try It

Lisa sent 12 text messages today! $\frac{3}{4}$ of the messages were to her sister. How many text messages did Lisa send to her sister?

1. Draw a picture.

2. Draw a tape diagram.

3. Represent your work with multiplication of fractions.

$\frac{\square}{\square}$ of ____ $= \frac{\square}{\square} \times$ ____ $= \frac{\square}{\square} = \frac{\square}{\square} =$ ____

4. Check your work with two equivalent expressions.

____ ÷ ____ x ____ = ____ x ____ ÷ ____ = ____

On your Own:

Now it’s time for you to do it on your own.

Name: ______________________ G5 U4 Lesson 3 - Independent Work

Remember: A fraction OF a number means a fraction TIMES a number.

Solve the problem below with a picture and fill in the blanks.

1. Leslie’s farm is 12 acres. She planted $\frac{2}{3}$ of it with vegetables and the rest with fruit. How many acres did she plant with fruit? Draw a picture: Fill in the blanks: $\frac{\square}{\square}$ of ___ is $\frac{\square}{\square}$ x ___ = $\frac{\square}{\square}$ = $\frac{\square}{\square}$ = ___ Check with ___ ÷ ___ x ___ = ___	2. Miles took $\frac{1}{2}$ of his medicine with breakfast. He will take the other half with dinner. If Miles is supposed to take 20 mg of medicine, how much did he take with breakfast? Draw a picture: Fill in the blanks: $\frac{\square}{\square}$ of ___ is $\frac{\square}{\square}$ x ___ = $\frac{\square}{\square}$ = $\frac{\square}{\square}$ = ___ Check with ___ ÷ ___ x ___ = ___
3. Rose spent 8 hours playing at her friend’s house today. They spent $\frac{3}{4}$ of the time doing art	4. Nathaniel played video games for 6 hours this weekend. He spent $\frac{2}{3}$ of that time on Roblox.

Lisa sent 12 text messages today! $\frac{3}{4}$ of the messages were to her sister. How many text messages did Lisa send to her sister?

1. Draw a picture.

2. Draw a tape diagram.

3. Represent your work with multiplication of fractions.

$\frac{\square}{\square}$ of ____ $= \frac{\square}{\square} \times$ ____ $= \frac{\square}{\square} = \frac{\square}{\square} =$ ____

4. Check your work with two equivalent expressions.

_____ ÷ _____ x _____ = _____ x _____ ÷ _____ = _____

Solve. $\frac{2}{3} \times 6$

5. Draw a tape diagram.

6. Represent your work with multiplication of fractions.

$\frac{\square}{\square}$ of ____ $= \frac{\square}{\square} \times$ ____ $= \frac{\square}{\square} = \frac{\square}{\square} =$ ____

Name: ______________________________ G5 U4 Lesson 3 - Independent Work

Remember: A fraction OF a number means a fraction TIMES a number.

Solve the problem below with a picture and fill in the blanks.

1. Leslie's farm is 12 acres. She planted $\frac{2}{3}$ of it with vegetables and the rest with fruit. How many acres did she plant with fruit?

Draw a picture:

Fill in the blanks: $\frac{\square}{\square}$ _____ is

$\frac{\square}{\square} \times$ _____ $= \frac{\square}{\square} = \frac{\square}{\square} =$ _____

Check with _____ ÷ _____ x _____ = _____

2. Miles took $\frac{1}{2}$ of his medicine with breakfast. He will take the other half with dinner. If Miles is supposed to take 20 mg of medicine, how much did he take with breakfast?

Draw a picture:

Fill in the blanks: $\frac{\square}{\square}$ _____ is

$\frac{\square}{\square} \times$ _____ $= \frac{\square}{\square} = \frac{\square}{\square} =$ _____

Check with _____ ÷ _____ x _____ = _____

3. Rose spent 8 hours playing at her friend's house today. They spent $\frac{3}{4}$ of the time doing art projects. How long did Rose do art projects?

Draw a picture:

Fill in the blanks: $\frac{\square}{\square}$ _____ is

$\frac{\square}{\square} \times$ _____ $= \frac{\square}{\square} = \frac{\square}{\square} =$ _____

Check with _____ ÷ _____ x _____ = _____

4. Nathaniel played video games for 6 hours this weekend. He spent $\frac{2}{3}$ of that time on Roblox. How long did he spend on Roblox?

Draw a picture:

Fill in the blanks: $\frac{\square}{\square}$ _____ is

$\frac{\square}{\square} \times$ _____ $= \frac{\square}{\square} = \frac{\square}{\square} =$ _____

Check with _____ ÷ _____ x _____ = _____

Solve the problem below with a picture and fill in the blanks.

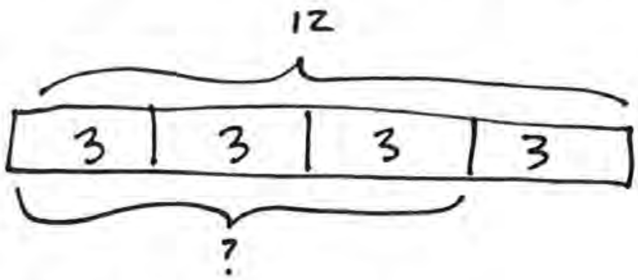
5. Jessie put stamps on $\frac{3}{5}$ of the cards she wanted to send for Valentine's Day. If she had 20 cards, how many were stamped? Draw a picture: Fill in the blanks: $\frac{\square}{\square}$ _____ is $\frac{\square}{\square} \times$ _____ $= \frac{\square}{\square} = \frac{\square}{\square} =$ _____ Check with _____ ÷ _____ x _____ = _____	6. I used $\frac{2}{3}$ of a bag of cheese in my taco recipe. If the bag held 12 ounces, how many ounces of cheese did I use? Draw a picture: Fill in the blanks: $\frac{\square}{\square}$ _____ is $\frac{\square}{\square} \times$ _____ $= \frac{\square}{\square} = \frac{\square}{\square} =$ _____ Check with _____ ÷ _____ x _____ = _____
7. Marvin picked 10 pounds of apples. $\frac{2}{5}$ of them were green and the rest were red. How many pounds of green apples did he pick? Draw a picture: Fill in the blanks: $\frac{\square}{\square}$ _____ is $\frac{\square}{\square} \times$ _____ $= \frac{\square}{\square} = \frac{\square}{\square} =$ _____ Check with _____ ÷ _____ x _____ = _____	8. Dan's phone said he used it for 8 hours this week. $\frac{3}{4}$ of that time was used for internet and the rest was used for calls. How many hours did Dan spend on the internet? Draw a picture: Fill in the blanks: $\frac{\square}{\square}$ _____ is $\frac{\square}{\square} \times$ _____ $= \frac{\square}{\square} = \frac{\square}{\square} =$ _____ Check with _____ ÷ _____ x _____ = _____

Name: ANSWER KEY

Lisa sent 12 text messages today! $\frac{3}{4}$ of the messages were to her sister. How many text messages did Lisa send to her sister?

1. Draw a picture.

2. Draw a tape diagram.



3. Represent your work with multiplication of fractions.

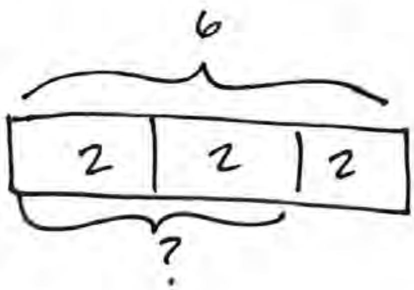
$$\frac{\boxed{3}}{\boxed{4}} \text{ of } \underline{12} = \frac{\boxed{3}}{\boxed{4}} \times \underline{12} = \frac{\boxed{3 \times 12}}{\boxed{4}} = \frac{\boxed{36}}{\boxed{4}} = \underline{9}$$

4. Check your work with two equivalent expressions.

$$\underline{12} \div \underline{4} \times \underline{3} = \underline{12} \times \underline{3} \div \underline{4} = \underline{9}$$

Solve. $\frac{2}{3} \times 6$

5. Draw a tape diagram.



6. Represent your work with multiplication of fractions.

$$\frac{\boxed{2}}{\boxed{3}} \text{ of } \underline{6} = \frac{\boxed{2}}{\boxed{3}} \times \underline{6} = \frac{\boxed{2 \times 6}}{\boxed{3}} = \frac{\boxed{12}}{\boxed{3}} = \underline{4}$$

Name: ANSWER KEY

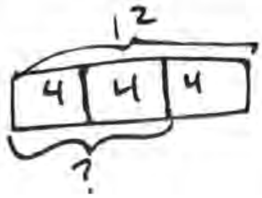
G5 U4 Lesson 3 - Independent Work

Remember: A fraction OF a number means a fraction TIMES a number.

Solve the problem below with a picture and fill in the blanks.

1. Leslie's farm is 12 acres. She planted $\frac{2}{3}$ of it with vegetables and the rest with fruit. How many acres did she plant with fruit?

Draw a picture:



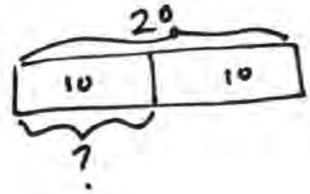
Fill in the blanks: $\frac{\boxed{2}}{\boxed{3}}$ of 12 is 8

$\frac{\boxed{2}}{\boxed{3}} \times 12 = \frac{\boxed{2\times12}}{\boxed{3}} = \frac{\boxed{24}}{\boxed{3}} = 8$

Check with 12 ÷ 3 x 2 = 8

2. Miles took $\frac{1}{2}$ of his medicine with breakfast. He will take the other half with dinner. If Miles is supposed to take 20 mg of medicine, how much did he take with breakfast?

Draw a picture:



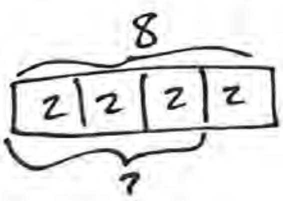
Fill in the blanks: $\frac{\boxed{1}}{\boxed{2}}$ of 20 is

$\frac{\boxed{1}}{\boxed{2}} \times 20 = \frac{\boxed{1\times20}}{\boxed{2}} = \frac{\boxed{20}}{\boxed{2}} = 10$

Check with 20 ÷ 2 x 1 = 10

3. Rose spent 8 hours playing at her friend's house today. They spent $\frac{3}{4}$ of the time doing art projects. How long did Rose do art projects?

Draw a picture:



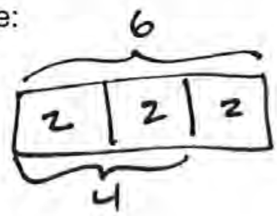
Fill in the blanks: $\frac{\boxed{3}}{\boxed{4}}$ of 8 is 6

$\frac{\boxed{3}}{\boxed{4}} \times 8 = \frac{\boxed{3\times8}}{\boxed{4}} = \frac{\boxed{24}}{\boxed{4}} = 6$

Check with 8 ÷ 4 x 3 = 6

4. Nathaniel played video games for 6 hours this weekend. He spent $\frac{2}{3}$ of that time on Roblox. How long did he spend on Roblox?

Draw a picture:



Fill in the blanks: $\frac{\boxed{2}}{\boxed{3}}$ of 6 is 4

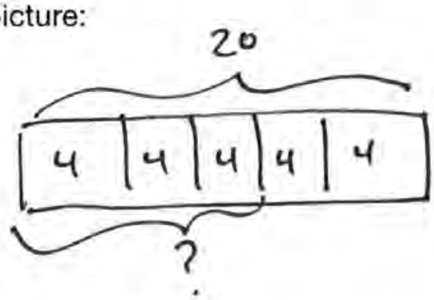
$\frac{\boxed{2}}{\boxed{3}} \times 6 = \frac{\boxed{2\times6}}{\boxed{3}} = \frac{\boxed{12}}{\boxed{3}} = 4$

Check with 6 ÷ 3 x 2 = 4

Solve the problem below with a picture and fill in the blanks.

5. Jessie put stamps on $\frac{3}{5}$ of the cards she wanted to send for Valentine's Day. If she had 20 cards, how many were stamped?

Draw a picture:



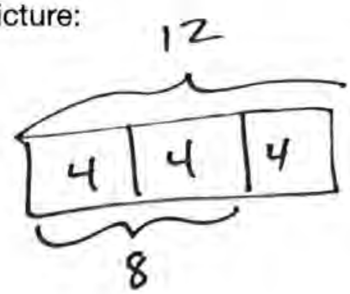
Fill in the blanks: $\frac{\boxed{3}}{\boxed{5}}$ of $\underline{20}$ is 12

$\frac{\boxed{3}}{\boxed{5}} \times \underline{20} = \frac{\boxed{3 \times 20}}{\boxed{5}} = \frac{\boxed{60}}{\boxed{5}} = \underline{12}$

Check with $\underline{20} \div \underline{5} \times \underline{3} = \underline{12}$

6. I used $\frac{2}{3}$ of a bag of cheese in my taco recipe. If the bag held 12 ounces, how many ounces of cheese did I use?

Draw a picture:



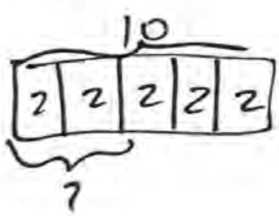
Fill in the blanks: $\frac{\boxed{2}}{\boxed{3}}$ of $\underline{12}$ is 8

$\frac{\boxed{2}}{\boxed{3}} \times \underline{12} = \frac{\boxed{2 \times 12}}{\boxed{3}} = \frac{\boxed{24}}{\boxed{3}} = \underline{8}$

Check with $\underline{12} \div \underline{3} \times \underline{2} = \underline{8}$

7. Marvin picked 10 pounds of apples. $\frac{2}{5}$ of them were green and the rest were red. How many pounds of green apples did he pick?

Draw a picture:



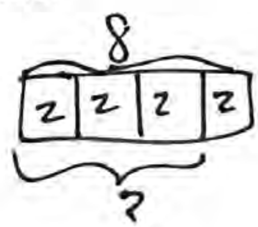
Fill in the blanks: $\frac{\boxed{2}}{\boxed{5}}$ of $\underline{10}$ is 4

$\frac{\boxed{2}}{\boxed{5}} \times \underline{10} = \frac{\boxed{2 \times 10}}{\boxed{5}} = \frac{\boxed{20}}{\boxed{5}} = \underline{4}$

Check with $\underline{10} \div \underline{5} \times \underline{2} = \underline{4}$

8. Dan's phone said he used it for 8 hours this week. $\frac{3}{4}$ of that time was used for internet and the rest was used for calls. How many hours did Dan spend on the internet?

Draw a picture:



Fill in the blanks: $\frac{\boxed{3}}{\boxed{4}}$ of $\underline{8}$ is 6

$\frac{\boxed{3}}{\boxed{4}} \times \underline{8} = \frac{\boxed{3 \times 8}}{\boxed{4}} = \frac{\boxed{24}}{\boxed{4}} = \underline{6}$

Check with $\underline{8} \div \underline{4} \times \underline{3} = \underline{6}$

G5 U4 Lesson 4

Relate multiplying fractions to repeated addition

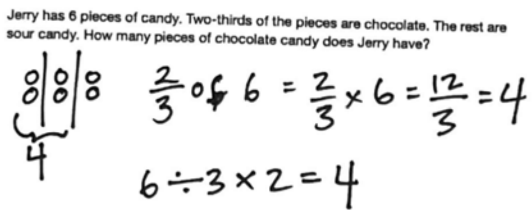
CITYTUTOR DC

G1 U4 Lesson 4 - Today we will relate multiplying fractions to repeated addition.

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): Today we will relate multiplying fractions to repeated addition. This is going to be great at making sure that our last lesson still works with everything else we've learned about multiplication over the years. I think it is really going to make multiplying fractions stick for you.

Let's Review (Slide 3): In our last lesson, we learned how to multiply fractions. Keep your eyes on the words while I read this problem. *Read the problem while the kids read along silently.* How would you represent and solve this problem? *This is an opportunity for everyone to review all the different types of correct reasoning. If someone suggests something that is incorrect, be sure to say, "That's not exactly right. Can someone else help?" Be sure to stamp correct thinking by saying, "That is right" and write it down on the board. You will want to capture all the correct ideas including: "of" language, multiplying fractions, division with multiplication and a tape diagram.*

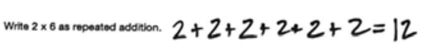


Possible Student Answers, Key Points:

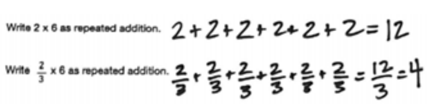
- Two thirds of 6 is two thirds times 6 so we do 2 x 6 over 3. 2 x 6 is 12 and 12 divided by 3 is 4.
- We divide by 3 and multiply by 2. 6 divided by 3 is 2 and 2 x 2 is 4.
- We multiply by 2 and divide by 3. 6 x 2 is 12 and 12 divided by 3 is 4.
- We draw a rectangle to represent 6. Then we split it into 3 pieces. There's 2 in each piece. We shade in two pieces, which is 4.

There are a lot of ways to represent this problem. We have "of" language. We can think of it as multiplying fractions. We can use division then multiplication or multiplication then division. We can draw a tape diagram. All of these are correct. All of these get the same answer - 4.

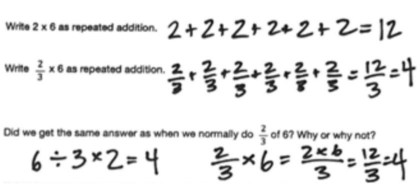
Let's Talk (Slide 4): The big idea we want to figure out today is how this relates to what we learned about multiplication in earlier grades because in earlier grades you probably learned that multiplication is the same as repeated addition.



This says to write 2 x 6 as repeated addition. That would be 2 repeated 6 times. I write 2 + 2 + 2 + 2 + 2 + 2. I can count 6 twos or 6 units of 2.

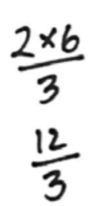


Now let's write $\frac{2}{3} \times 6$ as repeated addition. That would be $\frac{2}{3}$ repeated 6 times. I write $\frac{2}{3} + \frac{2}{3} + \frac{2}{3} + \frac{2}{3} + \frac{2}{3} + \frac{2}{3}$. Remember that when we add fractions, we don't add denominators. We have 2 pieces and 2 pieces and 2 pieces and 2 pieces and 2 pieces and 2 pieces. That's 12 pieces. It's really 2 + 2 + 2 + 2 + 2 + 2 over 3. That's 12 over 3, 12 thirds. 12 thirds is 12 divided by 3, which is 4. This is what we just did on the last slide with the 4 pieces of chocolate candy!



So, did we get the same answers as when we normally do $\frac{2}{3}$ of 6? Yes! Let's show the work. We said on the last slide that $\frac{2}{3}$ of 6 could be thought of as 2 x 6 over 3.

Repeated addition of the numerator is like multiplying the numerator. The bottom number of the fraction, the denominator stayed the dividing number. That means everything we've been learning works together which is one of the most important things in math. All the ideas have to agree with each other. And here we have repeated addition agreeing with taking a fraction of a number which agrees with multiplying a fraction by a number.



Let's Think (Slide 5): If all of these ideas are agreeing then that means the commutative property should also work. The commutative property means that we should be able to switch the order of our multiplication and get the same answer. This says, "Is 2 thirds times 6 equal to 6 times 2 thirds?"

We just did 2 thirds times 6. It was 2 x 6 over 3 which is 12 over 3 which is 4.

$$\frac{2\times 6}{3} \qquad \frac{6\times 2}{3}$$

$$\frac{12}{3} \qquad \frac{12}{3}$$

Now we can do 6 times 2 thirds. That's 6 x 2 over 3 which is still 12 over 3. It's still 4! It works either way!

Let's Try it (Slides 6): Let's practice multiplying fractions together. We will check our work with repeated addition! I will walk you through step by step.

WARM WELCOME

Today we will related multiplying fractions to repeated addition.

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Let's Review: In our last lesson, we learned how to multiply fractions.

Jerry has 6 pieces of candy. Two-thirds of the pieces are chocolate. The rest are sour candy. How many pieces of chocolate candy does Jerry have?

Let's Talk: Today we want to see how multiplying fractions relates to repeated addition.

Write 2 x 6 as repeated addition.

Write $\frac{2}{3}$ x 6 as repeated addition.

Did we get the same answer as when we normally do $\frac{2}{3}$ of 6? Why or why not?

Let's Think:

The commutative property means that we should be able to switch the order of our multiplication and get the same answer.

Is $\frac{2}{3} \times 6 = 6 \times \frac{2}{3}$?

Let's Try It:

Let's practice multiplying fractions together. We will check our work with repeated addition!

Name: ______________________________ G5 U4 Lesson 4 - Let's Try It

Martin wants to eat $\frac{3}{4}$ of the pizza. The pizza has 12 slices. How many slices does Martin want to eat?

1. Draw a tape diagram.

2. Represent your work with multiplication of fractions.

$$\frac{\square}{\square} \text{ of } \_\_\_\_ = \frac{\square}{\square} \times \_\_\_\_ = \frac{\square}{\square} = \frac{\square}{\square} = \_\_\_\_$$

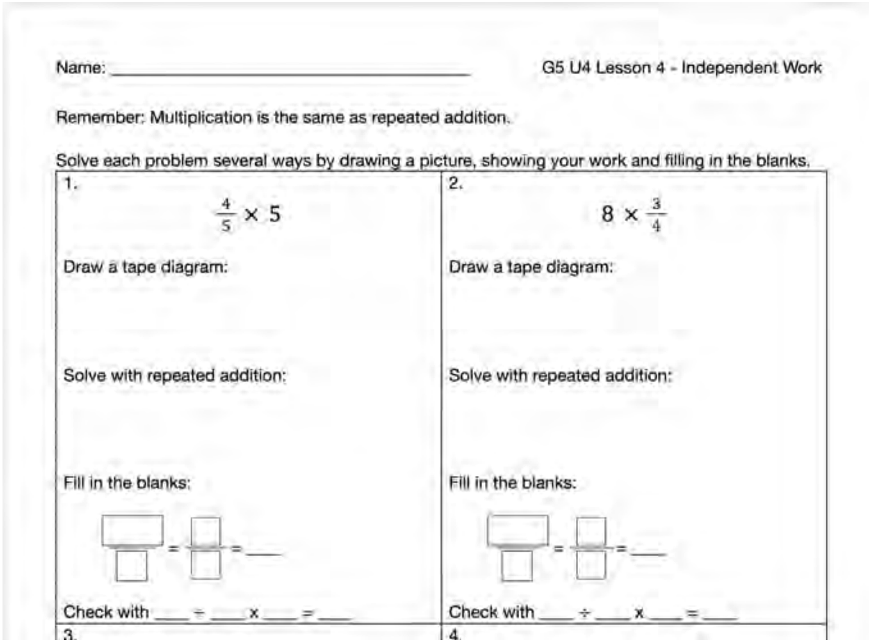
3. Check your work with two equivalent expressions.

$\_\_\_\_ \div \_\_\_\_ \times \_\_\_\_ = \_\_\_\_ \times \_\_\_\_ \div \_\_\_\_ = \_\_\_\_$

4. Now check your work with repeated addition.

On your Own:

Now it’s time for you to do it on your own.



Name: ______________________________ G5 U4 Lesson 4 - Independent Work

Remember: Multiplication is the same as repeated addition.

Solve each problem several ways by drawing a picture, showing your work and filling in the blanks.

1. $\frac{4}{5} \times 5$ Draw a tape diagram: Solve with repeated addition: Fill in the blanks: $\frac{\square}{\square} = \frac{\square}{\square} =$ ___ Check with ___ ÷ ___ x ___ = ___	2. $8 \times \frac{3}{4}$ Draw a tape diagram: Solve with repeated addition: Fill in the blanks: $\frac{\square}{\square} = \frac{\square}{\square} =$ ___ Check with ___ ÷ ___ x ___ = ___
3.	4.

Martin wants to eat $\frac{3}{4}$ of the pizza. The pizza has 12 slices. How many slices does Martin want to eat?

1. Draw a tape diagram.

2. Represent your work with multiplication of fractions.

$$\frac{\square}{\square} \text{ of } \_\_\_\_ = \frac{\square}{\square} \times \_\_\_\_ = \frac{\square}{\square} = \frac{\square}{\square} = \_\_\_\_$$

3. Check your work with two equivalent expressions.

_____ ÷ _____ x _____ = _____ x _____ ÷ _____ = _____

4. Now check your work with repeated addition.

Solve. $3 \times \frac{4}{5}$

5. Represent your work with multiplication of fractions.

$$\frac{\square}{\square} = \frac{\square}{\square} = \_\_\_\_$$

6. Represent your work with repeated addition.

Freddy has 3 dogs. Each dog gets $\frac{3}{4}$ cup of kibble in the morning. How much kibble does Freddy need in the morning?

7. Draw a tape diagram:

8. Represent your work with multiplication of fractions.

$$\frac{\boxed{}}{\boxed{}} = \frac{\boxed{}}{\boxed{}} = \underline{}$$

9. Represent your work with repeated addition.

Name: ____ G5 U4 Lesson 4 - Independent Work

Remember: Multiplication is the same as repeated addition.

Solve each problem several ways by drawing a picture, showing your work and filling in the blanks.

1.

$$\frac{4}{5} \times 5$$

Draw a tape diagram:

Solve with repeated addition:

Fill in the blanks:

$$\frac{\boxed{}}{\boxed{}} = \frac{\boxed{}}{\boxed{}} = \_\_\_\_$$

Check with _____ ÷ _____ x _____ = _____

2.

$$8 \times \frac{3}{4}$$

Draw a tape diagram:

Solve with repeated addition:

Fill in the blanks:

$$\frac{\boxed{}}{\boxed{}} = \frac{\boxed{}}{\boxed{}} = \_\_\_\_$$

Check with _____ ÷ _____ x _____ = _____

3.

$$\frac{1}{2} \times 10$$

Draw a tape diagram:

Solve with repeated addition:

Fill in the blanks:

$$\frac{\boxed{}}{\boxed{}} = \frac{\boxed{}}{\boxed{}} = \_\_\_\_$$

Check with _____ ÷ _____ x _____ = _____

4.

$$9 \times \frac{2}{3}$$

Draw a tape diagram:

Solve with repeated addition:

Fill in the blanks:

$$\frac{\boxed{}}{\boxed{}} = \frac{\boxed{}}{\boxed{}} = \_\_\_\_$$

Check with _____ ÷ _____ x _____ = _____

Solve each problem several ways by drawing a picture, showing your work and filling in the blanks.

5.

$$4 \times \frac{2}{3}$$

Draw a tape diagram:

Solve with repeated addition:

Fill in the blanks:

$$\frac{\square}{\square} = \frac{\square}{\square} = \underline{\qquad}$$

6.

$$3 \times \frac{4}{7}$$

Draw a tape diagram:

Solve with repeated addition:

Fill in the blanks:

$$\frac{\square}{\square} = \frac{\square}{\square} = \underline{\qquad}$$

7. Gary takes $\frac{1}{4}$ ounce of medicine every day. How much medicine does he take in a week?

Draw a tape diagram:

Solve with repeated addition:

Fill in the blanks:

$$\frac{\square}{\square} = \frac{\square}{\square} = \underline{\qquad}$$

8. Lisa walks her dog three times a day. Each time, she walks her dog $\frac{2}{3}$ of a mile. How far does she walk her dog each day?

Draw a tape diagram:

Solve with repeated addition:

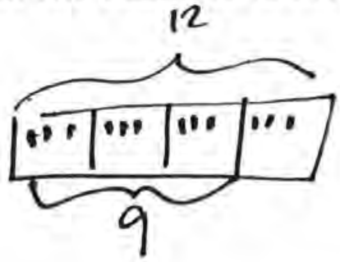
Fill in the blanks:

$$\frac{\square}{\square} = \frac{\square}{\square} = \underline{\qquad}$$

Name: ANSWER KEY

Martin wants to eat $\frac{3}{4}$ of the pizza. The pizza has 12 slices. How many slices does Martin want to eat?

1. Draw a tape diagram.



2. Represent your work with multiplication of fractions.

$$\frac{\boxed{3}}{\boxed{4}} \text{ of } \underline{12} = \frac{\boxed{3}}{\boxed{4}} \times \underline{12} = \frac{\boxed{3 \times 12}}{\boxed{4}} = \frac{\boxed{36}}{\boxed{4}} = \underline{9}$$

3. Check your work with two equivalent expressions.

$$\underline{12} \div \underline{4} \times \underline{3} = \underline{12} \times \underline{3} \div \underline{4} = \underline{9}$$

4. Now check your work with repeated addition.

$$\frac{3}{4} + \frac{3}{4} + \frac{3}{4} + \frac{3}{4} + \frac{3}{4} + \frac{3}{4} + \frac{3}{4} + \frac{3}{4} + \frac{3}{4} + \frac{3}{4} + \frac{3}{4} + \frac{3}{4} = \frac{36}{4} = 9$$

Solve. $10 \times \frac{4}{5}$

5. Represent your work with multiplication of fractions.

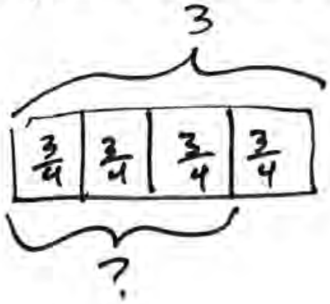
$$\frac{\boxed{10 \times 4}}{\boxed{5}} = \frac{\boxed{40}}{\boxed{5}} = \underline{8}$$

6. Represent your work with repeated addition.

$$\frac{4}{5} + \frac{4}{5} + \frac{4}{5} + \frac{4}{5} + \frac{4}{5} + \frac{4}{5} + \frac{4}{5} + \frac{4}{5} + \frac{4}{5} + \frac{4}{5} = \frac{40}{5} = 8$$

Freddy has 3 dogs. Each dog gets $\frac{3}{4}$ cup of kibble in the morning. How much kibble does Freddy need in the morning?

7. Draw a tape diagram:



8. Represent your work with multiplication of fractions.

$$\frac{\boxed{3 \times 3}}{\boxed{4}} = \frac{\boxed{9}}{\boxed{4}} = 2\frac{1}{4}$$

$$\begin{array}{r} 2 \\ 4\overline{)9} \\ -8 \\ \hline 1 \end{array}$$

9. Represent your work with repeated addition.

$$\frac{3}{4} + \frac{3}{4} + \frac{3}{4} = \frac{9}{4} = 2\frac{1}{4}$$

Name: ANSWER KEY

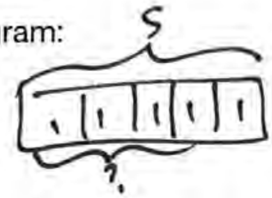
Remember: Multiplication is the same as repeated addition.

Solve each problem several ways by drawing a picture, showing your work and filling in the blanks.

1.

$$\frac{4}{5} \times 5$$

Draw a tape diagram:



Solve with repeated addition:

$\frac{4}{5} + \frac{4}{5} + \frac{4}{5} + \frac{4}{5} + \frac{4}{5} = \frac{20}{5} = 4$

Fill in the blanks:

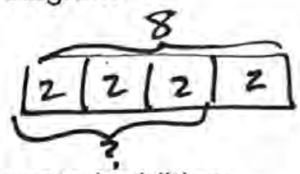
$\frac{\boxed{4 \times 5}}{\boxed{5}} = \frac{\boxed{20}}{\boxed{5}} = \underline{4}$

Check with $\underline{5} \div \underline{5} \times \underline{4} = \underline{4}$

2.

$$8 \times \frac{3}{4}$$

Draw a tape diagram:



Solve with repeated addition:

$\frac{3}{4} + \frac{3}{4} + \frac{3}{4} + \frac{3}{4} + \frac{3}{4} + \frac{3}{4} + \frac{3}{4} + \frac{3}{4} = \frac{24}{4} = 6$

Fill in the blanks:

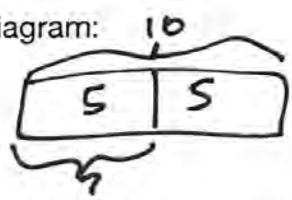
$\frac{\boxed{3 \times 8}}{\boxed{4}} = \frac{\boxed{24}}{\boxed{4}} = \underline{6}$

Check with $\underline{8} \div \underline{4} \times \underline{3} = \underline{6}$

3.

$$\frac{1}{2} \times 10$$

Draw a tape diagram:



Solve with repeated addition:

$\frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} = \frac{10}{2} = 5$

Fill in the blanks:

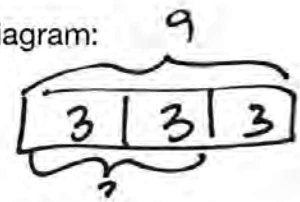
$\frac{\boxed{1 \times 10}}{\boxed{2}} = \frac{\boxed{10}}{\boxed{2}} = \underline{5}$

Check with $\underline{10} \div \underline{2} \times \underline{1} = \underline{5}$

4.

$$9 \times \frac{2}{3}$$

Draw a tape diagram:



Solve with repeated addition:

$\frac{2}{3} + \frac{2}{3} + \frac{2}{3} + \frac{2}{3} + \frac{2}{3} + \frac{2}{2} + \frac{2}{3} + \frac{2}{3} + \frac{2}{3} = \frac{18}{3} = 6$

Fill in the blanks:

$\frac{\boxed{2 \times 9}}{\boxed{3}} = \frac{\boxed{18}}{\boxed{3}} = \underline{6}$

Check with $\underline{9} \div \underline{3} \times \underline{2} = \underline{6}$

Solve each problem several ways by drawing a picture, showing your work and filling in the blanks.

5.

$$4 \times \frac{2}{3}$$

Draw a tape diagram:

Solve with repeated addition:

$$\frac{2}{3} + \frac{2}{3} + \frac{2}{3} + \frac{2}{3} = \frac{8}{3} = 2\frac{2}{3}$$

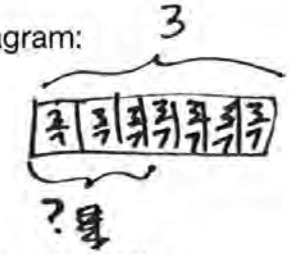
Fill in the blanks:

$$\frac{\boxed{2 \times 4}}{\boxed{3}} = \frac{\boxed{8}}{\boxed{3}} = \underline{2\frac{2}{3}}$$

6.

$$3 \times \frac{4}{7}$$

Draw a tape diagram:



Solve with repeated addition:

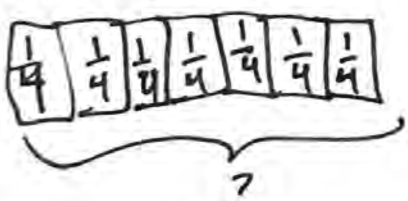
$$\frac{4}{7} + \frac{4}{7} + \frac{4}{7} = \frac{12}{7} = 1\frac{5}{7}$$

Fill in the blanks:

$$\frac{\boxed{4 \times 3}}{\boxed{7}} = \frac{\boxed{12}}{\boxed{7}} = \underline{1\frac{5}{7}}$$

7. Gary takes $\frac{1}{4}$ ounce of medicine every day. How much medicine does he take in a week?

Draw a tape diagram:



Solve with repeated addition:

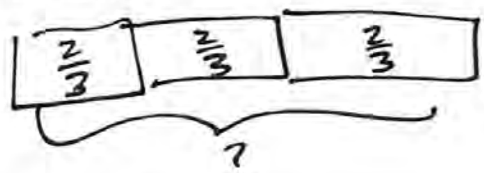
$$\frac{1}{4} + \frac{1}{4} + \frac{1}{4} + \frac{1}{4} + \frac{1}{4} + \frac{1}{4} + \frac{1}{4} = \frac{7}{4} = 1\frac{3}{4}$$

Fill in the blanks:

$$\frac{\boxed{1 \times 7}}{\boxed{4}} = \frac{\boxed{7}}{\boxed{4}} = \underline{1\frac{3}{4}}$$

8. Lisa walks her dog three times a day. Each time, she walks her dog $\frac{2}{3}$ of a mile. How far does she walk her dog each day?

Draw a tape diagram:



Solve with repeated addition:

$$\frac{2}{3} + \frac{2}{3} + \frac{2}{3} = \frac{6}{3} = 2$$

Fill in the blanks:

$$\frac{\boxed{2 \times 3}}{\boxed{3}} = \frac{\boxed{6}}{\boxed{3}} = \underline{2}$$

G5 U4 Lesson 5

Compare the size of a product to the size of its factors

CITYTUTOR DC

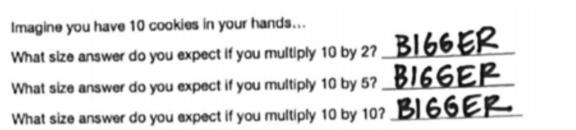
G1 U4 Lesson 5 - Today we will compare the size of a product to the size of its factors.

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): Today we will compare the size of a product to the size of its factors. Let me break this down. Compare means to decide if something is bigger or smaller. Product is the answer to a multiplication problem, and the factors are the number we multiply to make the product. So, today we are going to decide if the answer to our multiplication is going to be bigger or smaller than the numbers being multiplied to get the answer.

Let's Review (Slide 3): Up until this year, the answer to multiplication was always bigger than the numbers that were being multiplied. Imagine you have 10 cookies in your hands (*put out your hands and pretend to hold a bunch of cookies).* Let's think. What size answer do you expect if you multiply 10 by 2? In other words, what if we had these 10 cookies, two times? Possible Student Answers, Key Points:

- We would get 20.
- We would have more.
- The answer would be bigger.

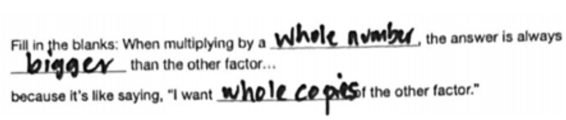


That's right, we expect that our answer is bigger because we take these cookies and get them lots of times. Like now two people are each holding 10 cookies. The answer is bigger than 10. We expect the answer to be bigger if we're multiplying it by a factor of 2.

Note: Repetition is important here, you are saying the same idea lots of different ways so the children hear all the correct language to describe the reasoning. If you need to, have two students come up and pretend to hold 10 cookies each to show the amount of cookies getting bigger.

Now, let's imagine another scenario. What if we had these 10 cookies times 5? We would get 50! We would have more! The answer would be bigger. That's right, we expect that our answer is bigger because we take these cookies and get them lots of times. Like now FIVE people are each holding 10 cookies. The answer is bigger than 10. We expect the answer to be bigger if we're multiplying it by a factor by 5. What if we had these 10 cookies times 10? We would get 100! We would have more. The answer would be bigger. That's right, we expect that our answer is bigger because we take these cookies and get them lots of times. Like now ten people are each holding 10 cookies. The answer is bigger than 10. We expect the answer to be bigger if we're multiplying it by a factor by 10.

This helps us see a pattern. Help me fill in the blanks. "When multiplying by a whole number, the answer is always BIGGER than the other factor…" We said "bigger" for each of these problems, right?



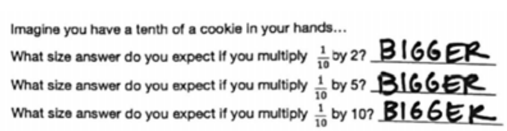
The answer is bigger because multiplying by a whole number is like saying, "I want whole copies of the other factor." Like I want lots of people to hold 10 cookies over and over and over to get lots of cookies. This is the idea that you learned in early grades.

Let's Talk (Slide 4): Now we need to think about whether expecting a bigger answer still makes sense when multiplying a fraction. Imagine you have a tenth of a cookie in your hands. That's just a little piece of a cookie. How sad! *Pretend to hold a piece of cookie between your fingers.*

Let's think. What size answer do you expect if you multiply that tenth by 2? In other words, what if we had this tenth of a cookie, two times? Possible Student Answers, Key Points:

- We would get 2 tenths.
- We would have more.
- The answer would be bigger.

We STILL expect that our answer to be bigger because we STILL take this piece of cookie and get it lots of times. Like now two people are each holding a tenth of a cookie. The answer is bigger than one tenth. We expect the answer to be bigger if we're multiplying it by a factor of 2. *If you need to, have two students come up and pretend to hold 10 cookies each to show the amount of cookies getting bigger.*

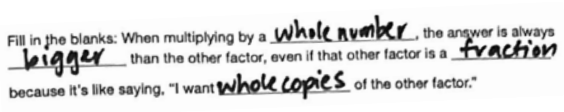


What size answer do you expect if you multiply that tenth by 5? We would get 5 tenths! We would have more! The answer would be bigger! That's right, we STILL expect that our answer to be bigger because we STILL take this piece of cookie and get it lots of times. Like now five people are each holding a tenth of a cookie. The answer is bigger than one tenth. We expect the answer to be bigger if we're multiplying it by a factor of 5.

What size answer do you expect if you multiply that tenth by 10? Possible Student Answers, Key Points:

- We would get 10 tenths.
- We would get 1 whole cookie.
- We would have more.
- The answer would be bigger.

We STILL expect that our answer to be bigger because we STILL take this piece of cookie and get it lots of times. Like now ten people are each holding a tenth of a cookie. The answer is bigger than one tenth. We expect the answer to be bigger if we're multiplying it by a factor of 10.


Fill in the blanks: When multiplying by a whole number, the answer is always bigger than the other factor, even if that other factor is a fraction because it's like saying, "I want whole copies of the other factor."

It's time to write down our pattern. Think about how we should fill in these blanks. "When multiplying by a whole number…" because we're still multiplying by 2, 5 and 10, which are whole numbers. "The answer is always bigger than the other factor, even if that other factor is a fraction."

That's because multiplying by a whole number is still like saying, "I want whole copies of the other factor." Like I want lots of people to hold a tenth of a cookie over and over and over to get lots of cookies. Multiplication still gives us a bigger answer like you learned in younger grades.

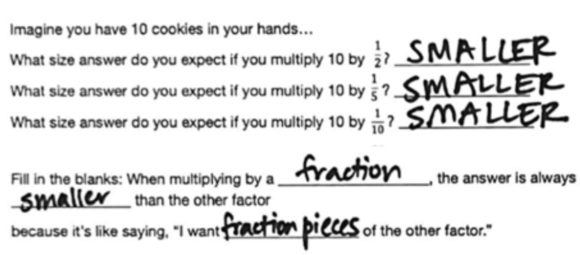
Let's Think (Slide 5): But now is when we get a surprise in the size of our answer! This says, Imagine you have 10 cookies in your hands. Okay, we're back to ten cookies. Show me ten cookies. *Put out your hands and pretend to hold a bunch of cookies.* Now, let's think. What size answer do you expect if you multiply 10 by one half? This isn't the same problem as the last time! We're not multiplying by 2; we're multiplying by one half. That's like taking half of these cookies. What size answer do you expect if you multiply 10 by one half? Possible Student Answers, Key Points:

- We would get 5.
- We would have less.
- The answer would be smaller.
-

Wow! So we're still multiplying. But this time our answer was smaller than 10. What size answer do you expect if you multiply by one fifth. We're not multiplying by 5; we're multiplying by one fifth. That's like taking a fifth of these cookies. What size answer do you expect if you multiply 10 by one fifth? Possible Student Answers, Key Points:

- We would get 2.
- We would have less.
- The answer would be smaller.

Wow! So we're still multiplying. But this time our answer was also smaller than 10. And, what size answer do you expect if you multiply by one tenth. We're not multiplying by 10; we're multiplying by one tenth. That's like taking a tenth of these cookies. What size answer do you expect if you multiply 10 by one tenth? We would get 1! We would have less. The answer would be smaller.
Wow! So we're still multiplying. But this time our answer was also smaller than 10.


Imagine you have 10 cookies in your hands…

What size answer do you expect if you multiply 10 by $\frac{1}{2}$? SMALLER

What size answer do you expect if you multiply 10 by $\frac{1}{5}$? SMALLER

What size answer do you expect if you multiply 10 by $\frac{1}{10}$? SMALLER

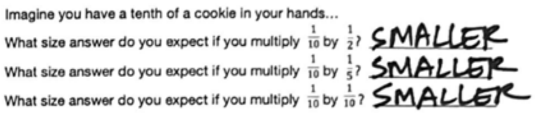
Fill in the blanks: When multiplying by a fraction, the answer is always smaller than the other factor because it's like saying, "I want fraction pieces of the other factor."

It's time to write down our pattern. Think about how we should fill in these blanks. "When multiplying by a fraction…" because we're multiplying 10 by 1/2, 1/5 and 1/10 now. "The answer is always smaller than the other factor."

That's because multiplying by a fraction is still like saying, "I want fractional pieces of the other factor." Like I want to get a fraction or a piece or a fair share of those cookies.

Whoa, multiplication DOESN't give us that bigger answer like you learned in younger grades. We don't see a bigger answer like we might be used to.

Let's Think (Slide 6): This is our last pattern to explore. We haven't learned how to get the answers to multiplying a fraction by a fraction yet. But all of this thinking we've been doing helps us make a prediction about the size answer we're going to get.



Imagine you have a tenth of a cookie in your hands. That's just a piece of a cookie. How sad! *Pretend to hold a piece of cookie between your fingers.* Let's think. What size answer do you expect if you multiply your tenth by just one half? That's like saying, "You have a piece of a cookie and I want a piece of it. I want a piece of your piece!" That's like taking half of this little cookie.

What size answer do you expect if you multiply one tenth by one half? Possible Student Answers, Key Points:

- Crumbs!
- We would have less.
- The answer would be smaller.

Our answer is smaller again! Because we started with a fraction. And then we took a fraction of that! *If necessary, you can mimic cutting a piece of a cookie. Or draw a picture of taking half of a tenth.*

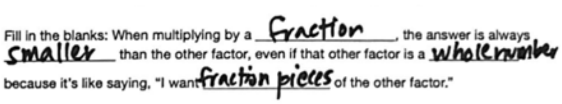
What size answer do you expect if you multiply your tenth by just one fifth? That's like saying, "You have a piece of a cookie and I want a piece of it. I want a piece of your piece!" That's like taking a fifth of this little cookie. What size answer do you expect if you multiply one tenth by one fifth? Possible Student Answers, Key Points:

- Crumbs!
- We would have less.
- The answer would be smaller.

Our answer is smaller again! Because we started with a fraction. And then we took a fraction of that!

What size answer do you expect if you multiply your tenth by just one tenth? That's like saying, "You have a piece of a cookie and I want a piece of it. I want a piece of your piece!" That's like taking a tenth of this little cookie. What size answer do you expect if you multiply one tenth by one tenth? Crumbs! We would have less!
Our answer is smaller again! Because we started with a fraction. And then we took a fraction of that!

Now, it's time to write down our pattern. Think about how we should fill in these blanks. "When multiplying by a fraction…" because we're multiplying 1/10 by 1/2, 1/5 and 1/10 now. "The answer is always smaller than the other factor,."



That's because multiplying by a fraction is still like saying, "I want fractional pieces of the other factor." Like I want to get a fraction or a piece or a fair share of those cookies. Multiplication DOESN't give us that bigger answer like you learned in younger grades. We don't see a bigger answer like we might be used to.

We just went through four slides. That means there are four possible scenarios where we have to predict the size of our answer. If we can imagine what is happening when we multiply like when we imagined holding cookies, whether we're getting whole copies or fractional pieces of the other factor, we'll be able to predict the size of the answer.

Let's Try it (Slides 7): Let's practice predicting the size of the multiplication answer together. I will take you through step by step.

WARM WELCOME

Today we will compare the size of the product to the size of the factors.

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Let's Review:

Up until this year, the answer to multiplication was always bigger than the numbers that were being multiplied.

Imagine you have 10 cookies in your hands…

What size answer do you expect if you multiply 10 by 2? ________________

What size answer do you expect if you multiply 10 by 5? ________________

What size answer do you expect if you multiply 10 by 10? ________________

Fill in the blanks: When multiplying by a ________________, the answer is always ______________ than the other factor…

because it's like saying, "I want ________________ of the other factor."

Let's Talk:

Now we need to think about whether expecting a bigger answer still makes sense when multiplying a fraction.

Imagine you have a tenth of a cookie in your hands…

What size answer do you expect if you multiply $\frac{1}{10}$ by 2? ________________

What size answer do you expect if you multiply $\frac{1}{10}$ by 5? ________________

What size answer do you expect if you multiply $\frac{1}{10}$ by 10? ________________

Fill in the blanks: When multiplying by a ________________, the answer is always ______________ than the other factor, even if that other factor is a _____________

because it's like saying, "I want ________________ of the other factor."

Let's Think: But now is when we get a surprise in the size of our answer!

Imagine you have 10 cookies in your hands…

What size answer do you expect if you multiply 10 by $\frac{1}{2}$? ___________________

What size answer do you expect if you multiply 10 by $\frac{1}{5}$? ___________________

What size answer do you expect if you multiply 10 by $\frac{1}{10}$? ___________________

Fill in the blanks: When multiplying by a _____________________, the answer is always _________________ than the other factor

because it's like saying, "I want ___________________ of the other factor."

Let's Think: This helps us make a prediction about multiplying a fraction by a fraction.

Imagine you have a tenth of a cookie in your hands…

What size answer do you expect if you multiply $\frac{1}{10}$ by $\frac{1}{2}$? ___________________

What size answer do you expect if you multiply $\frac{1}{10}$ by $\frac{1}{5}$? ___________________

What size answer do you expect if you multiply $\frac{1}{10}$ by $\frac{1}{10}$? ___________________

Fill in the blanks: When multiplying by a _____________________, the answer is always _________________ than the other factor, even if that other factor is a ______________...

because it's like saying, "I want ___________________ of the other factor."

Let's Try It:

Let's practice predicting the size of the multiplication answer together.

Name: ______________________________ G5 U5 Lesson 5 - Let's Try It

Leda is learning to multiply. She has been given the problem $\frac{2}{3} \times 8$. What can Leda predict about the size of her answer?

1. There are <u>two</u> factors so we know we will be able to make ____ predictions. Fill in the blanks.

We can compare our answer to _____.	We can compare our answer to _____.
2. I am multiplying _____ by a ____________.	I am multiplying _____ by a ____________.
3. If we are multiplying by a ____________,	4. If we are multiplying by a ____________,
we expect our answer to be ____________	we expect our answer to be ____________
because ______________________	because ______________________
______________________________	______________________________
5. I expect my answer to be ____________	6. I expect my answer to be ____________
than _____.	than _____.

On your Own:

Now it's time for you to do it on your own.

Name: ______________________________ G5 U4 Lesson 5 - Independent Work

Remember: Multiplying by a fraction is like taking a fraction of the other factor.

Fill in the circle with <, > or =. Then fill in the blank to explain your reasoning.

1. $\frac{2}{3} \times \frac{1}{4} \bigcirc \frac{1}{4}$	2. $6 \times \frac{1}{4} \bigcirc \frac{1}{4}$
I am multiplying ___ by a ____________	I am multiplying ___ by a ____________
so I expect my answer to be ____________	so I expect my answer to be ____________
because it is like getting ____________	because it is like getting ____________
______________________________.	______________________________.
3. $\frac{5}{8} \times \frac{1}{2} \bigcirc \frac{5}{8}$	4. $6 \times 3 \bigcirc 6$
I am multiplying ___ by a ____________	I am multiplying ___ by a ____________
so I expect my answer to be ____________	so I expect my answer to be ____________
because it is like getting	because it is like getting ____________

Name: ________________________ G5 U4 Lesson 5 - Let's Try It

Leda is learning to multiply. She has been given the problem $\frac{2}{3} \times 8$. What can Leda predict about the size of her answer?

1. There are two factors so we know we will be able to make _____ predictions. Fill in the blanks.

We can compare our answer to ______.

We can compare our answer to ______.

2. I am multiplying ______ by a ______________.

I am multiplying _____ by a ______________.

3. If we are multiplying by a ______________,

we expect our answer to be ______________

because ______________________________

____

4. If we are multiplying by a ______________,

we expect our answer to be ______________

because ______________________________

____

5. I expect my answer to be ______________

than _____.

6. I expect my answer to be ______________

than _____.

7. Fill in the circle with <, > or =.

$\frac{2}{3} \times 8 \bigcirc$ ___

8. Fill in the circle with <, > or =.

$\frac{2}{3} \times 8 \bigcirc$ ___

Fill in the circle with <, > or =.

$\frac{1}{4} \times \frac{1}{2} \bigcirc$

$\frac{1}{4} \times \frac{1}{2} \bigcirc$

9. We are comparing our answer to ______.

10. We are comparing our answer to ______.

11. I am multiplying ______ by a _________________.

12. I am multiplying _____ by a _____________.

13. If we are multiplying by a ___________________,

we expect our answer to be ___________________

because ______________________________________

____

14. If we are multiplying by a __________________,

we expect our answer to be __________________

because ___________________________________

____

15. I expect my answer to be _______________

than _____.

16. I expect my answer to be _______________

than _____.

17. Fill in the circle with <, > or =.

18. Fill in the circle with <, > or =.

Remember: Multiplying by a fraction is like taking a fraction of the other factor.

Fill in the circle with <, > or =. Then fill in the blank to explain your reasoning.

1. $\frac{2}{3} \times \frac{1}{4} \bigcirc \frac{1}{4}$ I am multiplying ____ by a ____________________ so I expect my answer to be ________________ because it is like getting ____________________ ____ __.	2. $6 \times \frac{1}{4} \bigcirc \frac{1}{4}$ I am multiplying ____ by a ____________________ so I expect my answer to be ________________ because it is like getting ____________________ ____ __.
3. $\frac{5}{8} \times \frac{1}{2} \bigcirc \frac{5}{8}$ I am multiplying ____ by a ____________________ so I expect my answer to be ________________ because it is like getting ____________________ ____ __.	4. $6 \times 3 \bigcirc 6$ I am multiplying ____ by a ____________________ so I expect my answer to be ________________ because it is like getting ____________________ ____ __.
5. $\frac{2}{3} \times 2\frac{1}{2} \bigcirc 2\frac{1}{2}$ I am multiplying ____ by a ____________________ so I expect my answer to be ________________ because it is like getting ____________________ ____ __.	6. $8 \times \frac{3}{10} \bigcirc \frac{3}{10}$ I am multiplying ____ by a ____________________ so I expect my answer to be ________________ because it is like getting ____________________ ____ __.

Fill in the circle with <, > or =. Then fill in the blank to explain your reasoning.

7.

$5 \times \frac{1}{4} \bigcirc \frac{1}{4}$

I am multiplying ____ by a ______________________

so I expect my answer to be ________________

because it is like getting ______________________

____.

8.

$7\frac{1}{3} \times \frac{2}{3} \bigcirc \frac{2}{3}$

I am multiplying ____ by a ______________________

so I expect my answer to be ________________

because it is like getting ______________________

____.

9.

$\frac{5}{8} \times \frac{3}{4} \bigcirc \frac{5}{8}$

Explain your reasoning:

____

____

____

____

10.

$2 \times 8\frac{1}{4} \bigcirc 8\frac{1}{4}$

Explain your reasoning:

____

____

____

____

11.

$\frac{2}{3} \times 2 \bigcirc \frac{2}{3}$

Explain your reasoning:

____

____

____

____

12.

$\frac{3}{2} \times \frac{8}{5} \bigcirc \frac{3}{2}$

Explain your reasoning:

____

____

____

____

Name: ANSWER KEY

Leda is learning to multiply. She has been given the problem $\frac{2}{3} \times 8$. What can Leda predict about the size of her answer?

1. There are two factors so we know we will be able to make two predictions. Fill in the blanks.

We can compare our answer to $\frac{2}{3}$.

2. I am multiplying $\frac{2}{3}$ by a whole number.

3. If we are multiplying by a whole number, we expect our answer to be bigger because we will get whole copies of it.

5. I expect my answer to be bigger than $\frac{2}{3}$.

7. Fill in the circle with <, > or =.

$\frac{2}{3} \times 8$ > $\frac{2}{3}$

We can compare our answer to 8.

I am multiplying 8 by a fraction.

4. If we are multiplying by a fraction, we expect our answer to be smaller because we will get fractional pieces of it.

6. I expect my answer to be smaller than 8.

8. Fill in the circle with <, > or =.

$\frac{2}{3} \times 8$ < 8

Fill in the circle with <, > or =.

$\frac{1}{4} \times \frac{1}{2} < \frac{1}{4}$

9. We are comparing our answer to $\frac{1}{4}$.

11. I am multiplying $\frac{1}{4}$ by a fraction ________.

13. If we are multiplying by a fraction, we expect our answer to be smaller because we will get fractional pieces of it

15. I expect my answer to be smaller than $\frac{1}{4}$.

17. Fill in the circle with <, > or =.

$\frac{1}{4} \times \frac{1}{2} < \frac{1}{2}$

10. We are comparing our answer to $\frac{1}{2}$.

12. I am multiplying $\frac{1}{2}$ by a fraction

14. If we are multiplying by a fraction, we expect our answer to be smaller because we will get fractional pieces of it

16. I expect my answer to be smaller than $\frac{1}{2}$.

18. Fill in the circle with <, > or =.

Name: ANSWER KEY

G5 U4 Lesson 5 - Independent Work

Remember: Multiplying by a fraction is like taking a fraction of the other factor.

Fill in the circle with <, > or =. Then fill in the blank to explain your reasoning.

1.

$\frac{2}{3} \times \frac{1}{4} \bigcirc \frac{1}{4}$

I am multiplying $\frac{1}{4}$ by a fraction
so I expect my answer to be smaller
because it is like getting fractional
pieces of it.

2.

$6 \times \frac{1}{4} > \frac{1}{4}$

I am multiplying $\frac{1}{4}$ by a whole number
so I expect my answer to be bigger
because it is like getting
whole copies of it.

3.

$\frac{5}{8} \times \frac{1}{2} < \frac{5}{8}$

I am multiplying $\frac{5}{8}$ by a fraction
so I expect my answer to be smaller
because it is like getting fractional
pieces of it.

4.

$6 \times 3 > 6$

I am multiplying 6 by a whole number
so I expect my answer to be bigger
because it is like getting whole copies
of it.

5.

$\frac{2}{3} \times 2\frac{1}{2} < 2\frac{1}{2}$

I am multiplying $2\frac{1}{2}$ by a fraction
so I expect my answer to be smaller
because it is like getting fractional
pieces of it.

6.

$8 \times \frac{3}{10} > \frac{3}{10}$

I am multiplying $\frac{3}{10}$ by a whole number
so I expect my answer to be bigger
because it is like getting whole
copies of it.

Fill in the circle with <, > or =. Then fill in the blank to explain your reasoning.

7.

$5 \times \frac{1}{4} \bigcirc \frac{1}{4}$

I am multiplying $\frac{1}{4}$ by a whole number

so I expect my answer to be bigger

because it is like getting whole copies of $\frac{1}{4}$.

8.

$7\frac{1}{3} \times \frac{2}{3} \bigcirc \frac{2}{3}$

I am multiplying $\frac{2}{3}$ by a mixed numbe

so I expect my answer to be bigger

because it is like getting whole copies of it.

9.

$\frac{5}{8} \times \frac{3}{4}$ < $\frac{5}{8}$

Explain your reasoning:

I am multiplying $\frac{5}{8}$ by a fraction so I expect my answer to be smaller than $\frac{5}{8}$ because it is like taking a piece of $\frac{5}{8}$.

10.

$2 \times 8\frac{1}{4}$ > $8\frac{1}{4}$

Explain your reasoning:

I am multiplying $8\frac{1}{4}$ by a whole number so I expect my answer to be bigger because it is like getting whole copies of $8\frac{1}{4}$.

11.

$\frac{2}{3} \times 2$ > $\frac{2}{3}$

Explain your reasoning:

I am multiplying $\frac{2}{3}$ by a whole number so I expect my answer to be bigger because it is like getting whole copies of $\frac{2}{3}$.

12.

$\frac{3}{2} \times \frac{8}{5} \bigcirc \frac{3}{2}$

Explain your reasoning:

G5 U4 Lesson 6

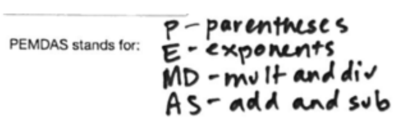
Compare expressions with fraction multiplication

G1 U4 Lesson 6 - Today we will compare expressions that have fraction multiplication.

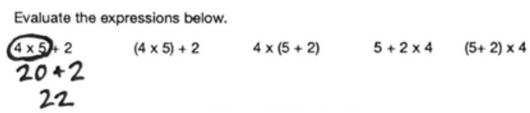
Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): In our last class, we started to think about whether our multiplication answer will be bigger or smaller than the factors that are multiplied to make it. And we called that comparison. Today we are going to keep comparing expressions that have multiplication of fractions.

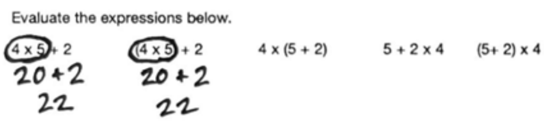
Let's Review (Slide 3): In order to understand the expressions we will need to remember to follow the order of operations, also known as PEMDAS. Raise your hand if you have heard of PEMDAS. What does PEMDAS stand for? *Simply collect a few answers to see what kids know. Then explain the correct answer as you write.*



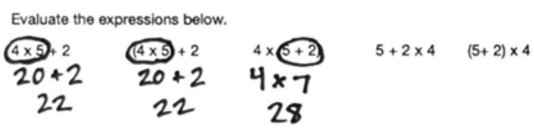
PEMDAS tells us the order to do the pieces of an expression. P stands for parentheses. E stands for exponents. MD stands for multiplication and division. We just do those from left to right. AS stands for addition and subtraction. We do those from left to right too.



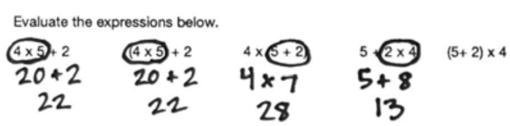
Let's use PEMDAS to evaluate the expressions below. Here I see, 4 x 5 + 2. I don't just jump in. I go through the letters. P is for parentheses. There aren't any of those. E is for exponents. There aren't any of them. MD is multiplication and division. So I do 4 x 5 is 20 and I bring down the 2. Notice I recopy the expression with the part I've done to help me see each step. 20 + 2 is 22.



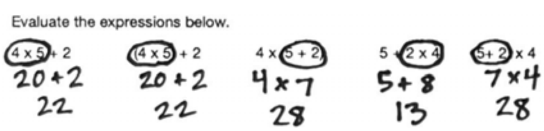
Let's do the next one. P is for parentheses. So I do 4 x 5. E is for exponents. There aren't any of them. MD is multiplication and division.We already did the multiplication. AS is addition and subtraction. 20 + 22 is 22. We get the same answer we got before. The parentheses didn't change this problem. They weren't really necessary because the multiplication would have come before the addition anyway.



Let's do the next one. P is for parentheses. Oh, look! We need to do 5 + 2 first. This is different. Again, I recopy the expression with the part I've done to help me see each step. The only step left is 4 x 7 is 28. This time we did get a different answer because the parentheses changed the order we would have done if they hadn't been there. We had the same numbers and operations but a different answer.

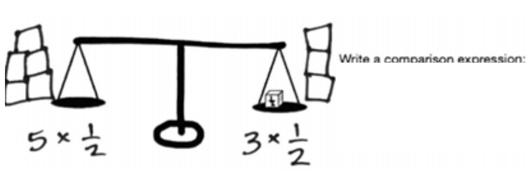


Let's do the next one. P is for parentheses. There aren't any of those. E is for exponents. There aren't any of those. MD is for multiplication and division. I have to do 2 x 4 first - even though they are later in the expression. 2 x 4 is 8. I recopy the expression with the part I did. That leaves 5 + 8 is 13.

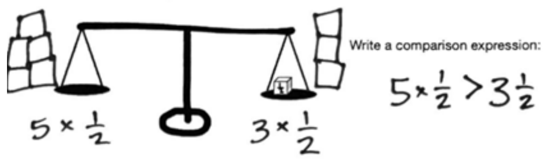


Last one. P is for parentheses. That means I have to do the 5 + 2 first. 5 + 2 is 7. I recopy the expression. 7 x 4 is 28. This time we got a different answer because the parenthese changed the order we did things. We are going to need to remember this PEMDAS for expressions with fraction multiplication too.

Let's Talk (Slide 4): Now, even though we were just talking about how to evaluate expressions. We don't need to evaluate them in order to compare them. But PEMDAS will still help us think about where to look first in an expression. Let's talk about this. *Read the problem.*



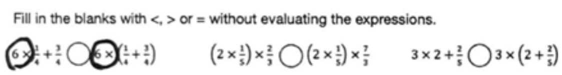
I am going to draw a picture to help us understand. Zora puts 5 weights that weighed ½ pound each. It looks like this. If I were going to write an expression, it would be 5 x ⅕.



Malcolm put 3 weights that weighed ½ pound each. It looks like this. If I were going to write an expression, it would be 3 x ⅕. Now here's the key, we could do the math and get to an answer. That is one way to decide which is heavier. But we don't have to do the math. And today, we are going to try to compare expressions without evaluating the expressions that means we are going to try to decide less than or greater than or equal to without doing the math. I can't always just look at it and know. But in this case, there is something that is the same about both sides. They both have ½ pound weights. That is the same. So I am really just comparing the 5 and the 3. I know when I multiply by a whole number it's like whole copies. So which will be bigger 5 whole copies or 3 whole copies? *Don't call on anyone. Just give the students time to think and then answer the question yourself.* 5 copies of something will be more than 3 copies of that exact same thing.

So I know 5 x ½ is bigger. Left hand is less than and right hand is greater than so I write the right hand symbol, which is the greater than symbol.

Let's Think (Slide 5): We can think of all our comparisons as a balance scale and look for what is the same and different on each side. Let me show you what I mean. This says, "Fill in the blanks with <, > or = without evaluating the expressions." That means I'm not going to do the math. Instead, I'm going to look at what is the same on both sides and then think about what the differences mean.

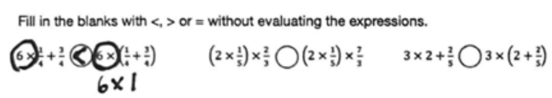


Let's look at the first one. I see 6x on both sides. *Circle the 6x on both sides.* So I'm getting 6 whole copies of whatever comes next. That will mean a bigger amount once I do the math.

The fractions getting added are the same too. But one set is NOT in parentheses and one set IS in parentheses. That's what's different. So now I need to think about what that difference means. What do you think it means? Possible Student Answers, Key Points:

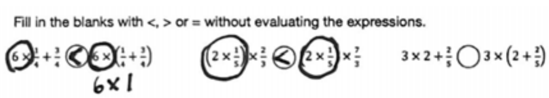
- We have to do the parentheses first.
- We have to do the multiplication first on the left.
- We have to do the addition first on the right.

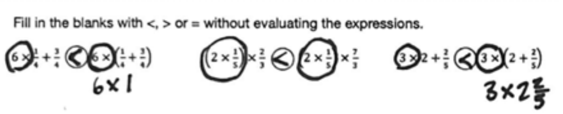
Since we have to do multiplication first on the left, we will have 6 copies of ¼ then add the ¾ at the end. But on the right side, we will add ¼ + ¾ and get 1. That's bigger. We're going to have 6 copies of something bigger. The right side will be bigger.



I am going to fill this in with my left hand which means less than.

Let's look at the next one. I see two times one fifth on both sides. Let me circle that. Now I can think about multiplying the same thing by two thirds or seven thirds. Seven thirds is bigger so that means more copies. That side is bigger. I use "left hand less than" again.





Let's look at the next one. I see 3x on both sides. The difference is 3 times 2 or 3 times a sum in parentheses. That would be 3 times two and two fifths. So that's going to be bigger. I use "left hand less than" again.

Let's Try it (Slides 6): Let's practice this together. I will walk you thinking through what is the same and what is different.

WARM WELCOME

Today we will compare expressions that have multiplication of fractions.

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Let's Review: Today we will need to remember to follow order of operations, also known as PEMDAS.

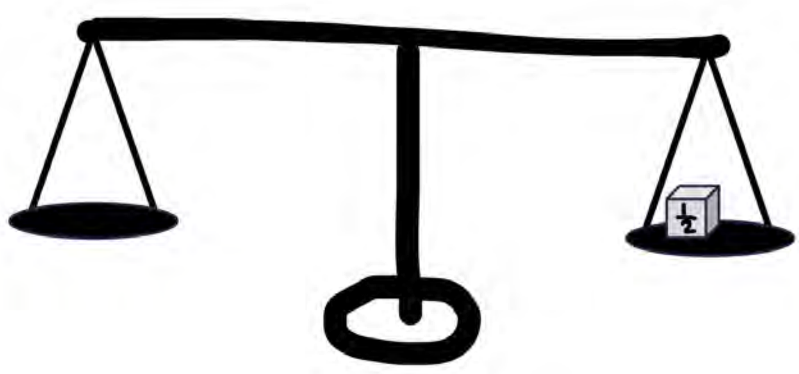
PEMDAS stands for:

Evaluate the expressions below.

4 x 5 + 2 (4 x 5) + 2 4 x (5 + 2) 5 + 2 x 4 (5+ 2) x 4

Let's Talk: We do not need to evaluate expressions in order to compare them.

Imagine a balance with half pound weights. Zora puts 5 weights on the left side and Malcolm puts 3 weights on the right side. Whose side is heavier?



Write a comparison expression:

Let's Think: We can think of all our comparisons as a balance scale and look for what is the same and different on each side.

Fill in the blanks with <, > or = without evaluating the expressions.

$6 \times \frac{1}{4} + \frac{3}{4} \bigcirc 6 \times \left(\frac{1}{4} + \frac{3}{4}\right)$ $\quad$ $\left(2 \times \frac{1}{5}\right) \times \frac{2}{3} \bigcirc \left(2 \times \frac{1}{5}\right) \times \frac{7}{3}$ $\quad$ $3 \times 2 + \frac{2}{5} \bigcirc 3 \times \left(2 + \frac{2}{5}\right)$

Let's Review: Today we will need to remember to follow order of operations, also known as PEMDAS.

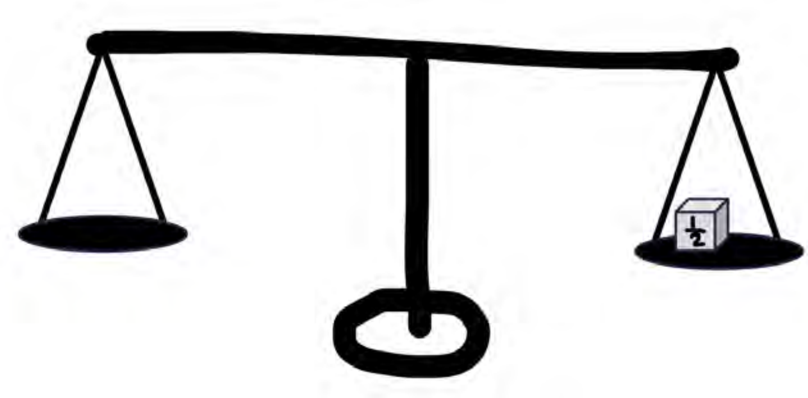
PEMDAS stands for:

Evaluate the expressions below.

4 x 5 + 2 $\qquad$ (4 x 5) + 2 $\qquad$ 4 x (5 + 2) $\qquad$ 5 + 2 x 4 $\qquad$ (5+ 2) x 4

Let's Talk: We do not need to evaluate expressions in order to compare them.

Imagine a balance with half pound weights. Zora puts 5 weights on the left side and Malcolm puts 3 weights on the right side. Whose side is heavier?



Write a comparison expression:

Let's Think: We can think of all our comparisons as a balance scale and look for what is the same and different on each side.

Fill in the blanks with <, > or = without evaluating the expressions.

$6 \times \frac{1}{4} + \frac{3}{4} \bigcirc 6 \times \left(\frac{1}{4} + \frac{3}{4}\right)$

$\left(2 \times \frac{1}{5}\right) \times \frac{2}{3} \bigcirc \left(2 \times \frac{1}{5}\right) \times \frac{7}{3}$

$3 \times 2 + \frac{2}{5} \bigcirc 3 \times \left(2 + \frac{2}{5}\right)$

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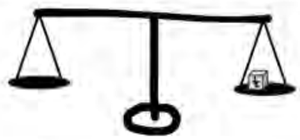
Let's Try It:

Let's practice comparing expressions together!

Name: ______________________ G5 U5 Lesson 6 - Let's Try It

Imagine you have a balance with half pound weights. Martin put 3 half pound weights on the scale plus a 2 pound book on the left side of the scale. Maya put 3 half pound weights and 3 books on the right side of the scale. Which side of the scale was heavier.

1. Draw a picture.



2. Write an expression for each side.

______________ ◯ ______________

3. What is the same about each side? ______________________

4. What is different about each side? ______________________

5. What does the difference of each side represent?

____

____

On your Own:

Now it's time for you to do it on your own.

Name: ______________________ G5 U4 Lesson 6 - Independent Work

Remember: The denominator tells us how many pieces a whole is split into.

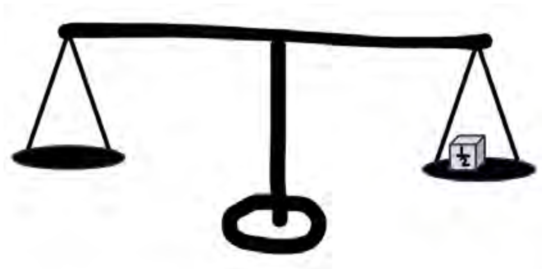
Fill in the blank with <, > or =. Then explain your thinking

1. $\frac{2}{3} \times (4 + 8)$ ____ $12 \times \frac{2}{3}$	______________________
2. $(\frac{2}{3} \times \frac{1}{4}) \times \frac{1}{2}$ ____ $(\frac{2}{3} \times \frac{1}{4}) \times \frac{3}{2}$	______________________

Name: ______________________________

Imagine you have a balance with half pound weights. Martin put 3 half pound weights on the scale plus a 2 pound book on the left side of the scale. Maya put 3 half pound weights and 3 books on the right side of the scale. Which side of the scale was heavier.

1. Draw a picture.



2. Write an expression for each side.

______________________ ◯ ______________________

3. What is the same about each side? ______________________________

4. What is different about each side? ______________________________

5. What does the difference of each side represent?

____

____

6. Put <, > or = in the circle between the expressions you wrote.

Compare the expressions without evaluating them. Fill in the circle with <, > or =.

$$\frac{2}{3} \times \left(\frac{1}{4} + \frac{4}{5}\right) \quad \bigcirc \quad \frac{1}{4} + \frac{4}{5}$$

7. What is the same about each side? ______________________________

8. What is different about each side? ______________________________

9. What does the difference of each side represent?

____

____

____

10. Put <, > or = in the circle between the expressions you wrote.

Name: ______________________________ G5 U4 Lesson 6 - Independent Work

Remember: The denominator tells us how many pieces a whole is split into.

Fill in the blank with <, > or =. Then explain your thinking

1. $\frac{2}{3} \times (4 + 8)$ ____ $12 \times \frac{2}{3}$	______________________________ ______________________________ ______________________________ ______________________________ ______________________________
2. $(\frac{2}{3} \times \frac{1}{4}) \times \frac{1}{2}$ ____ $(\frac{2}{3} \times \frac{1}{4}) \times \frac{3}{2}$	______________________________ ______________________________ ______________________________ ______________________________ ______________________________
3. $4 \times \frac{3}{5} + \frac{3}{4}$ ____ $4 \times (\frac{3}{5} + \frac{3}{4})$	______________________________ ______________________________ ______________________________ ______________________________ ______________________________

4. $3 \times 4 + 3 \times \frac{1}{8}$ ____ $2 \times \frac{1}{8}$

Fill in the blank with <, > or =. Then explain your thinking

5. $\frac{1}{3} \times (4 + \frac{9}{10})$ ____ $\frac{2}{3} \times (4 + \frac{9}{10})$

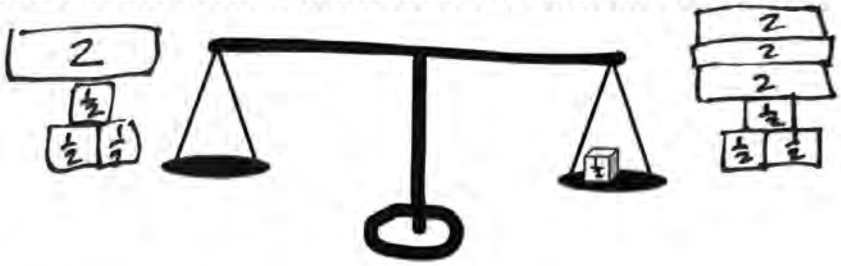
6. $8 \times (\frac{2}{3} + \frac{1}{4})$ ____ $8 \times \frac{2}{3} + \frac{1}{4}$

7. $10 \times \frac{2}{5} + 3\frac{1}{2}$ ____ $\frac{1}{10} \times \frac{2}{5} + 3\frac{1}{2}$	____ ____ ____ ____ ____
8. $23 - 3 \times \frac{6}{8}$ ____ $23 - 3 \times \frac{1}{8}$	____ ____ ____ ____ ____

Name: ANSWER KEY

Imagine you have a balance with half pound weights. Martin put 3 half pound weights on the scale plus a 2 pound book on the left side of the scale. Maya put 3 half pound weights and 3 books on the right side of the scale. Which side of the scale was heavier.

1. Draw a picture.



2. Write an expression for each side.

$3 \times \frac{1}{2} + 2$ < $3 \times \frac{1}{2} + 3 \times 2$ or $3 \times (\frac{1}{2} + 2)$

3. What is the same about each side? $3 \times \frac{1}{2}$

4. What is different about each side? $\frac{1}{2}$ vs. $3 \times \frac{1}{2}$

5. What does the difference of each side represent?

The left side has 1 copy of 2 but the right side has 3 copies of 2. So the left side will be less than the right side.

6. Put <, > or = in the circle between the expressions you wrote.

Compare the expressions without evaluating them. Fill in the circle with <, > or =.

$\frac{2}{3} \times (\frac{1}{4} + \frac{4}{5})$ < $\frac{2}{3} \times \frac{1}{4} + \frac{4}{5}$

7. What is the same about each side? $\frac{2}{3}$ of

8. What is different about each side? adding $\frac{4}{5}$ then taking fraction or just adding after

9. What does the difference of each side represent?

The left side will mean taking a fraction of both $\frac{1}{4}$ and $\frac{4}{5}$. The right side only takes a fraction of $\frac{1}{4}$. $\frac{4}{5}$ can stay the same size which will make it bigger.

10. Put <, > or = in the circle between the expressions you wrote.

Name: ANSWER KEY G5 U4 Lesson 6 - Independent Work

Remember: The denominator tells us how many pieces a whole is split into.

Fill in the blank with <, > or =. Then explain your thinking

1. $\frac{2}{3} \times (4 + 8)$ = $12 \times \frac{2}{3}$

Both sides have $\frac{2}{3}$ x something. If I add 4+8, it is the same as the 12. So both sides are really the same.

2. $(\frac{2}{3} \times \frac{1}{4}) \times \frac{1}{2}$ < $(\frac{2}{3} \times \frac{1}{4}) \times \frac{3}{2}$

Both sides have $(\frac{2}{3} \times \frac{1}{4})$. The left side is taking $\frac{1}{2}$ of that. The right side is taking $\frac{3}{2}$ of that. $\frac{3}{2}$ is bigger than $\frac{1}{2}$ so it will be more copies of the $(\frac{2}{3} \times \frac{1}{4})$.

3. $4 \times \frac{3}{5} + \frac{3}{4}$ < $4 \times (\frac{3}{5} + \frac{3}{4})$

Both sides have 4x something. The left is 4 copies of $\frac{3}{5}$ with a litte fraction added on. The right is 4 copies of $\frac{3}{3}$ and there would be 4 copies of the $\frac{3}{4}$ so it is bigger.

4. $3 \times 4 + 3 \times \frac{1}{8}$ > $2 \times \frac{1}{8}$

Both sides have something $\times \frac{1}{8}$. The left side has more copies of $\frac{1}{8}$ plus more so it is bigger.

Fill in the blank with <, > or =. Then explain your thinking

5. $\frac{1}{3} \times (4 + \frac{9}{10})$ $<$ $\frac{2}{3} \times (4 + \frac{9}{10})$	Both sides have $(4 + \frac{9}{10})$. The left side takes $\frac{1}{3}$ of that amount. The right side takes $\frac{2}{3}$, which is a larger fraction, of that amount. So the right side is bigger.
6. $8 \times (\frac{2}{3} + \frac{1}{4})$ $>$ $8 \times \frac{2}{3} + \frac{1}{4}$	Both sides have 8× something. The left side will have 8× something bigger since the paretheses mean add first. Theright side will have 8× something smaller plus a little bit.
7. $10 \times \frac{2}{5} + 3\frac{1}{2}$ $>$ $\frac{1}{10} \times \frac{2}{5} + 3\frac{1}{2}$	Both sides are multiplying $\frac{2}{5}$ then adding $3\frac{1}{2}$. The left side is multiplying by a whole number so it would be bigger than the right side which is multiplying by a fraction.
8. $23 - 3 \times \frac{6}{8}$ $<$ $23 - 3 \times \frac{1}{8}$	Both sides are subtracting from 23. The left side is sbtracting 3 copies of a bigger fraction so that side will actually be smaller.

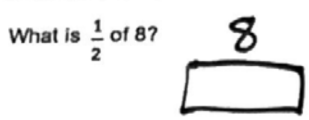
G5 U4 Lesson 7

Multiply unit fractions by unit fractions

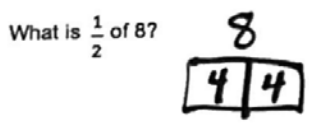
G1 U4 Lesson 7 - Today we will multiply unit fractions by unit fractions.

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): Today we will multiply unit fractions by unit fractions. Unit fractions are just fractions where we have only 1 unit so the numerator is 1. Let's dive in!



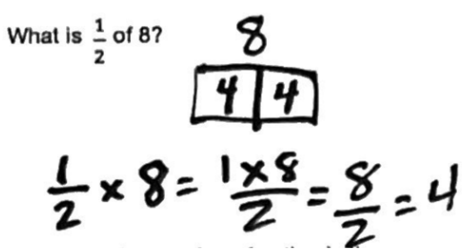
Let's Review (Slide 3): We already learned that multiplying by a fraction is the same as taking a fraction OF something. What is $\frac{1}{2}$ of 8? We can think of 8 altogether and draw it as one big block like this.



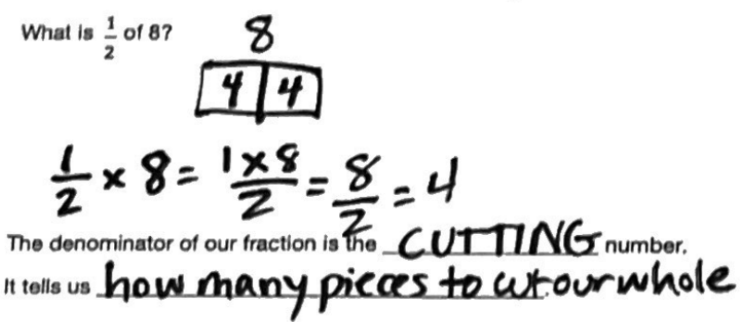
How do I take half? Possible Student Answers, Key Points:

- Cut it into 2 pieces.
- Split it down the middle.
- Divide it by 2.
- Multiply it by ½.

We can split it into 2, which is like dividing it by 2. Each piece gets 4.

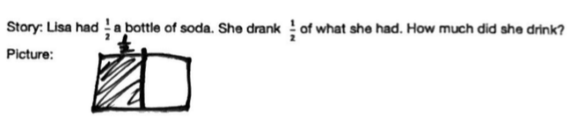


Or we can think of the "of" as a multiplication symbol. We have $\frac{1}{2}$ times 8 which is $\frac{8}{2}$ and we're still doing 8 divided by 2 which is 4. Remember, when I multiply by a fraction, what happens to the size of my answer, does it get bigger or smaller? *Give them time to think without calling on anyone. Then give the right answer.* It gets bigger!



The denominator of our fraction is the CUTTING number. It tells us how many pieces to cut our whole into.

Let's Talk (Slide 4): Now it's time to take a fraction of another fraction. I am going to read this story aloud while you follow along with your eyes. *Point to each word as you read. Read the story.*

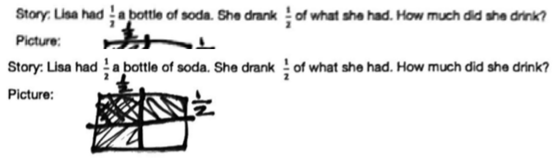


Let's draw this out to see what's happening. I am going to use this rectangle to stand for my soda bottle, and Lisa had half of a bottle. So let me shade half.

Now Lisa drank half of what she had. Did she drink half of the bottle? No! She drank half of what she had? What did she have? Possible Student Answers, Key Points:

- Half a bottle.
- That shaded part.

She had half a bottle so she drank half of the half. I am still going to use the denominator as a cutting number so I am going to cut my cuts. I will draw the half going the other way so I can see each piece like this. Notice what kind of picture we made. This is really



important. We made rows of equal pieces, sometimes called an array. You learned this back in third grade. It is a multiplication picture, like 2 x 2.

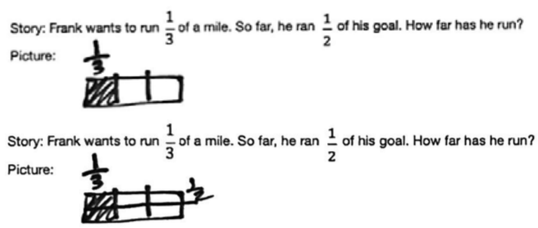
I only want 1 out of 2 parts of this so I am just going to shade this half. Look where the shading overlaps! That is ½ of a ½. I get ¼.

Words: $\frac{1}{2}$ of $\frac{1}{2}$ is $\frac{1}{4}$

Numbers: $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$

Let's write this in words. It is just $\frac{1}{2}$ of $\frac{1}{2}$ is $\frac{1}{4}$. Let's write this in numbers. We know that the "of" is multiplication so it is $\frac{1}{2}$ times $\frac{1}{2}$. We know this makes ¼ but first I want you to notice something really important. We said that our picture looked like a multiplication picture. Now we can see that it's like the numbers get multiplied. 1 x 1 in the numerator and 2 x 2 in the denominator. That makes ¼.

Let's Talk (Slide 5): Let's make sure our method works with another problem! I am going to read this story aloud while you follow along with your eyes. *Point to each word as you read. Read the story.*

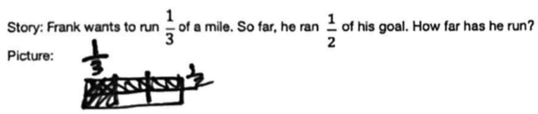


Let's draw this out to see what's happening. I am going to use this rectangle to stand for a mile. Frank wants to run ⅓ so let me shade ⅓

Now Miles only ran ½ of his goal. Did she run half of the mile? No! He ran half of his goal? What was his goal? Possible Student Answers, Key Points:

- One third of a mile.
- That shaded part.

His goal was to run one third of a mile so I am going to take half of the third. I am still going to use the denominator as a cutting number so I am going to cut my cuts. I will draw the half going the other way so I can see each piece like this. Notice what kind of picture we made. This is really important. We made rows of equal pieces, sometimes called an array. You learned this back in third grade. It is a multiplication picture, like 3 x 2.



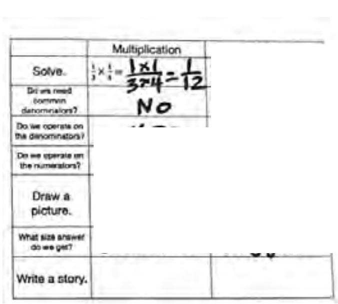
I only want 1 out of 2 parts of this so I am just going to shade this half. Look where the shading overlaps! That is ½ of a ⅓ I get ⅓

Words: $\frac{1}{2}$ of $\frac{1}{3}$ is $\frac{1}{6}$

Numbers: $\frac{1}{2} \times \frac{1}{3} = \frac{1}{6}$

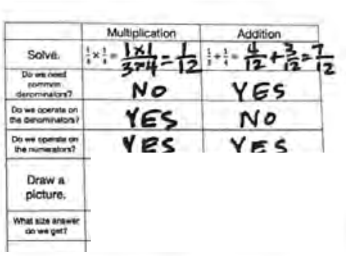
Let's write this in words. It is just $\frac{1}{2}$ of $\frac{1}{3}$ is $\frac{1}{6}$. Let's write this in numbers. We know that the "of" is multiplication so it is $\frac{1}{3}$ times $\frac{1}{2}$. We know this makes 1/6 but first I want you to notice something really important. We said that our picture looked like a multiplication picture. Now we can see that it's like the numbers get multiplied. 1 x 1 in the numerator and 3 x 2 in the denominator. That makes ⅙.

Let's Think (Slides 6): It is really easy to get fractions ideas mixed up with each other. It will help us remember the strategies if we explore how multiplying fractions compares to adding fractions. Let's fill out this chart together.



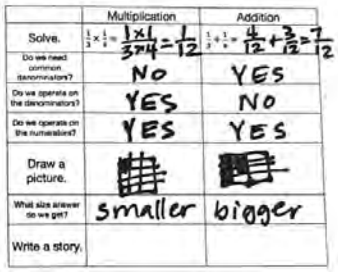
	Multiplication	
Solve.	$\frac{1}{3} \times \frac{1}{4} = \frac{1 \times 1}{3 \times 4} = \frac{1}{12}$	
Do we need common denominators?	No	
Do we operate on the denominators?		
Do we operate on the numerators?		
Draw a picture.		
What size answer do we get?		
Write a story.		

We said we multiply the numerators, 1 x 1 = 1, and we multiply the denominators, 3 x 4 = 12. Do we need common denominators? No! We just multiplied them. So, did we operate on the denominators? Yes! We multiplied them. Did we operate on the numerators? Yes! We multiplied them.



	Multiplication	Addition
Solve.	$\frac{1}{3}\times\frac{1}{4}=\frac{1\times1}{3\times4}=\frac{1}{12}$	$\frac{1}{3}+\frac{1}{4}=\frac{4}{12}+\frac{3}{12}=\frac{7}{12}$
Do we need common denominators?	NO	YES
Do we operate on the denominators?	YES	NO
Do we operate on the numerators?	YES	YES
Draw a picture.		
What size answer do we get?		

Do you remember how we add? Do we just add across? No! We have to find common denominators. ⅓ is the same as 4/12 and ¼ is the same as 3/12. 4/12 plus 3/12 is 7/12. Addition is actually way harder than multiplication. Do we need common denominators? Yes! Once we found common denominators, did I operate on them? Did I add them? No! Did we operator on the numerators? Did I add them? Yes!



	Multiplication	Addition
Solve.	$\frac{1}{3}\times\frac{1}{4}=\frac{1\times1}{3\times4}=\frac{1}{12}$	$\frac{1}{3}+\frac{1}{4}=\frac{4}{12}+\frac{3}{12}=\frac{7}{12}$
Do we need common denominators?	NO	YES
Do we operate on the denominators?	YES	NO
Do we operate on the numerators?	YES	YES
Draw a picture.		
What size answer do we get?	smaller	bigger
Write a story.		

Let's draw a picture. For multiplication, I have ⅓ and then I take ¼ of the ⅓ I can see that my answer gets smaller.

For addition, I have ⅓ and then I draw another ¼. To add these, I have to think of them both as twelfths and put them together. I can see that my answer gets bigger.

Who can make up a story for our multiplication problem? Remember, we're taking a fraction of a fraction. *There are many right answers. Make sure you are clear by saying "correct" or "incorrect" to students' responses. You do not need to write these down.* Who can make up a story for our addition problem? Remember, we're taking a fraction and getting more. *There are many right answers. Make sure you are clear by saying "correct" or "incorrect" to students' responses. You do not need to write these down.*

Let's Try it (Slides 7): Let's practice this together. We will draw a picture and write numbers.

WARM WELCOME

Today we will multiply unit fractions by unit fractions.

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Let's Review:

We already learned that multiplying by a fraction is the same as taking a fraction OF something.

What is $\frac{1}{2}$ of 8?

The denominator of our fraction is the ________________ number.

It tells us ____________________________________.

Let's Talk:

Now it's time to take a fraction of another fraction!

Story: Lisa had $\frac{1}{2}$ a bottle of soda. She drank $\frac{1}{2}$ of what she had. How much did she drink?

Picture:

Words:

Numbers:

Let's Talk:

Let's make sure our method works with another problem!

Story: Frank wants to run $\frac{1}{3}$ of a mile. So far, he ran $\frac{1}{2}$ of his goal. How far has he run?

Picture:

Words:

Numbers:

Let's Think:

It will help us remember the strategies if we explore how multiplying fractions compares to adding fractions.

	Multiplication	Addition
Solve.	$\frac{1}{3} \times \frac{1}{4} =$	$\frac{1}{3} + \frac{1}{4} =$
Do we need common denominators?		
Do we operate on the denominators?		
Do we operate on the numerators?		
Draw a picture.		
What size answer do we get?		
Write a story.		

Let's Try It:

Let's practice multiplying fractions together.

Name: ______________________________ G5 U5 Lesson 7 - Let's Try It

Maynard is painting a wall. He wants to paint $\frac{1}{3}$ of the wall blue and $\frac{2}{3}$ of the wall green. So far, Maynard has painted $\frac{1}{4}$ of the blue part. How much of the whole wall has Maynard painted?

1. Draw a picture.

2. Represent your work with numbers:

3. Write your answer in a complete sentence. Be sure to put units with your numerical answer.

____

____

On your Own:

Now it's time for you to do it on your own.

Name: ______________________________ G5 U4 Lesson 7 - Independent Work

Remember: The denominator tells us how many pieces a whole is split into.

Show your work with numbers and by shading the rectangle below. Make sure to label your picture.

1. $\frac{1}{3} \times \frac{1}{3} =$	2. $\frac{1}{7} \times \frac{1}{10} =$
1. $\frac{1}{4} \times \frac{1}{2} =$	2. $\frac{1}{3} \times \frac{1}{5} =$

Maynard is painting a wall. He wants to paint $\frac{1}{3}$ of the wall blue and $\frac{2}{3}$ of the wall green. So far, Maynard has painted $\frac{1}{4}$ of the blue part. How much of the whole wall has Maynard painted?

1. Draw a picture.

2. Represent your work with numbers:

3. Write your answer in a complete sentence. Be sure to put units with your numerical answer.

____

____

____

Solve. $\frac{1}{8} \times \frac{1}{2} = ?$

4. Draw a picture.

5. Represent your work with numbers:

6. How are the steps for multiplying fractions the same or different from the steps for adding fractions? Why does that make sense?

7. Write your own multiplication of fractions story to match the numbers you just used.

Name: ____

Remember: The denominator tells us how many pieces a whole is split into.

Show your work with numbers and by shading the rectangle below. Make sure to label your picture.

1. $\frac{1}{3} \times \frac{1}{3} =$	2. $\frac{1}{2} \times \frac{1}{10} =$
1. $\frac{1}{4} \times \frac{1}{2} =$	2. $\frac{1}{3} \times \frac{1}{5} =$
1. $\frac{1}{3} \times \frac{1}{6} =$	2. $\frac{1}{5} \times \frac{1}{4} =$

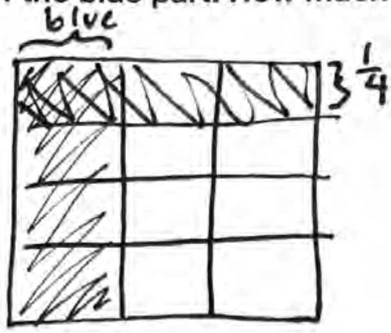
Solve the story problem with numbers and by drawing a picture.

7. Martiza brought $\frac{1}{2}$ of a sandwich to school for lunch. But she wasn't very hungry so she only ate $\frac{1}{2}$ of what she brought. What fractional part of a sandwich did Maritza eat at lunch?
8. Amber Elementary School has a track that is $\frac{1}{2}$ of a mile long. Darius ran $\frac{1}{5}$ of the track. How far did Darius run?
9. John is going to plant $\frac{1}{3}$ of his garden with flowers, $\frac{1}{3}$ of his garden with fruit and $\frac{1}{3}$ of his garden with vegetables. He has $\frac{1}{4}$ acres of land for his garden. How many acres will John plant with flowers?
10. Rebecca needs $\frac{1}{4}$ cup of sugar to make a cake. She has $\frac{1}{2}$ of what she needs and she will have to buy the rest. What fraction of a cup of sugar does Rebecca have?

Name: ANSWER KEY

Maynard is painting a wall. He wants to paint $\frac{1}{3}$ of the wall blue and $\frac{2}{3}$ of the wall green. So far, Maynard has painted $\frac{1}{4}$ of the blue part. How much of the whole wall has Maynard painted?

1. Draw a picture.



2. Represent your work with numbers:

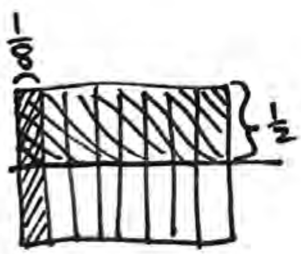
$$\frac{1}{4} \times \frac{1}{3} = \frac{1}{12}$$

3. Write your answer in a complete sentence. Be sure to put units with your numerical answer.

Maynard has painted $\frac{1}{12}$ of the wall.

Solve. $\frac{1}{8} \times \frac{1}{2} = ?$

4. Draw a picture.



5. Represent your work with numbers:

$$\frac{1}{8} \times \frac{1}{2} = \frac{1}{16}$$

6. How are the steps for multiplying fractions the same or different from the steps for adding fractions? Why does that make sense?

We multiply numerators just like we add numerators. But we don't add denominators and we <u>do</u> multiply denominators.

7. Write your own multiplication of fractions story to match the numbers you just used.

* many right answers *

Example:

Joe had $\frac{1}{8}$ of a sandwich. He ate $\frac{1}{2}$ of it. How much did he eat?

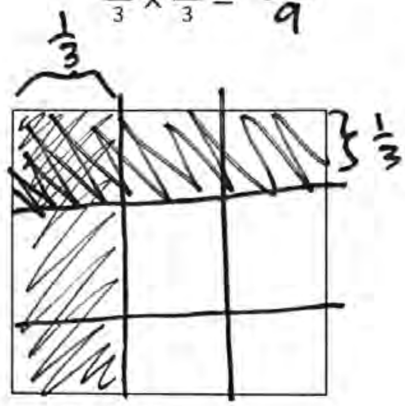
Name: ANSWER KEY

Remember: The denominator tells us how many pieces a whole is split into.

Show your work with numbers and by shading the rectangle below. Make sure to label your picture.

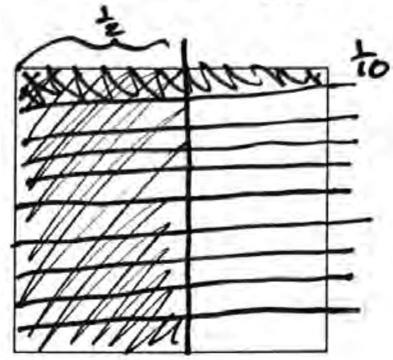
1.

$\frac{1}{3} \times \frac{1}{3} = \frac{1}{9}$



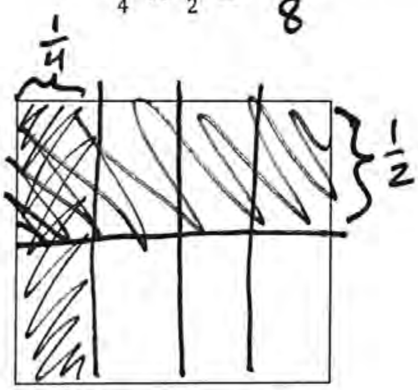
2.

$\frac{1}{2} \times \frac{1}{10} = \frac{1}{20}$



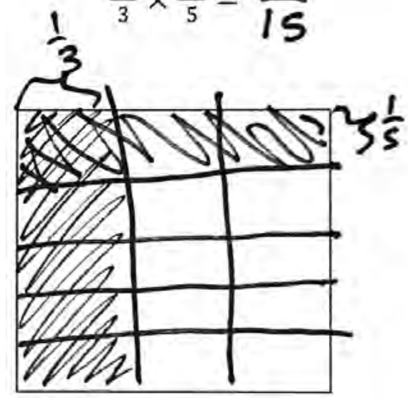
1.

$\frac{1}{4} \times \frac{1}{2} = \frac{1}{8}$



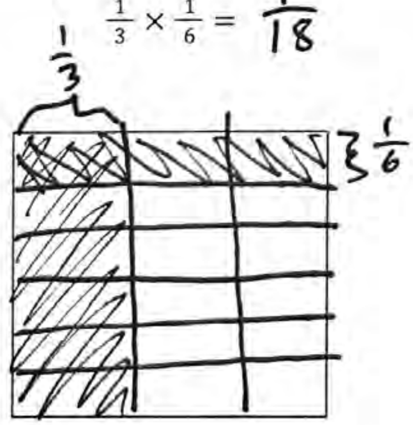
2.

$\frac{1}{3} \times \frac{1}{5} = \frac{1}{15}$



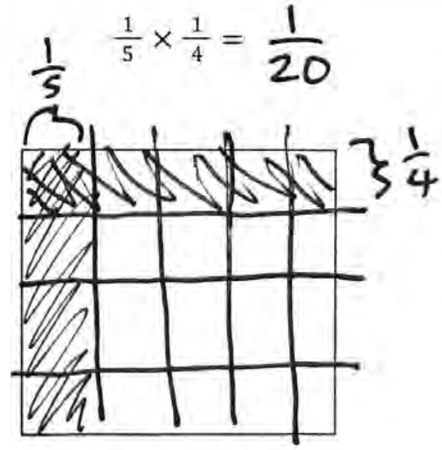
1.

$\frac{1}{3} \times \frac{1}{6} = \frac{1}{18}$



2.

$\frac{1}{5} \times \frac{1}{4} = \frac{1}{20}$

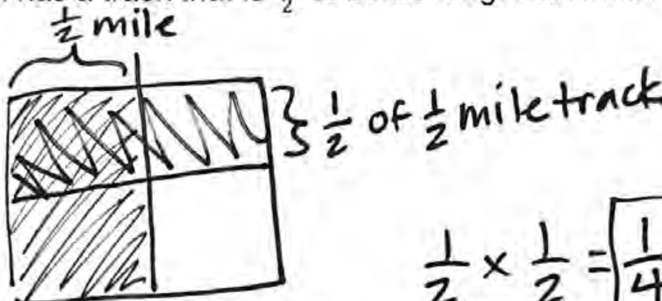


Solve the story problem with numbers and by drawing a picture.

7. Martiza brought $\frac{1}{2}$ of a sandwich to school for lunch. But she wasn't very hungry so she only ate $\frac{1}{2}$ of what she brought. What fractional part of a sandwich did Maritza eat at lunch?

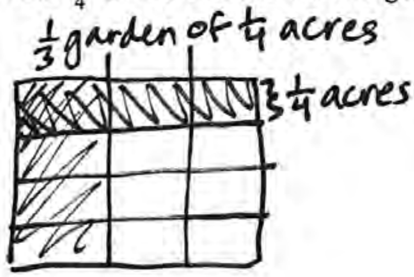
$\frac{1}{2} \times \frac{1}{2} = \boxed{\frac{1}{4} \text{ sandwich}}$

8. Amber Elementary School has a track that is $\frac{1}{2}$ of a mile long. Darius ran $\frac{1}{5}$ of the track. How far did Darius run?



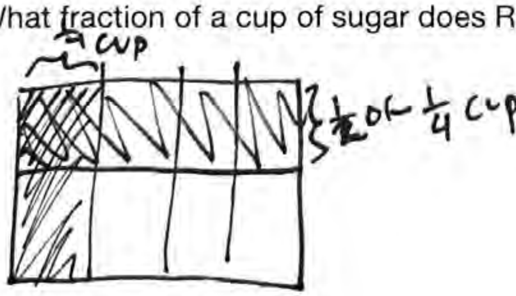
$\frac{1}{2} \times \frac{1}{2} = \boxed{\frac{1}{4} \text{ mile}}$

9. John is going to plant $\frac{1}{3}$ of his garden with flowers, $\frac{1}{3}$ of his garden with fruit and $\frac{1}{3}$ of his garden with vegetables. He has $\frac{1}{4}$ acres of land for his garden. How many acres will John plant with flowers?



$\frac{1}{3} \times \frac{1}{4} = \boxed{\frac{1}{12} \text{ acres}}$

10. Rebecca needs $\frac{1}{4}$ cup of sugar to make a cake. She has $\frac{1}{2}$ of what she needs and she will have to buy the rest. What fraction of a cup of sugar does Rebecca have?



$\frac{1}{2} \times \frac{1}{4} = \boxed{\frac{1}{8} \text{ cup}}$

G5 U4 Lesson 8

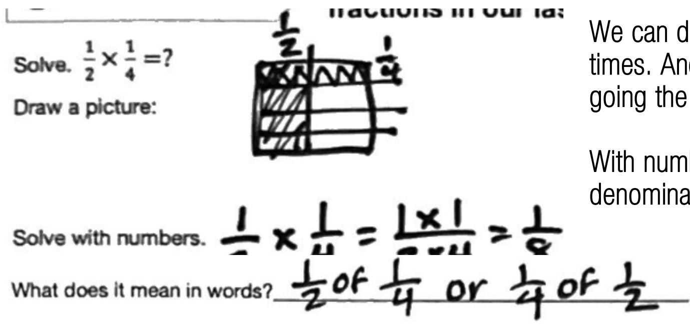
Multiply unit fractions by non-unit fractions

G1 U4 Lesson 8 - Today we will multiply unit fractions by non-unit fractions.

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): Today we will multiply unit fractions by non-unit fractions. Unit fractions are just fractions where we have only 1 unit so the numerator is 1. So one of our fractions will have a one in the numerator and the other fraction will have a different digit in the numerator. It shouldn't change the way we do the math, right? Multiplying fractions is still multiplying fractions. Let's dive in!

Let's Review (Slide 3): What did you learn about multiplying fractions in our last lesson? *Solicit students ideas and record them in the correct place. Be sure to say, "That's incorrect" if a student says something that is not right. As you write correct thinking, make sure to reiterate what the student said by narrating as you write.*

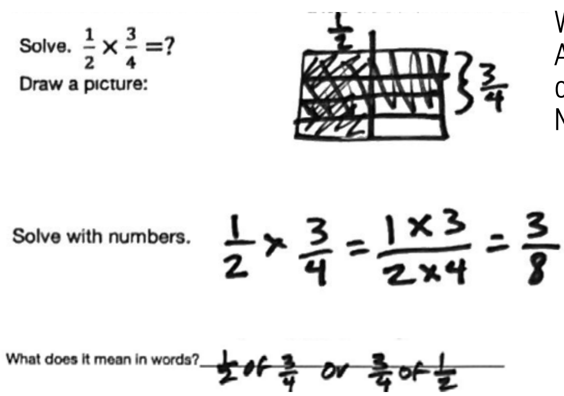


We can draw ½ by cutting a rectangle into 2 pieces. Now we want ½ only ¼ times. Another way to say it, is that we want ¼ of ½. I will need to cut 4 pieces going the other way. And I can see that the overlap is **⅛**

With numbers, we just multiply the numerators, 1 x 1 is 1, and we multiply the denominators, 2 x 4 is 8. Our answer is **⅛**

We can think of the "times symbol" as taking a fraction "of." So this problem is really ½ of ¼ or ¼ of ½.

Let's Talk (Slide 4): We will see what happens when we use the same steps for multiplying a fraction that doesn't have 1 in the numerator, a non-unit fraction.

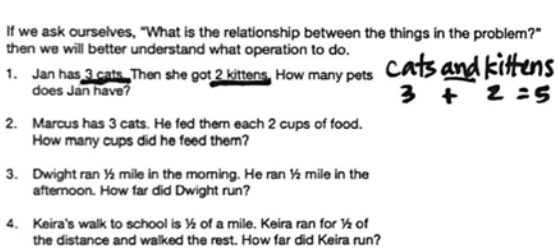


We can draw ½ by cutting a rectangle into 2 pieces. Now we want ½ only ¾ times. Another way to say it, is that we want ¾ of ½. I will need to cut 4 pieces going the other way. But this time, we don't just want one piece. We want THREE pieces. Now the overlap isn't **⅛**It's **⅛**

Remember in our last lesson, we talked about how the picture makes equal rows, which is like an array. It's a multiplication picture. So it makes sense that with numbers, we just multiply the numerators, 1 x 3 is 3, and we multiply the denominators, 2 x 4 is 8. Our answer is **⅛**

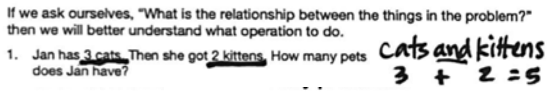
This is just the same as always. We can think of the "times symbol" as taking a fraction "of." So this problem is really ½ of ¾ or ¾ of ½.

Let's Think (Slide 5): Multiplying fractions is honestly even easier than adding fractions. The hard part comes when we are doing story problems. It is easy to mix up multiplication and addition story problems. If we ask ourselves, "What is the relationship between the things in the problem?" then we will better understand what operation to do. I'll show you what I mean. Follow along with your eyes while I read the problem. *Read the first problem.*



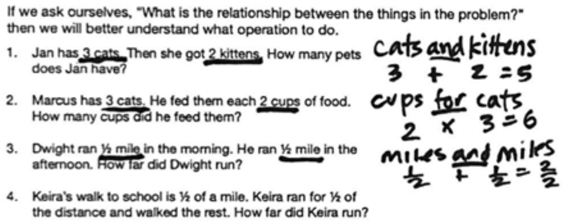
I can underline the number and the word after the number to see what the story is about. In this case, the problem is about 3 cats and 2 kittens. Now I ask myself, "What is the relationship between cats and kittens?" Cats AND kittens are both pets. That word "and" helps me realize I want to put these together. 3 + 2 = 5 pets.

Follow along with your eyes while I read the problem. *Read the second problem.* I can underline the number and the word after the number to see what the story is about. In this case, the problem is about 3 cats and 2 cups of food. Now I ask myself, "What is the relationship between cats and cups?" The cups are FOR the cats. Or I might think, the cats eat the



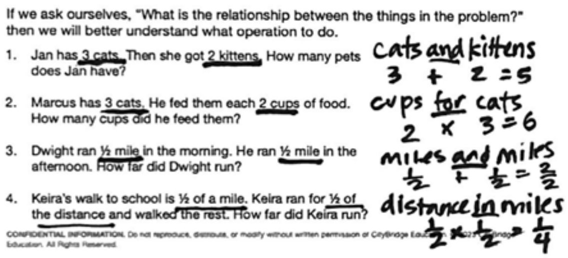
If we ask ourselves, "What is the relationship between the things in the problem?" then we will better understand what operation to do.

1. Jan has 3 cats. Then she got 2 kittens. How many pets does Jan have? — Cats and kittens $3 + 2 = 5$



If we ask ourselves, "What is the relationship between the things in the problem?" then we will better understand what operation to do.

1. Jan has 3 cats. Then she got 2 kittens. How many pets does Jan have? — Cats and kittens $3 + 2 = 5$
2. Marcus has 3 cats. He fed them each 2 cups of food. How many cups did he feed them? — cups for cats $2 \times 3 = 6$
3. Dwight ran ½ mile in the morning. He ran ½ mile in the afternoon. How far did Dwight run? — miles and miles $\frac{1}{2} + \frac{1}{2} = \frac{2}{2}$
4. Keira's walk to school is ½ of a mile. Keira ran for ½ of the distance and walked the rest. How far did Keira run?



If we ask ourselves, "What is the relationship between the things in the problem?" then we will better understand what operation to do.

1. Jan has 3 cats. Then she got 2 kittens. How many pets does Jan have? — Cats and kittens $3 + 2 = 5$
2. Marcus has 3 cats. He fed them each 2 cups of food. How many cups did he feed them? — cups for cats $2 \times 3 = 6$
3. Dwight ran ½ mile in the morning. He ran ½ mile in the afternoon. How far did Dwight run? — miles and miles $\frac{1}{2} + \frac{1}{2} = \frac{2}{2}$
4. Keira's walk to school is ½ of a mile. Keira ran for ½ of the distance and walked the rest. How far did Keira run? — distance in miles $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$

cups. I don't think cats AND cups are both anything! This is a sign to me that it's a multiplication relationship. I have 2 cups, 3 times. 2 x 3 = 6

Follow along with your eyes while I read the problem. *Read the third problem.* I can underline the number and the word after the number to see what the story is about. In this case, the problem is about ½ mile and ½ mile. Now I ask myself, "What is the relationship between miles and miles?" This almost feels silly. Miles AND miles are both miles! Even if it's silly, that word "and" is the clue that I can add these. ½ + ½ is 2 halves or 1 whole.

Last one! Follow along with your eyes while I read the problem. *Read the fourth problem.* I can underline the number and the word after the number to see what the story is about. In this case, the problem is about ½ mile and ½ of the distance. WHOA! Before I even ask my relationship question, alarm bells are going off in my mind. This is super weird phrasing! It is ½ mile. It is ½ of the distance. Now I ask myself, "What is the relationship between miles and distance?" The distance is measured in miles. I can already hear I want part of the miles. I want ½ of the ½. That's multiplication. ½ x ½ is ¼.

Let's Try it (Slides 6): Let's practice this together. We will draw a picture and write numbers to multiply fractions. Then you'll try out some story problems.

WARM WELCOME

Today we will multiply unit fractions by non-unit fractions.

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Let's Review:

What did you learn about multiplying fractions in our last lesson?

Solve. $\frac{1}{2} \times \frac{1}{4} = ?$

Draw a picture:

Solve with numbers.

What does it mean in words?______________________________________

Let's Talk:

We will see what happens when we use the same steps for multiplying a fraction that doesn't have 1 in the numerator.

Solve. $\frac{1}{2} \times \frac{3}{4} = ?$

Draw a picture:

Solve with numbers.

What does it mean in words?______________________________________

Let's Think: It is easy to mix up multiplication and addition story problems!

If we ask ourselves, “What is the relationship between the things in the problem?” then we will better understand what operation to do.

1. Jan has 3 cats. Then she got 2 kittens. How many pets does Jan have?

2. Marcus has 3 cats. He fed them each 2 cups of food. How many cups did he feed them?

3. Dwight ran ½ mile in the morning. He ran ½ mile in the afternoon. How far did Dwight run?

4. Keira's walk to school is ½ of a mile. Keira ran for ½ of the distance and walked the rest. How far did Keira run?

Let's Try It: Let's practice together.

Name: ____________________ G5 U5 Lesson 8 - Let's Try It

Benji is making a graphic novel. He wants $\frac{1}{2}$ of the book to be words and $\frac{1}{2}$ of the book to be comics. So far, he has drawn $\frac{3}{5}$ of the comics. How much of the book has he completed?

1. Draw a picture.

2. Represent your work with numbers:

3. Write your answer in a complete sentence. Be sure to put units with your numerical answer.

____

____

On your Own:

Now it's time for you to do it on your own.

Name: ______________________________ G5 U5 Lesson 8 - Let's Try It

Benji is making a graphic novel. He wants $\frac{1}{2}$ of the book to be words and $\frac{1}{2}$ of the book to be comics. So far, he has drawn $\frac{3}{5}$ of the comics. How much of the book has he completed?

1. Draw a picture.

2. Represent your work with numbers:

3. Write your answer in a complete sentence. Be sure to put units with your numerical answer.

____

____

Benji is making a graphic novel. He wants $\frac{1}{2}$ of the book to be words and $\frac{1}{2}$ of the book to be comics. So far, he has drawn $\frac{3}{5}$ of the comics. How much of the book has he completed?

1. Draw a picture.

2. Represent your work with numbers:

3. Write your answer in a complete sentence. Be sure to put units with your numerical answer.

____

____

Solve. $\frac{2}{3} \times \frac{1}{3} = ?$

4. Draw a picture.

5. Represent your work with numbers:

Lea's plate is filled with $\frac{3}{4}$ cups of vegetables. $\frac{1}{2}$ of the vegetables is broccoli. How many cups of broccoli are on Lea's plate?

6. This story problem is about ______________________ and ________________________. To choose the operation, I ask, what is the relationship between those things?

____

7. Fill in the circle with + or x: $\frac{3}{4}$ ◯ $\frac{1}{2}$ ◯

Lea's plate is filled with $\frac{3}{4}$ cups of cauliflower. Then she put $\frac{1}{2}$ cups of broccoli on her plate. How many cups of vegetables are on Lea's plate?

8. This story problem is about ____________________ and ______________________. To choose the operation, I ask, what is the relationship between those things?

____

9. Fill in the circle with + or x: $\frac{3}{4}$ $\frac{1}{2}$ ◯

10. Solve.

Name: ___________________________________

Remember: The denominator tells us how many pieces a whole is split into.

Show your work with numbers and by shading the rectangle below. Make sure to label your picture.

1. $\frac{2}{3} \times \frac{1}{3} =$	2. $\frac{1}{2} \times \frac{4}{10} =$
1. $\frac{3}{4} \times \frac{1}{2} =$	2. $\frac{1}{3} \times \frac{2}{5} =$
1. $\frac{1}{3} \times \frac{5}{6} =$	2. $\frac{3}{5} \times \frac{1}{4} =$

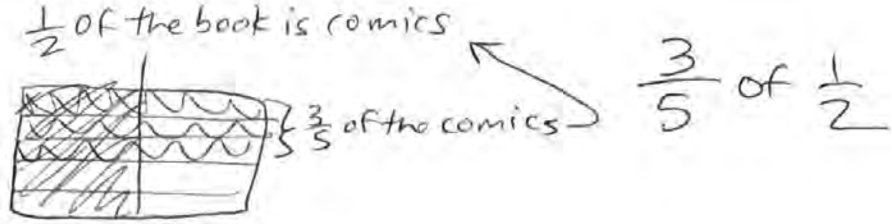
Solve the story problem with numbers and by drawing a picture. Be careful! One of the story problems is addition NOT multiplication!

7. Tim had $\frac{7}{10}$ of a gallon paint. He used $\frac{1}{2}$ of what he had to paint a small table. What fractional part of a gallon did he use to paint the table?
8. Sammy had $\frac{1}{3}$ of a large pizza. He ate $\frac{3}{4}$ of it for dinner. How much of the large pizza did Sammy eat for dinner?
9. Mac's Tree Service delivered $\frac{3}{4}$ crate of wood chips for Alicia's garden project. Alicia had $\frac{1}{2}$ crate left over from the previous summer. How many crates of wood chips does Alicia have now?
10. Franklin used $\frac{1}{3}$ of the bread that he had in the cupboard to make some sandwiches. If Franklin had $\frac{2}{5}$ of a loaf of bread, what fraction of a loaf did Franklin use to make the sandwiches?

Name: ANSWER KEY

Benji is making a graphic novel. He wants $\frac{1}{2}$ of the book to be words and $\frac{1}{2}$ of the book to be comics. So far, he has drawn $\frac{3}{5}$ of the comics. How much of the book has he completed?

1. Draw a picture.



2. Represent your work with numbers:

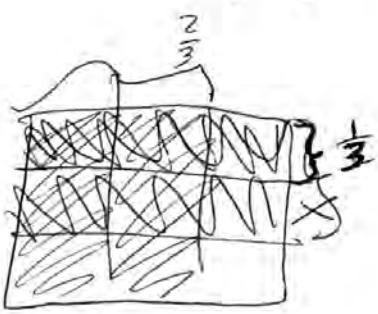
$\frac{3}{5} \times \frac{1}{2} = \boxed{\frac{3}{10} \text{ of the book}}$

3. Write your answer in a complete sentence. Be sure to put units with your numerical answer.

Benji has completed $\frac{3}{10}$ of the book.

Solve. $\frac{2}{3} \times \frac{1}{3} = ?$

4. Draw a picture.



5. Represent your work with numbers:

$\frac{2}{3} \times \frac{1}{3} = \boxed{\frac{2}{9}}$

Lea's plate is filled with $\frac{3}{4}$ cups of vegetables. $\frac{1}{2}$ of the vegetables is broccoli. How many cups of broccoli are on Lea's plate?

6. This story problem is about cups of vegetable and ~~of the vegetable~~ broccoli. To choose the operation, I ask, what is the relationship between those things?

~~the are the vega the cups are in the~~ the broccoli is part of the cups

7. Fill in the circle with + or x: $\frac{3}{4} \times \frac{1}{2}$

Lea's plate is filled with $\frac{3}{4}$ cups of cauliflower. Then she put $\frac{1}{2}$ cups of broccoli on her plate. How many cups of vegetables are on Lea's plate?

8. This story problem is about cups and cups. To choose the operation, I ask, what is the relationship between those things?

cups and cups are both the same

9. Fill in the circle with + or x: $\frac{3}{4} + \frac{1}{2}$

10. Solve.

$\frac{3}{4}$

$\frac{1 \times 2}{2 \times 2} = \frac{2}{4}$

$\frac{3}{4} + \frac{2}{4} = \frac{5}{4} = \boxed{1\frac{1}{4} \text{ cups}}$

$$\begin{array}{r} 1 \\ 4\overline{)5} \\ -4 \\ \hline 1 \end{array}$$

Name: ANSWER KEY

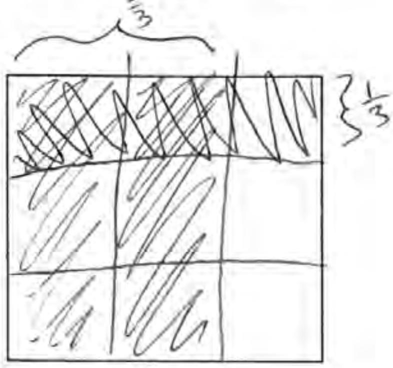
G5 U4 Lesson 8 - Independent Work

Remember: The denominator tells us how many pieces a whole is split into.

Show your work with numbers and by shading the rectangle below. Make sure to label your picture.

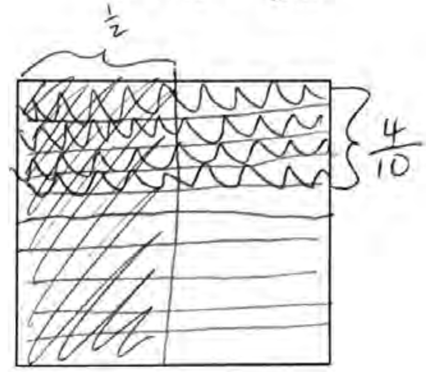
1.

$\frac{2}{3} \times \frac{1}{3} = \frac{2}{9}$



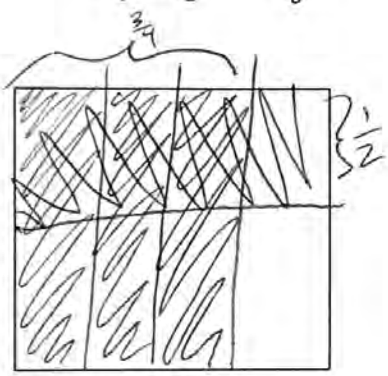
2.

$\frac{1}{2} \times \frac{4}{10} = \frac{4}{20}$



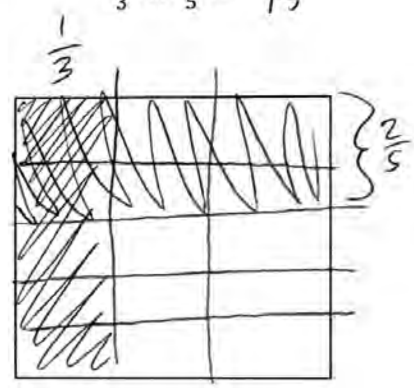
1.

$\frac{3}{4} \times \frac{1}{2} = \frac{3}{8}$



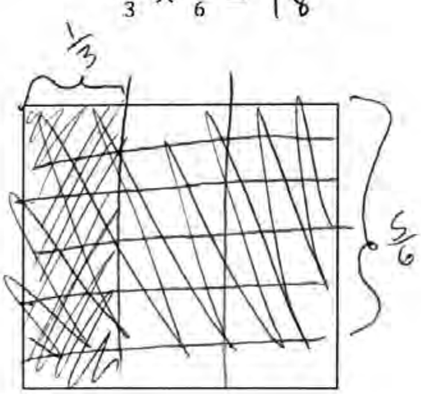
2.

$\frac{1}{3} \times \frac{2}{5} = \frac{2}{15}$



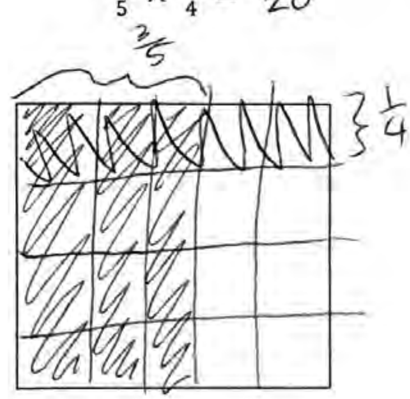
1.

$\frac{1}{3} \times \frac{5}{6} = \frac{5}{18}$



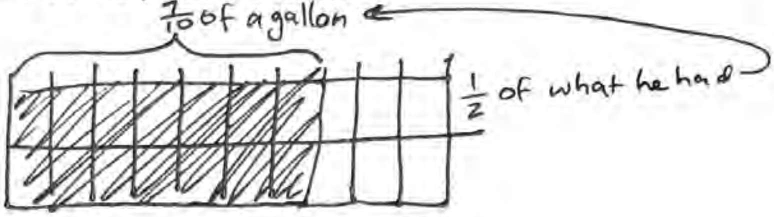
2.

$\frac{3}{5} \times \frac{1}{4} = \frac{3}{20}$



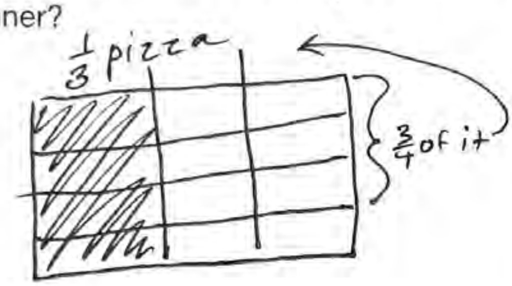
Solve the story problem with numbers and by drawing a picture. Be careful! One of the story problems is addition NOT multiplication!

7. Tim had $\frac{7}{10}$ of a gallon paint. He used $\frac{1}{2}$ of what he had to paint a small table. What fractional part of a gallon did he use to paint the table?



$\frac{1}{2}$ of $\frac{7}{10} = \frac{1}{2} \times \frac{7}{10} = \boxed{\frac{7}{20} \text{ gallon}}$

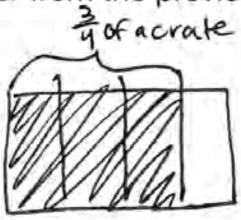
8. Sammy had $\frac{1}{3}$ of a large pizza. He ate $\frac{3}{4}$ of it for dinner. How much of the large pizza did Sammy eat for dinner?

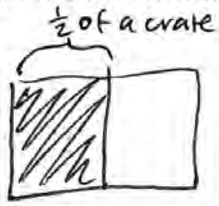


$\frac{3}{4}$ of $\frac{1}{3}$

$\frac{3}{4} \times \frac{1}{3} = \boxed{\frac{3}{12} \text{ pizza}}$

9. Mac's Tree Service delivered $\frac{3}{4}$ crate of wood chips for Alicia's garden project. Alicia had $\frac{1}{2}$ crate left over from the previous summer. How many crates of wood chips does Alicia have now?



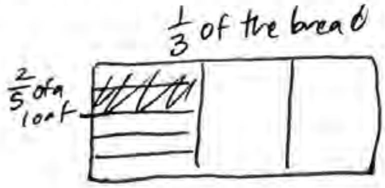


$\frac{1 \times 2}{2 \times 2} = \frac{2}{4}$

$4 \overline{)5}$ = 1 R 1 ($5 - 4 = 1$)

$\frac{3}{4} + \frac{1}{2} = \frac{3}{4} + \frac{2}{4} = \frac{5}{4} = \boxed{1\frac{1}{4} \text{ crate}}$

10. Franklin used $\frac{1}{3}$ of the bread that he had in the cupboard to make some sandwiches. If Franklin had $\frac{2}{5}$ of a loaf of bread, what fraction of a loaf did Franklin use to make the sandwiches?



$\frac{1}{3}$ of $\frac{2}{5}$

$\frac{1}{3} \times \frac{2}{5} = \boxed{\frac{2}{15} \text{ of a loaf}}$

G5 U4 Lesson 9

Multiply non-unit fractions by non-unit fractions

G1 U4 Lesson 9 - Today we will multiply non-unit fractions by non-unit fractions.

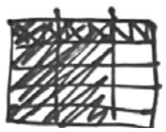
Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): Today we will multiply unit fractions by non-unit fractions. Unit fractions are just fractions where we have only 1 unit so the numerator is 1. So today our fractions will have different digits in the numerator. No big deal! It shouldn't change the way we do the math, right? Multiplying fractions is still multiplying fractions. Let's dive in!

Let's Review (Slide 3): What did you learn about multiplying fractions in our last lesson? *Solicit students ideas and record them in the correct place. Be sure to say, "That's incorrect" if a student says something that is not right. As you write correct thinking, make sure to reiterate what the student said by narrating as you write.*

Solve. $\frac{2}{3} \times \frac{1}{5} = ?$

Draw a picture:



$\frac{2}{15}$

We can draw $\frac{2}{3}$ by cutting a rectangle into 3 pieces and shading 2. Now we want that $\frac{2}{3}$ only $\frac{1}{5}$ times. Another way to say it, is that we want $\frac{1}{5}$ of $\frac{2}{3}$. I will need to cut 5 pieces going the other way. And I can see that the overlap is 2 fifteenths.

Solve with numbers. $\frac{2 \times 1}{3 \times 5} = \frac{2}{15}$

With numbers, we just multiply the numerators, 2 x 1 is 2, and we multiply the denominators, 5 x 3 is 15. Our answer is 2 fifteenths.

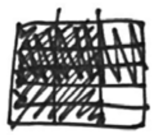
What does it mean in words? $\frac{2}{3}$ of $\frac{1}{5}$ or $\frac{1}{5}$ of $\frac{2}{3}$

We can think of the "times symbol" as taking a fraction "of." So this problem is really $\frac{1}{5}$ of $\frac{2}{3}$ or $\frac{2}{3}$ of $\frac{1}{5}$

Let's Talk (Slide 4): We will see what happens when we use the same steps for multiplying fractions that don't have 1 in the numerators.

Solve. $\frac{2}{3} \times \frac{3}{5} = ?$

Draw a picture:



$\frac{6}{15}$

We can draw $\frac{2}{3}$ by cutting a rectangle into 3 pieces and shading 2. Now we want $\frac{2}{3}$ only $\frac{3}{5}$ times. Another way to say it, is that we want $\frac{3}{5}$ of $\frac{2}{3}$. I will need to cut 5 pieces going the other way. But this time, we don't just want one piece. We want THREE pieces. The overlap is 6 fifteenths.

Solve with numbers. $\frac{2 \times 3}{3 \times 5} = \frac{6}{15}$

Remember in our last lesson, we talked about how the picture makes equal rows, which is like an array. It's a multiplication picture. So it makes sense that with numbers, we just multiply the numerators, 2 x 3 is 6, and we multiply the denominators, 3 x 5 is 15. Our answer is 6 fifteenths.

What does it mean in words? $\frac{2}{3}$ of $\frac{3}{5}$ or $\frac{3}{5}$ of $\frac{2}{3}$

This is just the same as always. We can think of the "times symbol" as taking a fraction "of." So this problem is really $\frac{2}{3}$ of $\frac{3}{5}$ or $\frac{3}{5}$ of $\frac{2}{3}$

Let's Think (Slide 5): We've talked about this before - the hardest part of multiplying fractions is recognizing it in story problems. How do you know when to multiply fractions in a story problem instead of adding them? Possible Student Answers, Key Points:

- The story will be about finding a fraction of another fraction.
- We would have different words that don't go together with the word "and."
- It would be a part of a part instead of a part and a part.

Give the students time to think about a fraction multiplication story problem in their heads. Then ask them to tell it to a person near them. Have a few students share and decide a group if it is really a fraction multiplication story. You can write key language down from the problems on the board as shown.

Let's Try it (Slides 6): Let's practice this together. We will draw a picture and write numbers to multiply fractions. Then you'll try out some story problems.

WARM WELCOME

Today we will multiply non-unit fractions by non-unit fractions.

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Let's Review:

What did you learn about multiplying fractions in our last lesson?

Solve. $\frac{2}{3} \times \frac{1}{5} = ?$

Draw a picture:

Solve with numbers.

What does it mean in words?______________________________________

Let's Talk:

We will see what happens when we use the same steps for multiplying fractions that don't have 1 in the numerators.

Solve. $\frac{2}{3} \times \frac{3}{5} = ?$

Draw a picture:

Solve with numbers.

What does it mean in words?______________________________________

Let's Think: **The hardest part of multiplying fractions is recognizing it in story problems.**

How do you know when to multiply fractions in a story problem instead of adding them? Give examples.

Let's Try It: Let's practice together.

Name: ______________________________ G5 U5 Lesson 9 - Let's Try It

Shelby had $\frac{3}{4}$ pounds of salt. She used $\frac{2}{3}$ of what she had to make play dough! (Did you know you can use salt to make play dough?!?!) How much salt did Shelby use to make the play dough?

1. Draw a picture.

2. Represent your work with numbers:

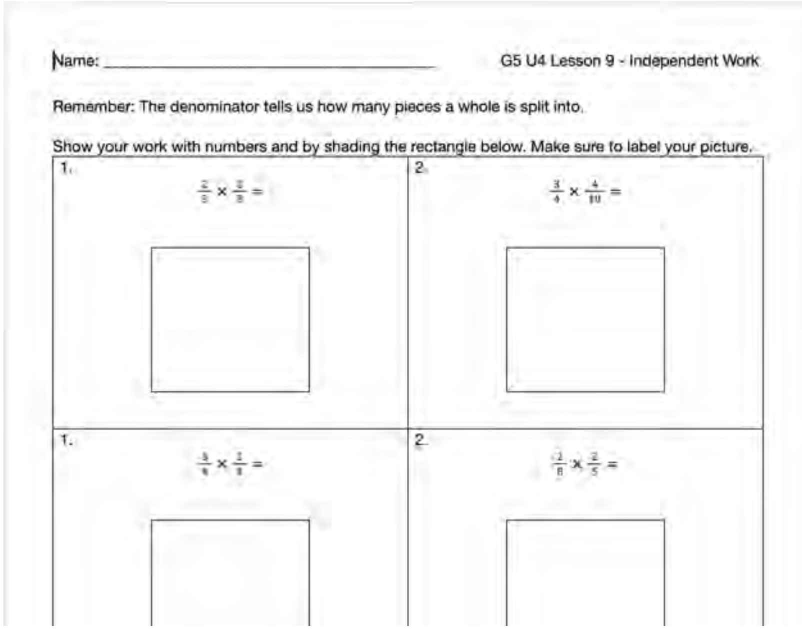
3. Write your answer in a complete sentence. Be sure to put units with your numerical answer.

____

____

On your Own:

Now it’s time for you to do it on your own.



Name: ______________________________ G5 U4 Lesson 9 - Independent Work

Remember: The denominator tells us how many pieces a whole is split into.

Show your work with numbers and by shading the rectangle below. Make sure to label your picture.

1. $\frac{2}{5} \times \frac{2}{3} =$	2. $\frac{3}{4} \times \frac{4}{10} =$
1. $\frac{5}{6} \times \frac{1}{3} =$	2. $\frac{1}{8} \times \frac{2}{5} =$

Shelby had $\frac{3}{4}$ pounds of salt. She used $\frac{2}{3}$ of what she had to make play dough! (Did you know you can use salt to make play dough?!?!) How much salt did Shelby use to make the play dough?

1. Draw a picture.

2. Represent your work with numbers:

3. Write your answer in a complete sentence. Be sure to put units with your numerical answer.

____

____

Solve. $\frac{2}{5} \times \frac{3}{2} = ?$

4. Draw a picture.

5. Represent your work with numbers:

6. Write your own multiplication of fractions story problem.

____

7. Draw a picture:

8. Solve the problem with numbers:

9. Write your own addition of fractions story problem.

10. Draw a picture:

11. Solve the problem with numbers:

Name: ____ G5 U4 Lesson 9 - Independent Work

Remember: The denominator tells us how many pieces a whole is split into.

Show your work with numbers and by shading the rectangle below. Make sure to label your picture.

1. $\frac{2}{3} \times \frac{2}{3} =$	2. $\frac{3}{4} \times \frac{4}{10} =$
1. $\frac{3}{4} \times \frac{2}{3} =$	2. $\frac{2}{8} \times \frac{2}{5} =$
1. $\frac{3}{5} \times \frac{5}{6} =$	2. $\frac{4}{5} \times \frac{3}{4} =$

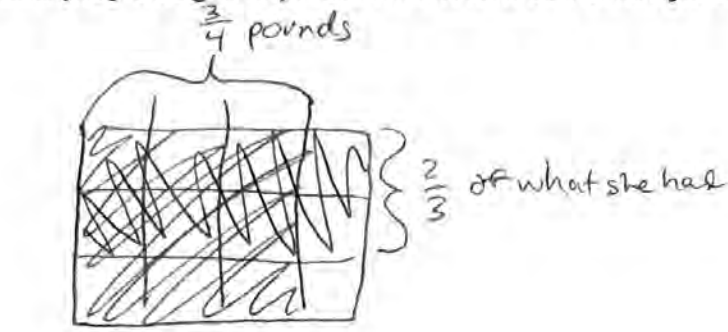
Solve the story problem with numbers and by drawing a picture. Be careful! One of the story problems is addition NOT multiplication!

7. Janice had $\frac{7}{10}$ of a bag of candy that she brought to school for Valentine's Day. She passed out $\frac{3}{4}$ of what she brought to her friends. What fraction of a bag did Janice give out?
8. Latisha collected $\frac{2}{10}$ of a bucket of shells at the beach. Her brother, Lewis, collected $\frac{3}{5}$ of a bucket of shells. What fraction of a bucket did Latisha and her brother collect?
9. Tyrek got a job to mow $\frac{3}{4}$ acres of lawn for his neighbor. So far he has done $\frac{2}{3}$ of the job. How much lawn did Tyrek mow so far?
10. A house in rural West Virginia costs $\frac{2}{3}$ of a million dollars on average. To buy the house, the bank requires $\frac{2}{3}$ of the total cost as a down payment. What is the size of a down payment on an average house in rural West Virginia?

Name: ANSWER KEY

Shelby had $\frac{3}{4}$ pounds of salt. She used $\frac{2}{3}$ of what she had to make play dough! (Did you know you can use salt to make play dough?!?!) How much salt did Shelby use to make the play dough?

1. Draw a picture.



2. Represent your work with numbers:

$$\frac{2}{3} \text{ of } \frac{3}{4} = \frac{2}{3} \times \frac{3}{4} = \frac{6}{12} = \boxed{\frac{1}{2}}$$

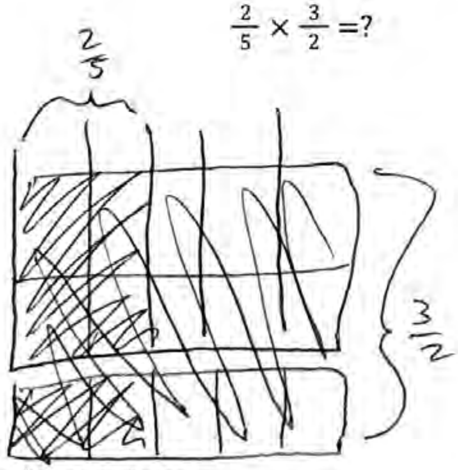
3. Write your answer in a complete sentence. Be sure to put units with your numerical answer.

Shelby used $\frac{1}{2}$ pound of salt to make play dough.

Solve.

$\frac{2}{5} \times \frac{3}{2} = ?$

4. Draw a picture.



5. Represent your work with numbers:

$$\frac{2}{5} \times \frac{3}{2} = \frac{6}{10} = \boxed{\frac{3}{5}}$$

6. Write your own multiplication of fractions story problem.

* many possible answers *

7. Draw a picture:

* many possible answers *

8. Solve the problem with numbers:

9. Write your own addition of fractions story problem.

* many possible answers *

10. Draw a picture:

* many possible answers *

11. Solve the problem with numbers:

Name: ANSWER KEY

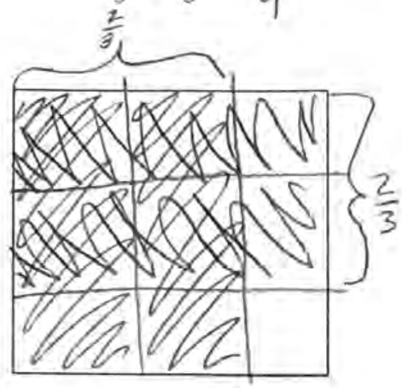
G5 U4 Lesson 9 - Independent Work

Remember: The denominator tells us how many pieces a whole is split into.

Show your work with numbers and by shading the rectangle below. Make sure to label your picture.

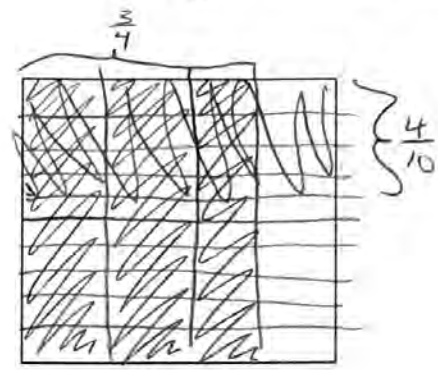
1.

$\frac{2}{3} \times \frac{2}{3} = \frac{4}{9}$



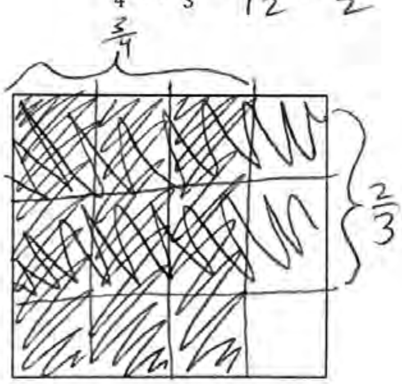
2.

$\frac{3}{4} \times \frac{4}{10} = \frac{12}{40} = \frac{6}{20} = \frac{3}{10}$



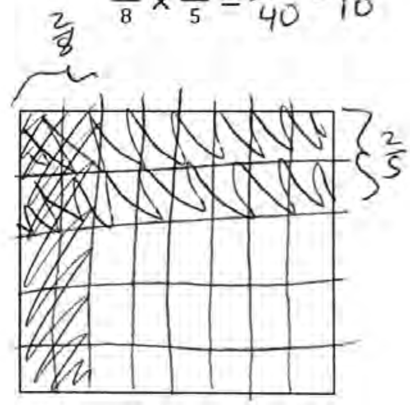
1.

$\frac{3}{4} \times \frac{2}{3} = \frac{6}{12} = \frac{1}{2}$



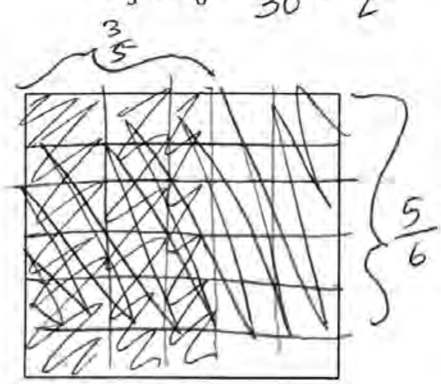
2.

$\frac{2}{8} \times \frac{2}{5} = \frac{4}{40} = \frac{1}{10}$



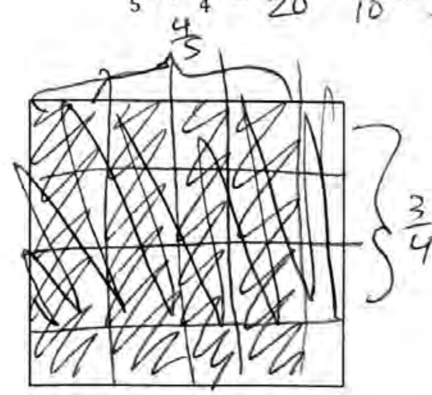
1.

$\frac{3}{5} \times \frac{5}{6} = \frac{15}{30} = \frac{1}{2}$



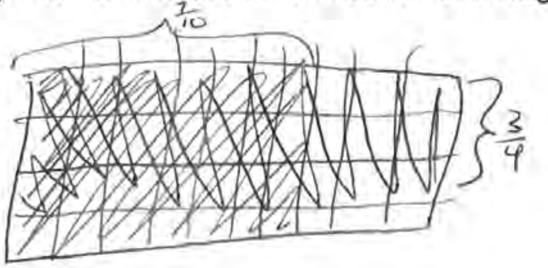
2.

$\frac{4}{5} \times \frac{3}{4} = \frac{12}{20} = \frac{6}{10} = \frac{3}{5}$



Solve the story problem with numbers and by drawing a picture. Be careful! One of the story problems is addition NOT multiplication!

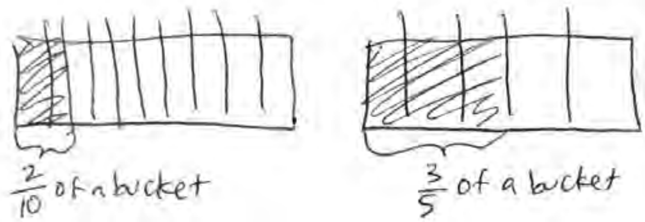
7. Janice had $\frac{7}{10}$ of a bag of candy that she brought to school for Valentine's Day. She passed out $\frac{3}{4}$ of what she brought to her friends. What fraction of a bag did Janice give out?



$\frac{3}{4}$ of $\frac{7}{10}$

$\frac{3}{4} \times \frac{7}{10} = \boxed{\frac{21}{40} \text{ of a bag}}$

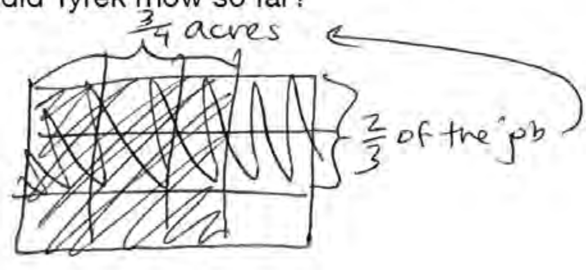
8. Latisha collected $\frac{2}{10}$ of a bucket of shells at the beach. Her brother, Lewis, collected $\frac{3}{5}$ of a bucket of shells. What fraction of a bucket did Latisha and her brother collect?



$\frac{2}{10} + \frac{3}{5}$ $\qquad$ $\frac{3 \times 2}{5 \times 2} = \frac{6}{10}$

$\frac{2}{10} + \frac{6}{10} = \frac{8}{10} = \boxed{\frac{4}{5} \text{ of a bucket}}$

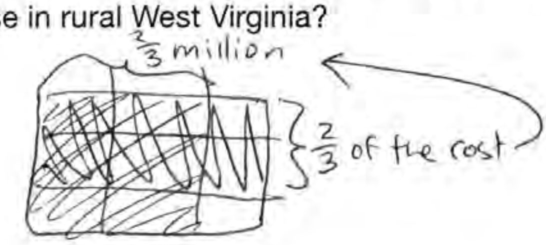
9. Tyrek got a job to mow $\frac{3}{4}$ acres of lawn for his neighbor. So far he has done $\frac{2}{3}$ of the job. How much lawn did Tyrek mow so far?



$\frac{2}{3}$ of $\frac{3}{4}$

$\frac{2}{3} \times \frac{3}{4} = \frac{6}{12} = \boxed{\frac{1}{2} \text{ acres}}$

10. A house in rural West Virginia costs $\frac{2}{3}$ of a million dollars on average. To buy the house, the bank requires $\frac{2}{3}$ of the total cost as a down payment. What is the size of a down payment on an average house in rural West Virginia?



$\frac{2}{3}$ of $\frac{2}{3}$

$\frac{2}{3} \times \frac{2}{3} = \boxed{\frac{4}{9} \text{ of a million}}$

G5 U4 Lesson 10

Relate decimal and fraction multiplication

G1 U4 Lesson 10 - Today we will relate decimal and fraction multiplication.

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): Today we will relate decimal and fraction multiplication. This is super helpful because you are going to be learning more and more operations. It is easy to get them confused. But everything we know about fraction multiplication is going to help with decimal multiplication. That's the great thing about math - it all works together and makes sense together. Let's go!

Let's Review (Slide 3): Earlier this year, you used fraction addition to learn about decimal addition. Who can tell me what our first step is to add $\frac{4}{10} + \frac{23}{100}$? Possible Student Answers, Key Points:

- You have to find common denominators.
- You use equivalent fractions.
- You multiply $\frac{4}{10}$ by 10 on top and 10 on the bottom.

Solve. $\frac{4}{10} + \frac{23}{100} = $ ___ $\frac{4 \times 10}{10 \times 10} = \frac{40}{100}$

These two fractions are different units - tenths and hundredths. We can't add different units so we have to add equivalent fractions instead. I am going to multiply $\frac{4}{10}$ by $\frac{10}{10}$ and get $\frac{40}{100}$. Now I can add.

Solve. $\frac{4}{10} + \frac{23}{100} = $ ___ $\frac{4 \times 10}{10 \times 10} = \frac{40}{100}$ $\frac{40}{100} + \frac{23}{100} = \frac{63}{100}$

40 hundredths plus 23 hundredths is 63 hundredths. We have pieces and pieces make pieces so the denominator just stays the same.

Solve. 0.4 + 0.23 = ______

$$\begin{array}{r} 0.4 \\ +\,0.23 \\ \hline \end{array}$$

Now let's think about these same numbers as decimals. How can we set up this addition of decimals?

Possible Student Answers, Key Points:

- We line up our denominators.
- We use a place value chart.

The common way we talk about it is to say that we line up our decimals. But when we do that what we're doing is lining up tenths with tenths and hundredths with hundredths.

Solve. 0.4 + 0.23 = ______

$$\begin{array}{r} 0.40 \\ +\,0.23 \\ \hline 0.63 \end{array}$$

And if I put a zero next to the 4, look! It looks just like when we ended up adding the 40 and 23 above, right? But it's nice and lined up, easy to add. And here I just bring down the decimal.

Now let's think about this question, "What does adding fractions teach us about adding decimals?" *Give students time to think but don't have them answer. Instead, give your own clear answer.* We need "like denominators" with fractions just like we need "like places" to be lined up with decimals. We don't add denominators so we don't add decimal place shifts. We just bring the decimal down.

What does adding fractions teach us about adding decimals?
We don't add denominators or place value shifts.

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Let's Talk (Slide 4): Now let's see what fraction multiplication has to teach us about decimal multiplication. We have to solve $\frac{4}{10} \times \frac{23}{100}$. We know this is easy peasy! We multiply the numerators and multiply the denominators. The only thing is that these are bigger numbers so I'm going to do the math to the side of my paper. 23 x 4. I multiply 4 times 3, which is 12. Put down the 2 and regroup the 1. Now 4 times 2 is 8 plus the 1 is 9. My numerator is 92.

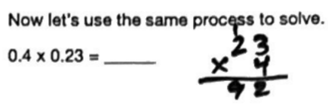
Solve. $\frac{4}{10} \times \frac{23}{100} = 92$

$$\begin{array}{r} {}^{1}23 \\ \times\ \ 4 \\ \hline 92 \end{array}$$

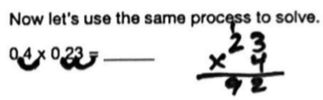
Solve. $\frac{4}{10} \times \frac{23}{100} = \frac{92}{1000}$

To multiply the denominators, I don't usually write out all these zeros. That will get too messy. I know these zeros are place holders that shift the digits so if I want to multiply them, I just count up all the shifts, all the place holders, all the zeros. There are 3 so I write one zero zero zero in the denominator. My answer is 92 thousandths.

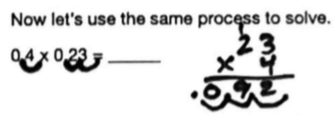
Let's just stop and look for a minute. This is NOT the same as decimal addition. The biggest difference is that we multiplied the denominators instead of keeping them the same. That is going to come back up again in a minute.



First let's think about numerators. We multiplied them without thinking about the denominators at all. So we are going to multiply these digits without thinking about the decimals points at all. You can write 0.23 x 0.4 but we are just multiplying the 23 x 4 like the decimal isn't there. We still get 92, right?

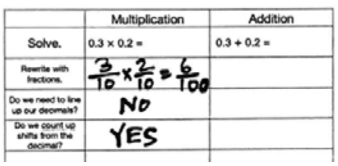


Now we know we multiplied the denominators of the fractions. The denominators are still secretly there. They are just in disguise as decimal places. This shift after the decimal shows tenths, right? These two places after the decimal show hundredths. So we are going to have to combine all those shifts just like we combined the zeros of our fractions.



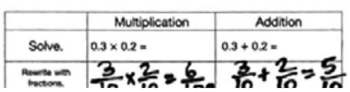
I count 1 shift, 2 shifts, 3 shifts. So my answer needs 1 shift, 2 shifts, 3 shifts. I need a zero in this empty place and I put a decimal. Look! We got 92 thousandths both ways!

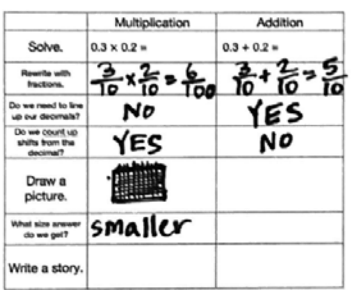
What does multiplying fractions teach us about multiplying decimals? We multiply our digit just like numerators. Then later we go back and count decimal shifts just like we would count up zeros in the denominator.



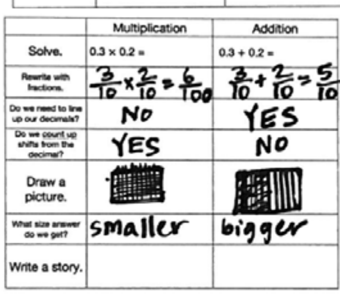
Let's Think (Slide 5): It's really easy to get the operations mixed up so let's compare and contract them to review. 0.3 x 0.2 is $\frac{3}{10} \times \frac{2}{10}$. 3 x 2 is 6. 10 x 10 is 100. Our answer is $\frac{6}{100}$. So do we need to line up our decimals? NO! Do we count up the shifts from the decimal? YES! Just like we see two zeros, we'll have two shifts after the decimal.

Let's just do addition. As fractions, it is $\frac{3}{10} + \frac{2}{10}$. That's $\frac{5}{10}$. So do we need to line up our decimals? YES! It looks like this! Do we count up shifts from the decimal? NO! We just bring our decimal down.





Let's draw a picture to check. 0.3 x 0.2 is really 3 tenths of 2 tenths. I am going to draw 2 tenths with ten pieces and shade 2. Now I want 3 tenths of that. I will draw those the other way and shade 2. Wow! That's a multiplication picture! We get 6 out of 100 pieces. What size answer do we get? SMALLER! Look at our pieces. They got tiny!



Let's draw the addition picture. I am going to draw 2 tenths with ten pieces and shade 2. Now I need another 3 pieces out of ten. I'll shade those this way. I have 5 pieces altogether. It's 5 tenths. What size answer do we get? BIGGER! Look, we shaded and then shaded more.

Who can help me make up a story for the multiplication? *See what students can offer then offer your own correct answer. You do not need to write it down.* We might say Lisa wants to trail that is 0.3 of a mile. She ran 0.2 of the trail. How far did Lisa run? Who can help me make up a story for the addition? *See what students can offer then offer your own correct answer. You do not need to write it down.* We might say Lisa ran 0.3 of a mile in the morning. She ran 0.2 of a mile in the afternoon. How far did Lisa run?

Let's Try it (Slides 6): Let's practice this together. We will multiply fractions and then multiply decimals and see how they are related.

WARM WELCOME

Today we will relate decimal and fraction multiplication.

Let's Review:

Earlier this year, you used fraction addition to learn about decimal addition.

Solve. $\frac{4}{10} + \frac{23}{100} = \_\_\_$

Solve. 0.4 + 0.23 = ______

What does adding fractions teach us about adding decimals?

Let's Talk:

Now let's see what fraction multiplication has to teach us about decimal multiplication.

Solve. $\frac{4}{10} \times \frac{23}{100} = \_\_\_$

Now let's use the same process to solve.

0.4 x 0.23 = ______

What does multiplying fractions teach us about multiplying decimals?

Let's Think:

It's easy to get the operations mixed up so let's compare and contrast them.

	Multiplication	Addition
Solve.	$0.3 \times 0.2 =$	$0.3 + 0.2 =$
Rewrite with fractions.		
Do we need to line up our decimals?		
Do we count up shifts from the decimal?		
Draw a picture.		
What size answer do we get?		
Write a story.		

Let's Try It:

Let's practice together.

Name: ______________________________ G5 U5 Lesson 10 - Let's Try It

Multiply the fractions then multiply the decimals.

1. Do the math. $\frac{2}{10} \times \frac{4}{100} =$ ____

2. Now we will multiply the same numbers as decimals and see if we get the same answer.

$0.2 \times 0.04 =$ __________

Step #1: Label the place values of your digits.

Step #2: Multiply the digits without the place value.

Step #3: Count the total amount that the digits shifted from the decimal point

_____ shifts

Step #4: Count the same number of shifts to put the decimal point in your answer.

Step #5: Label the place values of your answer to check it with the fraction multiplication.

On your Own:

Now it’s time for you to do it on your own.

Name: ______________________ G5 U4 Lesson 10 - Independent Work

Remember: We have to multiply the place values as well as the digits.

Show your work.

1. $\frac{9}{10} \times \frac{6}{100} = \frac{\quad}{\quad}$

   0.9 x 0.06 = __________

2. $\frac{12}{100} \times \frac{36}{100} = \frac{\quad}{\quad}$

   0.12 x 0.36 = __________

3. $9\frac{4}{10} \times 8\frac{2}{10} = \frac{\quad}{\quad}$

4. $\frac{49}{100} \times 2\frac{3}{10} = \frac{\quad}{\quad}$

Multiply the fractions then multiply the decimals.

1. Do the math. $\frac{2}{10} \times \frac{4}{100} = \_\_\_$

2. Now we will multiply the same numbers as decimals and see if we get the same answer.

0.2 x 0.04 = ______________

Step #1: Label the place values of your digits.

Step #2: Multiply the digits without the place value.

Step #3: Count the total amount that the digits shifted from the decimal point.

______ shifts

Step #4: Count the same number of shifts to put the decimal point in your answer.

Step #5: Label the place values of your answer to check it with the fraction multiplication.

Multiply the fractions then multiply the decimals.

3. Rewrite the mixed numbers as improper fractions.

$5\frac{2}{10} \times 3\frac{6}{10} = \_\_\_$

_____ × _____ = _____

4. Show the math you would do to multiply the numerators.

5. Rewrite your final answer as a mixed number. ____________

6. Now we will multiply the same numbers as decimals and see if we get the same answer.

5.2 x 3.6 = ____________

Step #1: Label the place values of your digits.

Step #2: Multiply the digits without the place value.

Step #3: Count the total amount that the digits shifted from the decimal point.

_____ shifts

Step #4: Count the same number of shifts to put the decimal point in your answer.

Step #5: Label the place values of your answer to check it with the fraction multiplication.

Name: ______________________________

Remember: We have to multiply the place values as well as the digits.

Show your work.

1. $\frac{9}{10} \times \frac{6}{100} = \underline{\quad}$ 0.9 x 0.06 = ____________	2. $\frac{12}{100} \times \frac{36}{100} = \underline{\quad}$ 0.12 x 0.36 = ____________
3. $9\frac{4}{10} \times 8\frac{2}{10} = \underline{\quad}$ $\underline{\quad\quad} \times \underline{\quad\quad} = \underline{\quad\quad}$ 9.4 x 8.2 = ____________	4. $\frac{49}{100} \times 2\frac{3}{10} = \underline{\quad}$ $\underline{\quad\quad} \times \underline{\quad\quad} = \underline{\quad\quad}$ 0.49 x 2.3 = ____________

Show your work.

5.

$$2\frac{8}{10} \times \frac{51}{100} = \_\_\_$$

$$\_\_\_ \times \_\_\_ = \_\_\_$$

2.8 x 0.51 = ______________

6.

$$\frac{4}{10} \times 1\frac{6}{10} = \_\_\_$$

$$\_\_\_ \times \_\_\_ = \_\_\_$$

0.4 x 1.6 = ______________

7.

$$58\frac{3}{10} \times \frac{42}{100} = \_\_\_$$

$$\_\_\_ \times \_\_\_ = \_\_\_$$

58.3 x 0.42 = ______________

8.

$$7\frac{6}{10} \times 2\frac{3}{100} = \_\_\_$$

$$\_\_\_ \times \_\_\_ = \_\_\_$$

7.6 x 2.03 = ______________

Name: ANSWER KEY

Multiply the fractions then multiply the decimals.

1. Do the math. $\frac{2}{10} \times \frac{4}{100} = \frac{8}{1000}$

2. Now we will multiply the same numbers as decimals and see if we get the same answer.

$\overset{O}{0}.\overset{T}{2} \times \overset{O}{0}.\overset{T}{0}\overset{H}{4} = \overset{O}{0}.\overset{T}{0}\overset{H}{0}\overset{Th}{8}$

Step #1: Label the place values of your digits.

Step #2: Multiply the digits without the place value.

$$\begin{array}{r} 2 \\ \times\ 4 \\ \hline .0\ 0\ 8 \end{array}$$

Step #3: Count the total amount that the digits shifted from the decimal point.

3 shifts

Step #4: Count the same number of shifts to put the decimal point in your answer.

Step #5: Label the place values of your answer to check it with the fraction multiplication.

Multiply the fractions then multiply the decimals.

3. Rewrite the mixed numbers as improper fractions.

$$5\frac{2}{10} \times 3\frac{6}{10} = \_\_\_\_$$

$$\frac{52}{10} \times \frac{36}{10} = \frac{1872}{100}$$

4. Show the math you would do to multiply the numerators.

$$\begin{array}{r} \overset{1}{5}2 \\ \times\ 36 \\ \hline 312 \\ 1560 \\ \hline 1872 \end{array}$$

5. Rewrite your final answer as a mixed number. $18\frac{72}{100}$

6. Now we will multiply the same numbers as decimals and see if we get the same answer.

O T O T
5.2 x 3.6 = 18.72
T O T H

Step #1: Label the place values of your digits.

Step #2: Multiply the digits without the place value.

$$\begin{array}{r} \overset{1}{5}2 \\ \times\ 36 \\ \hline 312 \\ 1560 \\ \hline 18.72 \end{array}$$

Step #3: Count the total amount that the digits shifted from the decimal point.

2 shifts

Step #4: Count the same number of shifts to put the decimal point in your answer.

Step #5: Label the place values of your answer to check it with the fraction multiplication.

Name: ANSWER KEY

G5 U4 Lesson 10 - Independent Work

Remember: We have to multiply the place values as well as the digits.

Show your work.

1.

$\frac{9}{10} \times \frac{6}{100} = \frac{54}{1000}$

$0.9 \times 0.06 =$ 0.054

```
   9
 × 6
 ----
.054
```

2.

$\frac{12}{100} \times \frac{36}{100} = \frac{432}{1000}$

$0.12 \times 0.36 =$ 0.0432

```
   1
   12
 × 36
 -----
   72
  360
 -----
.0432
```

3.

$9\frac{4}{10} \times 8\frac{2}{10} =$ ___

$\frac{94}{10} \times \frac{82}{10} = \frac{7708}{100}$

$9.4 \times 8.2 =$ 77.08

```
   3
   94
 × 82
 -----
  188
 7520
 -----
77.08
```

4.

$\frac{49}{100} \times 2\frac{3}{10} =$ ___

$\frac{49}{100} \times \frac{23}{10} = \frac{1127}{1000}$

$0.49 \times 2.3 =$ 1.127

```
  12
   49
 × 23
 -----
  147
  980
 -----
1.127
```

Show your work.

5. $2\frac{8}{10} \times \frac{51}{100} = \_\_\_$ $\frac{28}{10} \times \frac{51}{100} = \frac{1428}{1000}$ $2.8 \times 0.51 = \underline{1.428}$ $\begin{array}{r} 28 \\ \times 51 \\ \hline 28 \\ 1400 \\ \hline 1.428 \end{array}$	6. $\frac{4}{10} \times 1\frac{6}{10} = \_\_\_$ $\frac{4}{10} \times \frac{16}{10} = \frac{64}{100}$ $0.4 \times 1.6 = \underline{0.64}$ $\begin{array}{r} 16 \\ \times 4 \\ \hline .64 \end{array}$
7. $58\frac{3}{10} \times \frac{42}{100} = \_\_\_$ $\frac{583}{10} \times \frac{42}{100} = \frac{24486}{1000}$ $58.3 \times 0.42 = \underline{24.486}$ $\begin{array}{r} 583 \\ \times 42 \\ \hline 1166 \\ 23320 \\ \hline 24.486 \end{array}$	8. $7\frac{6}{10} \times 2\frac{3}{100} = \_\_\_$ $\frac{76}{10} \times \frac{203}{100} = \frac{15428}{1000}$ $7.6 \times 2.03 = \underline{15.428}$ $\begin{array}{r} 203 \\ \times 76 \\ \hline 1218 \\ 14210 \\ \hline 15.428 \end{array}$

G5 U4 Lesson 11
Multiply decimals fluently

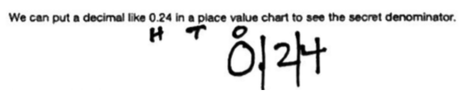
CITYTUTOR DC

G1 U4 Lesson 11 - Today we will multiply decimals fluently.

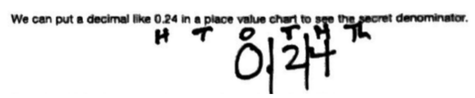
Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): Today we will multiply decimals fluently. That just means that we will get quicker at doing the steps we already know. We want to be able to get the right answer every time following the exact same steps.

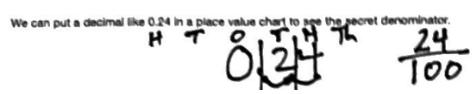
Let's Review (Slide 3): The whole strategy that we already learned to multiply decimals rests on one big understanding: Decimals are really just secret fractions. You might not have explained it that way but I bet you kind of already knew that. Let me show you what I mean. We can put our decimal in a place value chart to see the secret denominator.



Let me copy this number with some lines between the digits. I start at the decimal and this direction I have ones, tens, hundreds.

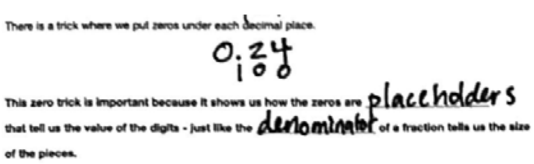


Then in the other direction I have tenths, hundredths, thousandths. So this number is secretly 24 hundredths.

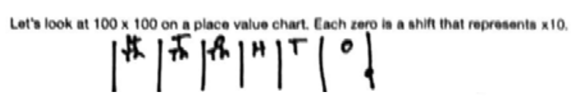


Let me write that as a fraction. You see? The spaces after the decimal secretly told us the number in the denominator.

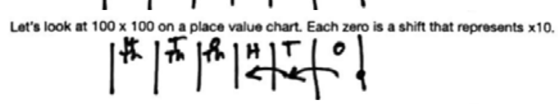
Now this part might be new for you. There is also a trick where I put a 1 under the decimal and then I put zeros under each decimal place. This zero trick is important because it shows us how the zeros are placeholders that tell us the value of the digits - just like the denominator of a fraction tells us the size of the pieces. So, when we multiply we can count up shifts after the decimal just like we can count up zeros.



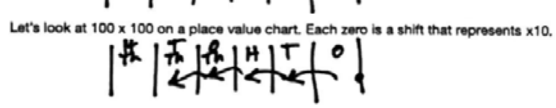
Let's Talk (Slide 4): When we multiply we count up all the zeros. In the same way, we can count up all the shifts after the decimal point. Let's look at 100 x 100 on a place value chart. Each zero is a shift that represents x 10.



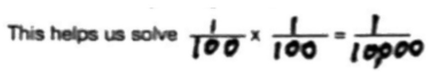
Here is my chart.



100 is 10 x 10.

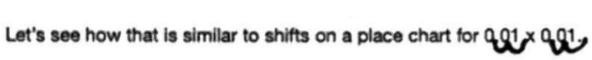


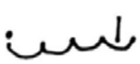
Multiply that by 100 is x10 x10. We get 10,000. Each zero was a shift on the place value chart and our answer was all the shifts together.



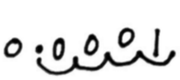
This helps us solve 1 over 100 times 1 over 100. 1 x 1 is 1. 100 x 100 is ten thousand. 4 zeros in our denominators mean 4 zeros in our answer's denominator.

Let's see how that is similar to shifts on a place value chart for 0.01 x 0.01. This is secretly 1 hundredth times 1 hundredths. But let's just look at it as shifts. 1 x 1 is 1. Now for the values. 0.01 is one shift then two shifts. The next number is three shifts then four shifts. I put all the shifts together just like I put all the zeros together.



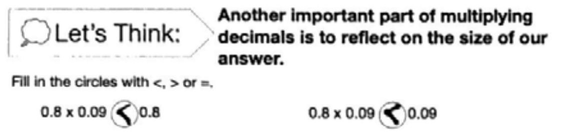


1 x 1 is 1. Then I need to put four shifts in my answer.

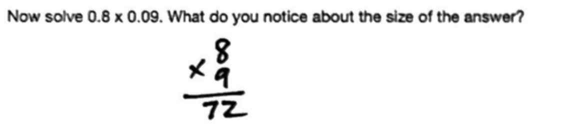


I fill in these spaces with zero and get 0.0001 and I get 1 ten thousandth! It is the same answer. None of this means you have to do anything different than you learned in the last lesson. I just want to make sure you understand that connection between multiplying fractions and multiplying decimals.

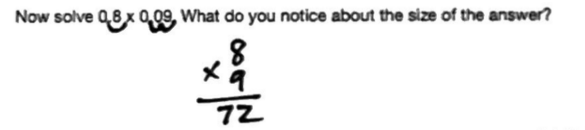
Let's Think (Slide 5): Another important part of multiplying decimals is to reflect on the size of our answer.



This says, fill in the circles with <, > or =. We know 0.8 x 0.09 is really 8 tenths of 9 hundredths or 9 hundredths or 8 tenths. Either way, it is a fraction of a fraction. We would expect our answer to be smaller than 0.8. And we'd expect the same thing for comparing to 0.09. A fraction of a fraction will be less.



So now let's solve 0.8 x 0.09. First I multiply 8 x 9 like they are just plain digits. That is 72.



Then I count up all the shifts from the decimal. There are 3.

So, I need 3 in my answer and I'll fill in the empty spots with zeros.

What do you notice about the size of the answer? It is smaller than 0.8. It is smaller than 0.09. We got the size answer we'd expect. You do not need to estimate or compare every single time but it is a great way to check your work so you can know if your answer is reasonable.

Let's Try it (Slides 6): Let's practice multiplying decimals together.

WARM WELCOME

Today we will multiply decimals fluently.

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Let's Review: We know that decimals are really just secret fractions.

We can put a decimal like 0.24 in a place value chart to see the secret denominator.

There is a trick where we put zeros under each decimal place.

This zero trick is important because it shows us how the zeros are ____________________

that tell us the value of the digits - just like the ___________________ of a fraction tells us the size

of the pieces.

Let's Talk: When we multiply, we count up all the zeros. In the same way, we can count up all the shifts after the decimal point.

Let's look at 100 x 100 on a place value chart. Each zero is a shift that represents x10.

This helps us solve ______ x ______ = ______

Let's see how that is similar to shifts on a place chart for 0.01 x 0.01.

Let's Think:

Another important part of multiplying decimals is to reflect on the size of our answer.

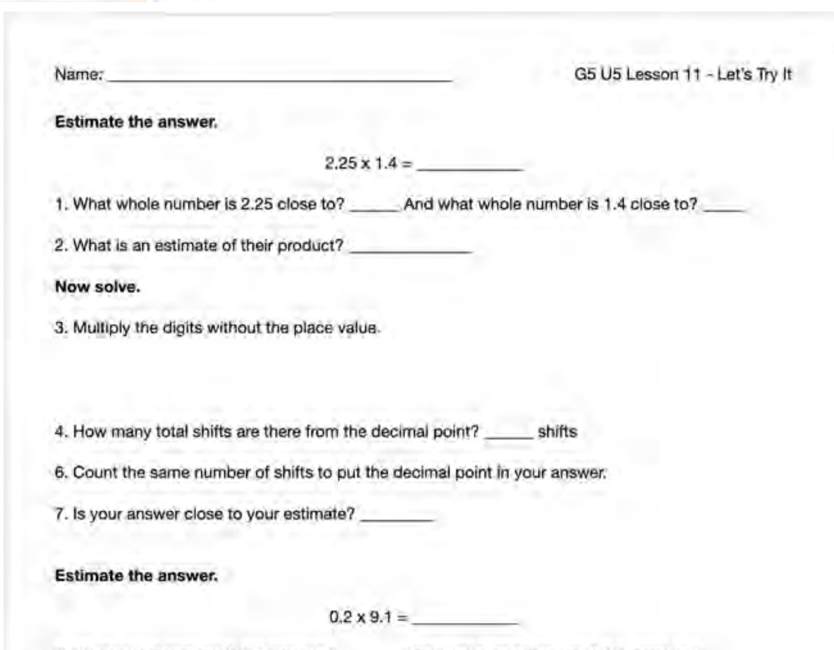
Fill in the circles with <, > or =.

0.8 x 0.09 ◯ 0.8   0.8 x 0.09 ◯ 0.09

Now solve 0.8 x 0.09. What do you notice about the size of the answer?

Let's Try It:

Let's practice together, and we'll estimate to see if our answer is reasonable.



Name: ______________________________ G5 U5 Lesson 11 - Let's Try It

Estimate the answer.

2.25 x 1.4 = __________

1. What whole number is 2.25 close to? _____ And what whole number is 1.4 close to? ____

2. What is an estimate of their product? ___________

Now solve.

3. Multiply the digits without the place value.

4. How many total shifts are there from the decimal point? _____ shifts

6. Count the same number of shifts to put the decimal point in your answer.

7. Is your answer close to your estimate? _______

Estimate the answer.

0.2 x 9.1 = __________

8. What whole number is 0.2 close to? _____ And what whole number is 9.1 close to? ____

On your Own:

Now it's time for you to do it on your own.

Name: ______________________________ G5 U4 Lesson 11 - Independent Work

Remember: We have to multiply the place values as well as the digits.

Show your work.

1. 0.23 x 3.4 = __________	2. 1.01 x 6.22 = __________
3. 6.4 x 4.2 = __________	4. 7.11 x 0.05 = __________

Estimate the answer.

$$2.25 \times 1.4 = \_\_\_\_\_\_\_\_\_\_\_\_$$

1. What whole number is 2.25 close to? ______ And what whole number is 1.4 close to? _____

2. What is an estimate of their product? ________________

Now solve.

3. Multiply the digits without the place value.

4. How many total shifts are there from the decimal point? ______ shifts

6. Count the same number of shifts to put the decimal point in your answer.

7. Is your answer close to your estimate? _________

Estimate the answer.

$$0.2 \times 9.1 = \_\_\_\_\_\_\_\_\_\_\_\_$$

8. What whole number is 0.2 close to? ______ And what whole number is 9.1 close to? _____

9. What is an estimate of their product? ________________

Now solve.

10. Multiply the digits without the place value.

11. How many total shifts are there from the decimal point? ______ shifts

12. Count the same number of shifts to put the decimal point in your answer.

13. Is your answer close to your estimate? _________

Name: ____ G5 U4 Lesson 11 - Independent Work

Remember: We have to multiply the place values as well as the digits.

Show your work.

1. $0.23 \times 3.4 =$ ______________	2. $1.01 \times 6.22 =$ ______________
3. $6.4 \times 4.2 =$ ______________	4. $7.11 \times 0.05 =$ ______________

Show your work.

5. $8.4 \times 2.7 =$ ______________	6. $51.9 \times 3.2 =$ ______________
7. $7.25 \times 1.64 =$ ______________	8. $82.1 \times 4.9 =$ ______________

Name: ANSWER KEY

Estimate the answer.

$2.25 \times 1.4 =$ 3.15

1. What whole number is 2.25 close to? 2 And what whole number is 1.4 close to? 1

2. What is an estimate of their product? $2 \times 1 = 2$

Now solve.

3. Multiply the digits without the place value.

$$\begin{array}{r} 225 \\ \times\ 14 \\ \hline 900 \\ 2250 \\ \hline 3.150 \end{array}$$

4. How many total shifts are there from the decimal point? 3 shifts

6. Count the same number of shifts to put the decimal point in your answer.

7. Is your answer close to your estimate? yes

Estimate the answer.

$0.2 \times 9.1 =$ ____________

8. What whole number is 0.2 close to? 0 And what whole number is 9.1 close to? 9

9. What is an estimate of their product? $0 \times 9 = 0$

Now solve.

10. Multiply the digits without the place value.

$$\begin{array}{r} 91 \\ \times\ 2 \\ \hline 1.82 \end{array}$$

11. How many total shifts are there from the decimal point? 2 shifts

12. Count the same number of shifts to put the decimal point in your answer.

13. Is your answer close to your estimate? yes

Name: ANSWER KEY

G5 U4 Lesson 11 - Independent Work

Remember: We have to multiply the place values as well as the digits.

Show your work.

1. $0.23 \times 3.4 =$ 0.782 23 34 92 690 .782	2. $1.01 \times 6.22 =$ 6.2822 101 622 202 2020 60600 6.2822
3. $6.4 \times 4.2 =$ 26.88 64 42 128 2560 26.88	4. $7.11 \times 0.05 =$ ~~0.3555~~ 0.3555 711 5 .3555

Show your work.

5. $8.4 \times 2.7 =$ 22.68 $\begin{array}{r} \overset{2}{8}4 \\ 27 \\ \hline 588 \\ 1680 \\ \hline 22.68 \end{array}$	6. $51.9 \times 3.2 =$ 166.08 $\begin{array}{r} 519 \\ 32 \\ \hline 1038 \\ 15570 \\ \hline 166.08 \end{array}$
7. $7.25 \times 1.64 =$ 11.89 $\begin{array}{r} 725 \\ \times 164 \\ \hline 2900 \\ 43500 \\ 72500 \\ \hline 11.8900 \end{array}$	8. $82.1 \times 4.9 =$ 402.29 $\begin{array}{r} 821 \\ 49 \\ \hline 7389 \\ 32840 \\ \hline 402.29 \end{array}$

G5 U4 Lesson 12

Solve word problems using fraction and decimal multiplication

G1 U4 Lesson 12 - Today we will solve word problems using fraction and decimal multiplication.

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): Today we will solve word problems using fraction and decimal multiplication. You will get to practice the things you've learned and apply them to real life situations. But there are going to be some addition and subtraction problems mixed in there so you are going to have to really be thoughtful about which operation you want to do before you start solving.

Let's Review (Slide 3): First, let's review a big idea that will help us recognize if it's even possible to add or subtract. That is, we can only add and subtract "like" things or common units. So, for example, we can add apples and apples and get apples. We can add apples and oranges and get fruit. We can't add apples and trees and get apple trees, right? Like apples grow on trees but we can't count them all up together like they're one group of something. Let's look at some examples.

1 week - 1 day = 6 days
7days - 1day

Here we have 1 week - 1 day. Does anyone think they know what 1 week - 1 day makes? *Let kids raise their hands but don't call anyone or take answers. Just let them think.* If I want to figure this out, I really think to myself that 1 week is 7 days. This is really 7 days - 1 day. That's makes 6 days.

But here's the important part. There is a key question that we're asking ourselves without even realizing it. That question is, "What is the relationship between weeks and days?" In other words, what do weeks and days have to do with each other. Everyone say, "What is the relationship?" That's the key question we are going to ask, "What is the relationship?" In this case, we're thinking, "Weeks AND days are both measures of time." And in this case we changed the problem to days AND days. That "AND" tells me these are like units that I can add or subtract.

weeks and days are both time

1 cat + 1 dog = 2 pets
1 pet + 1 pet

Let's look at this next one. 1 cat + 1 dog. In order to add or subtract these, I might think to myself 2 pets. I really thought of it as 1 cat is 1 pet plus 1 dog is 1 pet.

Now remember, I said there is a key question that we're asking ourselves without even realizing it. The question is, "What is the relationship?" So I think, "What is the relationship between cats and dogs?" I know cats AND dogs are both pets. They are the same unit so I can add and subtract them.

cats and dogs are both pets

1 quarter + 1 dime = 35 cents
25 cents + 10 cents

Let's look at this next one. 1 quarter + 1 dime. In order to add or subtract these, I might think to myself 25 cents + 10 cents is 35 cents.

Again, I had the secret, hidden question in my brain, "What is the relationship?" So I think, "What is the relationship between quarters and dimes?" Quarters AND dimes are both cents. That "AND" word let's me know that they are the same unit so I can add or subtract them. Now let's look at multiplication examples and see how our hidden question works.

quarters and dimes are both money

Let's Talk (Slide 4): Multiplication means putting equal groups together or making equal copies. You learned this in earlier grades. But maybe your teacher didn't spell it out. Because that's what multiplication means, the units we multiply are usually not "like" or the same because one unit is repeating or scaling because of the other. For example, if I have cookies in bags. Cookies and bags aren't the same unit. I don't say cookies AND bags. The cookies go IN the bags. They repeat if I have lots of bags repeating. Let's read these examples.

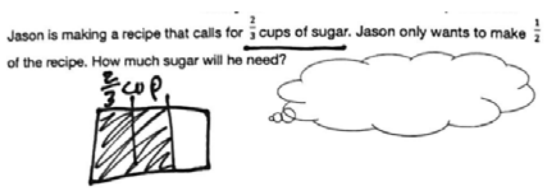
Jen has 3 dogs. They each have 2 bones. How many bones do they have? Do you remember our hidden question? I ask, "What is the relationship?" You say it! "What is the relationship?" Great! So I ask, "What is the relationship between dogs and bones?" Do we think of it as dogs AND bones as in dogs AND bones are both the same thing? NO! We think of dogs WITH bones or the bones are FOR the dogs. We can see this is not addition or subtraction. There is a repeating relationship here because for every dog, we have some bones. For the next dog, we have some bones, and so on.

Jen has 3 dogs. They each have 2 bones. How many bones do they have?

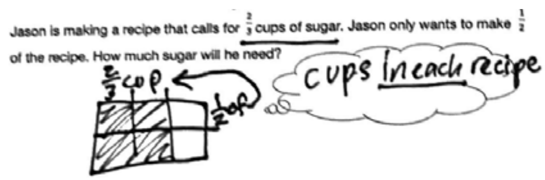
bones for dogs

What about the next one? Lisa reads 4 pages each day. How much did she read in 3 days? Do you remember our hidden question? I ask, "What is the relationship?" You say it! "What is the relationship?" Great! So I ask, "What is the relationship between pages and days?" Do we think of it as pages AND days as in pages AND days are both the same thing? NO! We think of pages ON the days or days OF pages. We can see this is not addition or subtraction. There is a repeating relationship here because for every day, she reads some pages. For the next day, she reads some more pages, and so on.

Let's Think (Slide 5): I have one other tip. When we draw a tape diagram of the problem BEFORE we solve it, then we are more likely to choose the correct operation. That's because to draw the tape diagram, we kind of also ask ourselves, "Well, what does this have to do with that?" or "What is the relationship between this and that?" Let's see. I am going to read the problem and I want you to read along in your head and follow along with your eyes. *Read the problem.*



Now let's draw it. The problem starts with $\frac{2}{3}$ cup of sugar. So I will draw a rectangle and I will cut it into 3 pieces and shade 2 pieces. That's two thirds of a cup of sugar.



The next part of our problem says he only wants to make $\frac{1}{2}$ of a recipe. Before I try to draw the half, I can ask myself that question again, "What is the relationship between cups and the recipe?" Cups are IN the recipe. Cups repeat because of the recipe.

$\frac{1}{2} \times \frac{2}{3} = \frac{2}{6}$

So I am already realizing these aren't like units, which means I can't add or subtract them. Instead, I can think of cut this into parts again FOR the recipe, BECAUSE OF the recipe. I will cut it this way and see I'm taking half of two thirds. That's multiplication! I can see the two sixths here. But I can also write $\frac{2}{3} \times \frac{1}{2} = \frac{2}{6}$.

Let's Try it (Slides 6): Let's practice solving two more word problems together before you try it on your own. You are going to see that these word problems seem really similar but they require different operations to solve. I will help you ask our hidden question.

WARM WELCOME

Today we will solve word problems using fraction and decimal multiplication.

Let's Review: We can add and subtract "like" things or common units.

1 week - 1 day = _____ ____________________

1 cat + 1 dog = _____ ____________________

1 quarter + 1 dime = _____ ____________________

Let's Talk: Multiplication means putting equal groups together or making equal copies.

The units we multiply are usually not "like" or the same because one unit is repeating or scaling because of the other.

Jen has 3 dogs. They each have 2 bones.
How many bones do they have?

Lisa reads 4 pages each day.
How much did she read in 3 days?

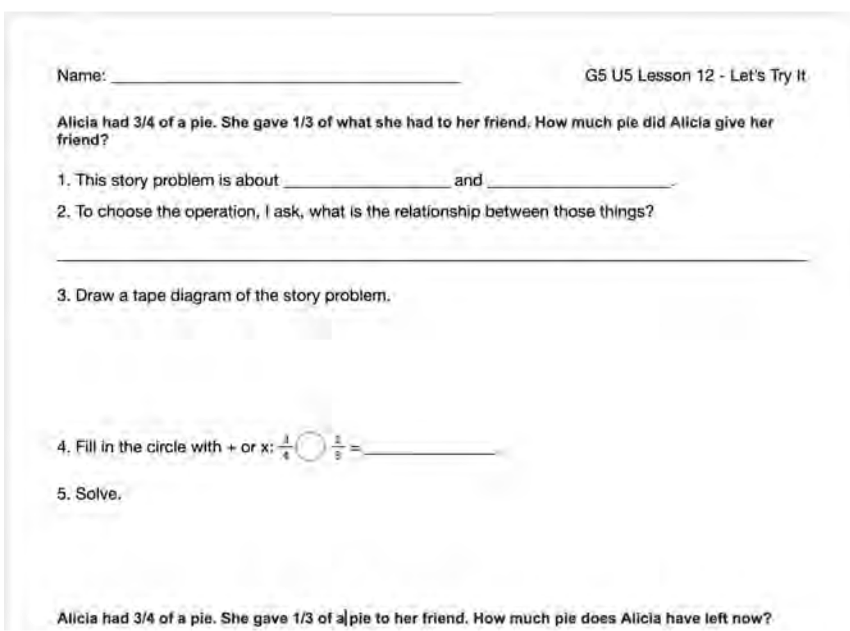
Let's Think:

When we draw a tape diagram of the problem BEFORE we solve it, we are more likely to choose the correct operation.

Jason is making a recipe that calls for $\frac{2}{3}$ cups of sugar. Jason only wants to make $\frac{1}{2}$ of the recipe. How much sugar will he need?

Let's Try It:

Let's practice together.



Name: ______________________ G5 U5 Lesson 12 - Let's Try It

Alicia had 3/4 of a pie. She gave 1/3 of what she had to her friend. How much pie did Alicia give her friend?

1. This story problem is about ______________ and ______________.
2. To choose the operation, I ask, what is the relationship between those things?

____

3. Draw a tape diagram of the story problem.

4. Fill in the circle with + or x: $\frac{3}{4}$ ◯ $\frac{1}{3}$ = ______________

5. Solve.

Alicia had 3/4 of a pie. She gave 1/3 of a pie to her friend. How much pie does Alicia have left now?

On your Own:

Now it's time for you to do it on your own.

Name: ______________________________ G5 U4 Lesson 12 – Independent Work

Remember: Ask yourself, "What is the relationship?"

Draw a tape diagram then show your numbers to solve.

1. A garden hose can fill a 2.5-gallon bucket in a minute. How many gallons of water can the hose fill in 0.75 minutes?	2. Tonia spent $\frac{3}{4}$ of an hour playing basketball. Then she rode for $\frac{2}{3}$ of an hour on her bike. How many hours of exercise did Tonia get?

Alicia had 3/4 of a pie. She gave 1/3 of what she had to her friend. How much pie did Alicia give her friend?

1. This story problem is about ____________________ and ______________________.
2. To choose the operation, I ask, what is the relationship between those things?

____

3. Draw a tape diagram of the story problem.

4. Fill in the circle with + or x: $\frac{3}{4}$ $\frac{1}{3}$ ◯ ______________

5. Solve.

Alicia had 3/4 of a pie. She gave 1/3 of a pie to her friend. How much pie does Alicia have left now?

1. This story problem is about ____________________ and ______________________.
2. To choose the operation, I ask, what is the relationship between those things?

____

3. Draw a tape diagram of the story problem.

4. Fill in the circle with + or x: $\frac{3}{4}$ $\frac{1}{3}$ ◯ ______________

5. Solve.

Name: ______________________________

Remember: Ask yourself, "What is the relationship?"

Draw a tape diagram then show your numbers to solve.

1. A garden hose can fill a 2.5-gallon bucket in a minute. How many gallons of water can the hose fill in 0.75 minutes?	2. Tonia spent $\frac{3}{4}$ of an hour playing basketball. Then she rode for $\frac{2}{3}$ of an hour on her bike. How many hours of exercise did Tonia get?
3. Hannah is planning a road trip and estimates that her car gets 28.5 miles per gallon. If she plans to use 3.4 gallons, how many miles will she drive?	4. Amy has $\frac{2}{3}$ of a pizza left over from lunch. She decides to eat $\frac{1}{2}$ of what's left as a snack. What fraction of the original pizza did Amy eat for her snack?

Show your work.

5. Maria baked a cake. The recipe called for $\frac{2}{3}$ cup of white sugar. Later, Maria read in the recipe that she also needed $\frac{2}{3}$ cup of brown sugar. How much sugar was needed for the recipe?	6. Samantha is doing a science experiment that requires 6.8 grams of salt. She wants to do the experiment three times. How much salt does Samantha need?
7. A chef made a fruit salad with 0.75 pounds of strawberries. Then the chef put in 0.5 pounds of blueberries. How many pounds of berries are in the fruit salad?	8. $\frac{2}{5}$ of Sarah's homework for this weekend is math. So far, Sarah has completed $\frac{9}{10}$ of the math homework. What fraction of the total homework has Sarah completed?

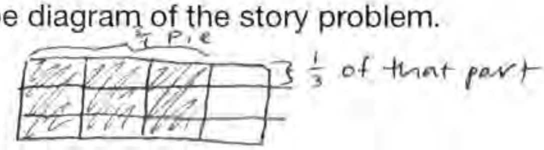
Name: ANSWER KEY

Alicia had 3/4 of a pie. She gave 1/3 of what she had to her friend. How much pie did Alicia give her friend?

1. This story problem is about pie and what she had.
2. To choose the operation, I ask, what is the relationship between those things?

she had part of the pie

3. Draw a tape diagram of the story problem.



4. Fill in the circle with + or x: $\frac{3}{4} \times \frac{1}{3} = \frac{3}{12}$

5. Solve.

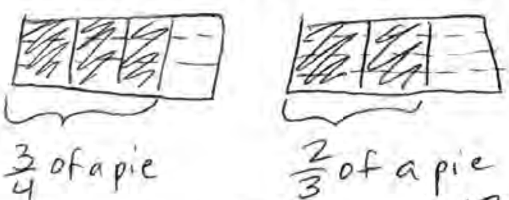
$$\frac{3}{4} \times \frac{1}{3} = \frac{3 \times 1}{4 \times 3} = \frac{3}{12}$$

Alicia had 3/4 of a pie. She gave 1/3 of a pie to her friend. How much pie does Alicia have left now?

1. This story problem is about pie and pie.
2. To choose the operation, I ask, what is the relationship between those things?

pie and pie are both the same

3. Draw a tape diagram of the story problem.



4. Fill in the circle with + or x: $\frac{3}{4} + \frac{1}{3} = \frac{17}{12} = 1\frac{5}{12}$

5. Solve. $\frac{3 \times 3}{4 \times 3} = \frac{9}{12}$ $\quad \frac{2 \times 4}{3 \times 4} = \frac{8}{12}$ $\quad \frac{9}{12} + \frac{8}{12} = \frac{17}{12}$ $\quad 17 \div 12 = 01$, $17 - 12 = 5$

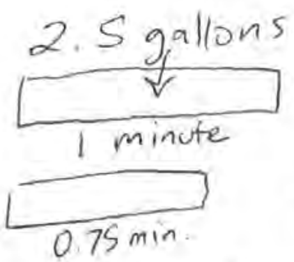
Name: ANSWER KEY

G5 U4 Lesson 12 - Independent Work

Remember: Ask yourself, "What is the relationship?"

Draw a tape diagram then show your numbers to solve.

1. A garden hose can fill a 2.5-gallon bucket in a minute. How many gallons of water can the hose fill in 0.75 minutes?

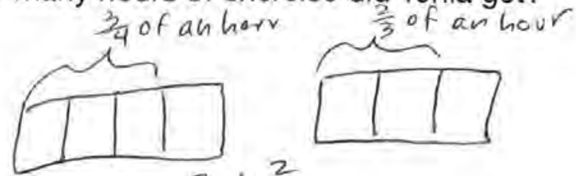


$$\begin{array}{r} 75 \\ \times\ 25 \\ \hline 375 \\ 1500 \\ \hline 1875 \end{array}$$

0.75 of 2.5

$0.75 \times 2.5 = \boxed{1.875 \text{ gallons}}$

2. Tonia spent $\frac{3}{4}$ of an hour playing basketball. Then she rode for $\frac{2}{3}$ of an hour on her bike. How many hours of exercise did Tonia get?



$\frac{3}{4} + \frac{2}{3}$

$\frac{3 \times 3}{4 \times 3} = \frac{9}{12}$

$\frac{2 \times 4}{3 \times 4} = \frac{8}{12}$

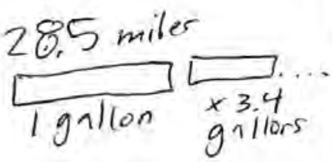
$\frac{9}{12} + \frac{8}{12} = \frac{17}{12}$

$$\begin{array}{r} 01 \\ 12\overline{)17} \\ -12 \\ \hline 5 \end{array}$$

$= \boxed{1\frac{5}{12} \text{ hours}}$

3. Hannah is planning a road trip and estimates that her car gets 28.5 miles per gallon. If she plans to ~~drive 35.5 miles, how many gallons of gas will she need for the trip?~~ use 3.4 gallons how many miles will she drive?

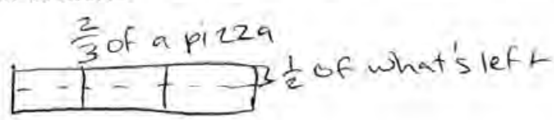
$$\begin{array}{r} 285 \\ \times\ 34 \\ \hline 1140 \\ 8550 \\ \hline 96.90 \end{array}$$



28.5×3.4

$\boxed{96.9 \text{ miles}}$

4. Amy has $\frac{2}{3}$ of a pizza left over from lunch. She decides to eat $\frac{1}{2}$ of what's left as a snack. What fraction of the original pizza did Amy eat for her snack?

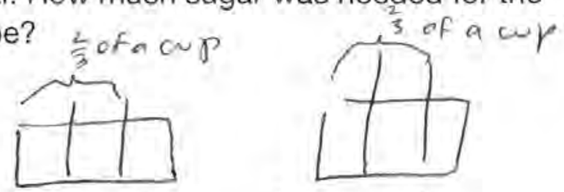


$\frac{1}{2}$ of $\frac{2}{3}$

$\frac{1}{2} \times \frac{2}{3} = \boxed{\frac{2}{6} \text{ of a pizza}}$

Show your work.

5. Maria baked a cake. The recipe called for $\frac{2}{3}$ cup of white sugar. Later, Maria read in the recipe that she also needed $\frac{2}{3}$ cup of brown sugar. How much sugar was needed for the recipe?

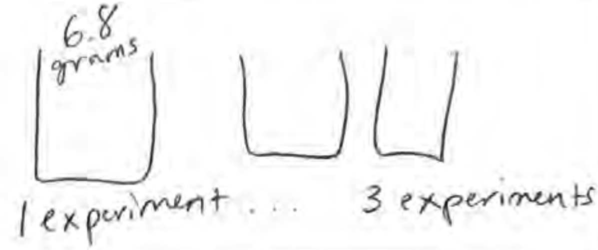


$$\frac{2}{3} + \frac{2}{3} = \frac{4}{3}$$

$$3\overline{)4}$$ = 1, -3, remainder 1

$\boxed{1\frac{1}{3} \text{ cups}}$

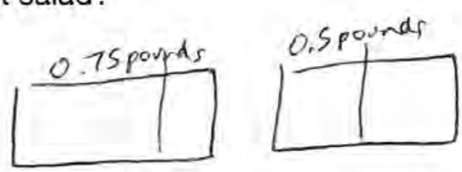
6. Samantha is doing a science experiment that requires 6.8 grams of salt. She wants to do the experiment three times. How much salt does Samantha need?



$6.8 \times 3 = \boxed{20.4 \text{ grams}}$

$$\begin{array}{r} 6.8 \\ \times\ 3 \\ \hline 20.4 \end{array}$$

7. A chef made a fruit salad with 0.75 pounds of strawberries. Then the chef put in 0.5 pounds of blueberries. How many pounds of berries are in the fruit salad?

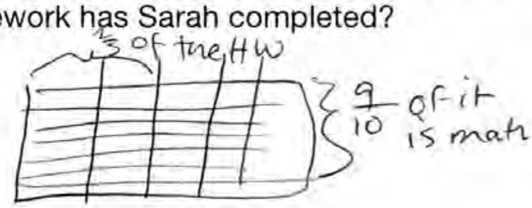


$0.75 + 0.5$

$$\begin{array}{r} 0.75 \\ 0.5 \\ \hline 1.25 \end{array}$$

$\boxed{1.25 \text{ pounds}}$

8. $\frac{2}{5}$ of Sarah's homework for this weekend is math. So far, Sarah has completed $\frac{9}{10}$ of the math homework. What fraction of the total homework has Sarah completed?



$\frac{9}{10}$ of $\frac{2}{5}$

$\frac{9}{10} \times \frac{2}{5} = \frac{18}{50} = \boxed{\frac{9}{25} \text{ of the HW}}$

G5 U4 Lesson 13

Divide a unit fraction by a whole number

CITYTUTOR DC

G1 U4 Lesson 13 - Today we will divide a unit fraction by a whole number.

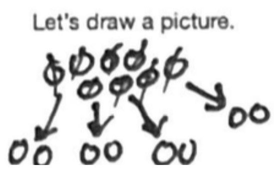
Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): Today we will divide a unit fraction by a whole number. This is big leagues now! We are really getting fancy! Let's try it!

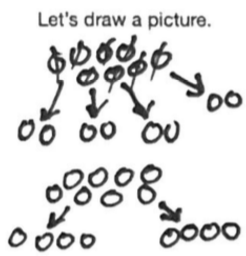
Let's Review (Slide 3): We always want to start with what we already know and build from there. So, let's start by asking, "What is the meaning of division?" What do you know about division? *Get a quick survey of students ideas without writing anything down. This question is simply to get a sense of what students remember.* Possible Student Answers, Key Points:

- Division is repeated subtraction.
- Division is the opposite of multiplication.
- Division means splitting into equal amounts.
- Division means cutting something up.
- Division means fair sharing.

This says, "Solve *8 ÷ 2*." Let's draw a picture. I have 8 things altogether. That first number 8 is the total amount. It is the amount we are going to divide. It is called the dividend. Everyone say, "Dividend!" *The students should say, "Dividend!"*



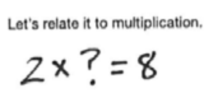
I can always think of division two ways. I can think of it as making groups of 2. Then I would take 2 and take 2 and take 2 and take 2. Look, I made 4 groups!



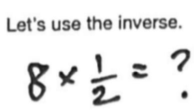
But let me draw another 8 circles. I can ALSO think of this as making two groups. Here and here. There are 4 in each group. This is called "fair sharing." We are going to focus on this meaning today. We can imagine two people coming up to a pile of 8 cookies and saying, "How can we split these fairly?"

Who can help me come up with another story for fair sharing of 8 divided by 2. *Collect a few suggestions. Be sure to tell students if their story isn't quite right with a simple, "That's not exactly right." Highlight one example. You don't have to write it down.* Possible Student Answers, Key Points:

- I have 8 pieces of pizza. I want to split between 2 friends. How many pieces can we each have?
- There are 8 kids. They are going to be put onto two teams. How many kids are on each team?

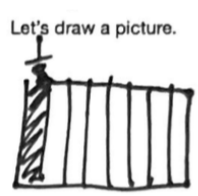


I want to quickly connect this to two other ideas you've learned because it is going to help us with our next lesson when instead of dividing fractions we divide BY fractions. First, division is the opposite of multiplication. So we can think of every division problem like a missing multiplication problem. If I am splitting 8 by 2 groups then I can also think, "Two groups of what makes eight?" I write it like this: 2 times question mark makes 8.

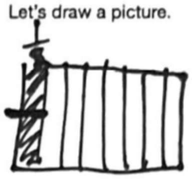


A few lessons ago, we also learned that multiplying by a fraction is like taking a fraction of something. It is the same as dividing. So I could also represent 8 divided by 2 as 8 times ½. We don't need to worry about writing all these numbers out now. But I want you to notice that to divide, we often multiply the opposite which is called the inverse since multiplication and division are opposites.

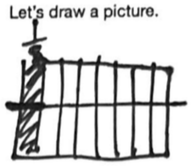
Let's Talk (Slide 4): So let's use all those ideas to divide a fraction. We will use the splitting idea to divide fractions just like we divide whole numbers. This says solve $\frac{1}{8}$ divided by 2.



Let's draw a picture. First, I need to draw a whole split into eighths. I will shade one.

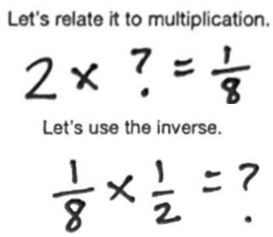


Now I want to split this into 2 groups. Imagine that I want a fair share for 2 people. I have to cut this piece! Each person would get one of these smaller pieces, right?



But in fractions we know that if we cut 1 piece, we have to cut all the pieces so they are the same size. So let me go ahead and cut the rest. Now I can write down the fraction that represents that smaller piece. Each person can get 1 out of 16.

Let's tell a story that would go with this problem. It's just fair sharing but we're sharing a fraction. So we could say, "There is ⅛ of a pan of brownies. Two friends decided to split the brownies evenly. How much do they each get?" And there's lots of different stories like that. *You don't have to write the story down.*



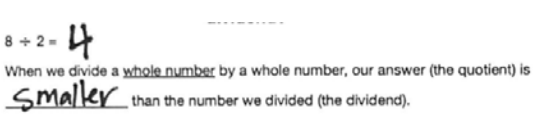
Let's relate this to multiplication. We know this is a missing multiplier. We ask 2 times what makes ⅛. I write it like this. You can see how we would have to multiply 2 times an itty bitty fraction if we just want a small answer like ⅛

And let's relate this to multiplying by the inverse also known as the opposite. Dividing by 2 is like multiplying by one half. Those two people are really splitting the brownies in half. They are talking 1 half of the 1 eighth.

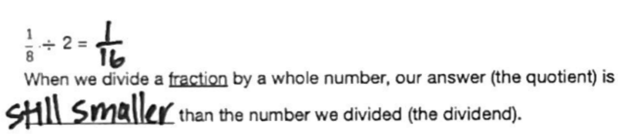
Let's Think (Slide 5): What do we notice about the size of the quotient compared to the size of the dividend? The quotient just means the answer to the division problem. The dividend just means the number we started with in the division problem. It is the number before the division symbol. It is the total amount that we start with before we start splitting or sharing.

In 8 divided by 2, 8 is the dividend. We know we get 4. 4 is the quotient. What do we notice about the size of the quotient? *Point to the answer, 4.* How does it compare to the size of the dividend? *Point to the dividend, 8. Don't let kids call out an answer. Give them time to think.* Possible Student Answers, Key Points:

- 4 is smaller than 8.
- The dividend is bigger than the quotient.
- The answer always gets smaller when we divide.



When we divide a whole number by a whole number, our answer, the quotient, is SMALLER than the number we divided, the dividend. That's because we're splitting it to share, right? And everyone who is sharing is going to get just a piece.



What about one eighth divided by 2? We just did the math on the last slide and got one sixteenth. When we divide a fraction by a whole number, our answer, the quotient, is still always SMALLER than the number we divided, the dividend. That's because we're still splitting it to share! And everyone who is sharing is going to get a piece of a piece.

Let's Try it (Slides 6): Hopefully you are seeing how dividing fractions is just using everything we've already learned. Let's practice a bit together and then you will try it on your own!

WARM WELCOME

Today we will divide a unit fraction by a whole number.

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Let's Review: What is the meaning of division?

Solve. $8 \div 2 = ?$

Let's draw a picture.

Let's tell a story.

Let's relate it to multiplication.

Let's use the inverse.

Let's Talk: We will use the splitting idea to divide fractions just like we divide whole numbers!

Solve. $\frac{1}{8} \div 2 = ?$

Let's draw a picture.

Let's tell a story.

Let's relate it to multiplication.

Let's use the inverse.

Let's Think:

What do we notice about the size of the quotient compared to the size of the dividend?

8 ÷ 2 =

When we divide a <u>whole number</u> by a whole number, our answer (the quotient) is

_________________ than the number we divided (the dividend).

$\frac{1}{8}$ ÷ 2 =

When we divide a <u>fraction</u> by a whole number, our answer (the quotient) is

_________________ than the number we divided (the dividend).

Let's Try It:

Let's practice together.

Name: ________________________________ G5 U5 Lesson 13 - Let's Try It

Cinderella has $\frac{1}{2}$ of a cookie. She wants to split it equally between her 3 adorable mouse friends. How much cookie can she give to each mouse?

1. This problem is really like asking: ______________________________

2. Draw a picture to solve.

3. Represent the problem with numbers.

______ ÷ ______ = ______

4. What do you notice?

____

How many eighths are in 2 whole?

5. Draw a picture to solve.

6. Represent the problem with numbers.

7. What do you notice?

On your Own:

Now it's time for you to do it on your own.

Name: ______________________________ G5 U4 Lesson 13 - Independent Work

Draw a diagram to justify your answer. Then represent it with a number.

1. Feso has a rope that is $\frac{1}{2}$ yard long. She wants to cut it into 3 equal pieces. What fractional amount of a yard can each piece be?	2. How many twos are in $\frac{1}{4}$?
3. Leo had $\frac{1}{4}$ of his cake leftover from his birthday party. He decided to split the cake	4. Solve. 1/[illegible] $\div 5 = ?$

Cinderella has $\frac{1}{2}$ of a cookie. She wants to split it equally between her 3 adorable mouse friends. How much cookie can she give to each mouse?

1. This problem is really like asking: ____

2. Draw a picture to solve.

3. Represent the problem with numbers.

4. What do you notice?

_______ ÷ ________ = ______

____

How many twos are in $\frac{1}{8}$?

5. Draw a picture to solve.

6. Represent the problem with numbers.

7. What do you notice?

_______ ÷ ________ = ______

____

Solve. $3 \div \frac{1}{3} =$

8. Draw a picture to solve.

9. Represent the problem with numbers.

10. What do you notice?

_______ ÷ ________ = ______

____

Name: ____ G5 U4 Lesson 13 - Independent Work

Draw a diagram to justify your answer. Then represent it with a number.

1. Feso has a rope that is $\frac{1}{2}$ yard long. She wants to cut it into 3 equal pieces. What fractional amount of a yard can each piece be?	2. How many twos are in $\frac{1}{4}$?
3. Leo had $\frac{1}{4}$ of his cake leftover from his birthday party. He decided to split the cake between his two brothers. How much cake with they each get?	4. Solve. $\frac{1}{3} \div 5 = ?$

Draw a diagram to justify your answer. Then represent it with a number.

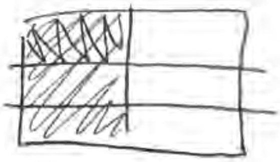
5. Sweeney's Candy Shop sells $\frac{1}{2}$ pound of candy in a box. Lisa split the box of candy between herself and two friends. How much candy does each friend get?	6. How many threes are in $\frac{1}{2}$?
7. Old MacDonald had a $\frac{1}{3}$ acre garden. He decided to plant an equal area of three different kinds of vegetables. What is the fractional number of acres he can plant with each different vegetable?	8. Solve. $\frac{1}{3} \div 6 = ?$

Name: ANSWER KEY

Cinderella has $\frac{1}{2}$ of a cookie. She wants to split it equally between her 3 adorable mouse friends. How much cookie can she give to each mouse?

1. This problem is really like asking: $\frac{1}{2}$ shared by 3

2. Draw a picture to solve.



3. Represent the problem with numbers.

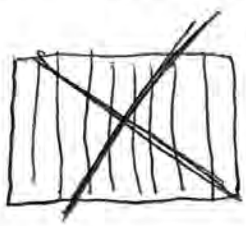
$\frac{1}{2} \div 3 = \frac{1}{6}$

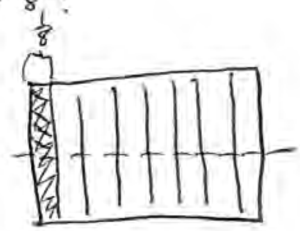
4. What do you notice? Its like $\frac{1}{2} \times \frac{1}{3} = \frac{1}{6}$

My answer is smaller.

How many ~~eighths are in 2 wholes?~~ twos are in $\frac{1}{8}$?

5. Draw a picture to solve.





6. Represent the problem with numbers.

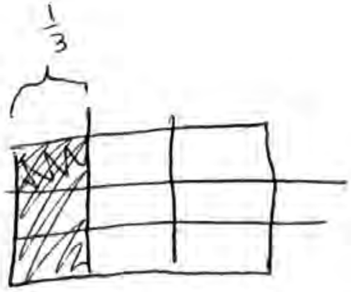
$\frac{1}{8} \div 2 = \frac{1}{16}$

7. What do you notice? Its like $\frac{1}{8} \times \frac{1}{2} = \frac{1}{16}$

My answer is smaller.

Solve. $\frac{1}{3} \div 3 =$

8. Draw a picture to solve.



9. Represent the problem with numbers.

$\frac{1}{3} \div 3 = \frac{1}{9}$

10. What do you notice? Its like $\frac{1}{3} \times \frac{1}{3} = \frac{1}{9}$

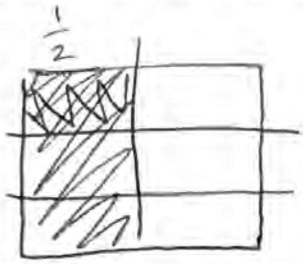
My answer is smaller.

Name: ANSWER KEY

G5 U4 Lesson 13 - Independent Work

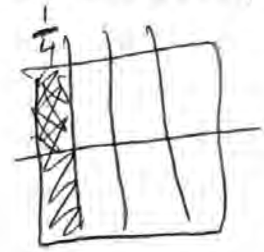
Draw a diagram to justify your answer. Then represent it with a number.

1. Feso has a rope that is $\frac{1}{2}$ yard long. She wants to cut it into 3 equal pieces. What fractional amount of a yard can each piece be?



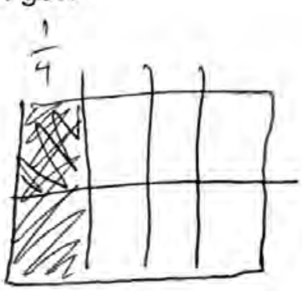
$\frac{1}{2} \div 3 = \boxed{\frac{1}{6} \text{ yard}}$

2. How many twos are in $\frac{1}{4}$?



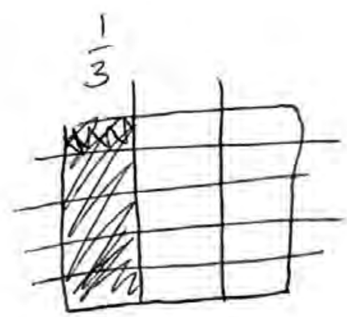
$\frac{1}{4} \div 2 = \boxed{\frac{1}{8}}$

3. Leo had $\frac{1}{4}$ of his cake leftover from his birthday party. He decided to split the cake between his two brothers. How much cake with they each get?



$\frac{1}{4} \div 2 = \boxed{\frac{1}{8} \text{ cake}}$

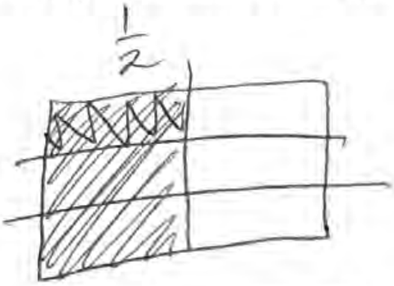
4. Solve. $\frac{1}{3} \div 5 = ?$



$\frac{1}{3} \div 5 = \boxed{\frac{1}{15}}$

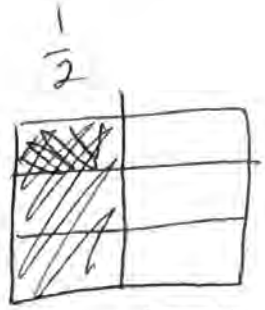
Draw a diagram to justify your answer. Then represent it with a number.

5. Sweeney's Candy Shop sells $\frac{1}{2}$ pound of candy in a box. Lisa split the box of candy between herself and two friends. How much candy does each friend get?



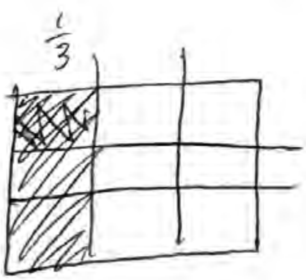
$\frac{1}{2} \div 3 = \boxed{\frac{1}{6}\text{ pound}}$

6. How many threes are in $\frac{1}{2}$?



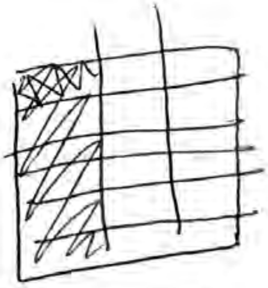
$\frac{1}{2} \div 3 = \boxed{\frac{1}{6}}$

7. Old MacDonald had a $\frac{1}{3}$ acre garden. He decided to plant an equal area of three different kinds of vegetables. What is the fractional number of acres he can plant with each different vegetable?



$\frac{1}{3} \div 3 = \boxed{\frac{1}{9}\text{ acre}}$

8. Solve. $\frac{1}{3} \div 6 = ?$



$\frac{1}{3} \div 6 = \boxed{\frac{1}{18}}$

G5 U4 Lesson 14

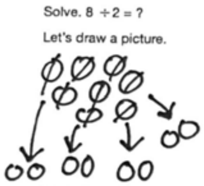
Divide a whole number by a unit fraction

G1 U4 Lesson 14 - Today we will divide a whole number by a unit fraction.

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): Today we will divide a whole number by a unit fraction.

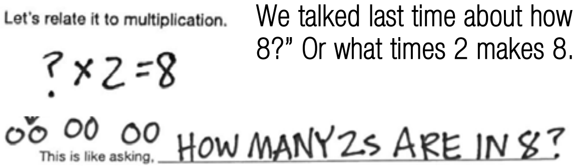
Let's Review (Slide 3): In our last lesson, we reviewed what we learned about division in earlier grades and we really focused on fair sharing. We can think of division as splitting 8 into 2 groups. But we can also think of it as splitting 8 into groups of 2.



Let's draw a picture. I am going to draw 8 circles. Now I will make a group of 2 and another group of 2 and another group of 2 and another group of 2. Let's count how many groups I made. 1 group, 2 groups, 3 groups, 4 groups! I made 4 groups.

Who can think of a story that would make sense with this picture? *Collect a few suggestions. Be sure to tell students if their story isn't quite right with a simple, "That's not exactly right." Do not accept stories where students switch to an 8 divided by 4 story. Do not accept answers where students switch the story to 8 divided by 2 groups. Choose one example to highlight; you don't have to write it down.* Possible Student Answers, Key Points:

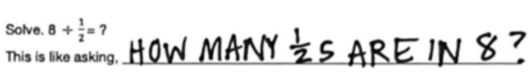
- I have 8 pieces of pizza. I want to give 2 pieces to each of my friends. How many friends can I give pizza to?
- There are 8 kids. Mrs. Brown wants to have 2 kids on each team. How many teams will she have?



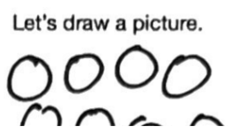
We talked last time about how to relate this to multiplication. We are really asking, "how many groups of 2 make 8?" Or what times 2 makes 8.

This is the key thing we need to keep in mind for the rest of the lesson though. This is like asking, "how many twos are in eight wholes?"

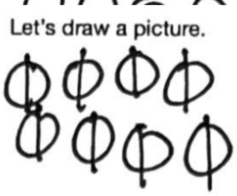
Let's Talk (Slide 4): We can use the question, "how many times is blank inside blank" to divide. This time we're not dividing a fraction. We're dividing BY a fraction.



This says, "solve 8 divided by 1 half." This is like we are making groups of 1 half can we make. Or "how many times is ½ inside 8?"

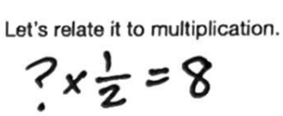


To figure that out, I am going to have to cut my 8 into halves. Am I going to get A LOT of pieces or a little bit of pieces? A lot! Let me draw 8 circles.



I want to know how many halves are in these 8. So I have to cut them in half. Watch me. Wow, I'm getting a lot! There are 2 in this circle and 2 in this circle and 2 in this circle and 2 in this circle and 2 in this circle and 2 in this circle and 2 in this circle and 2 in this circle. Let's count how many halves we made! 1 - 2 - 3 - 4 - 5 - 6 - 7 - 8 - 9 - 10 - 11 - 12 - 13 - 14 - 15 - 16!

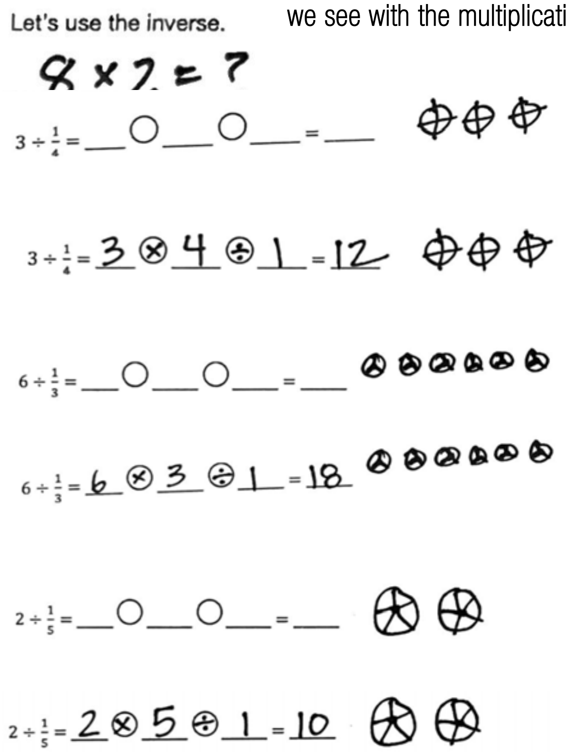
Let's tell a story. It could be something like this: I have 8 cookies. I want to give half a cookie to each of my friends. How many friends can I give cookies to? I can give a cookie to 16 friends! *You don't have to write this down.*



If we relate this to multiplication, remember we are saying, "how many times is 1 half in 8?" Then we can write question mark times ½ equals 8. This question mark would have to be super big to get ½ all the way up to 8, right?

But the inverse is where things get really important and interesting and this is where I really want you to think. We ended up getting 16. So really we ended up multiplying 8 x 2. We ended up multiplying by the denominator. You see, it turns out that dividing by a number that is already a cutting number, already a divisor means the opposite of dividing - multiplying. We end up with lots of pieces inside each piece - multiple pieces. Just like when we multiplied by a fraction, we divided by the denominator. When we divide by a fraction, we end up multiplying by the denominator. This is called doing the multiplicative inverse. In other words, doing the opposite operation with the opposite fraction.

Let's Talk (Slide 5): Let's talk about this opposite operation thing a little more. We can represent the pattern we see with the multiplicative inverse.



I will do a quick sketch so we can remember what is happening. I have 3 so I will draw 3 circles. And I want to know how many fourths are inside so I have to turn them into fourths. So many fourths are inside! Groups of fourths.

In fact, there are 3 groups of 4 fourths. That's 3 times the denominator of 4. And in this case, we would divide by the numerator. But that's just 1 so nothing really happens there. My answer is 12.

Let's look at the next one. 6 circles are needed here and I'm wondering how many thirds are in 6. Let me cut these into thirds. So many thirds!

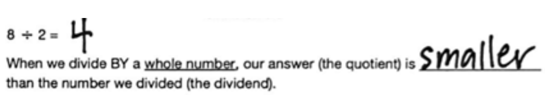
In fact, there are 6 groups of 3 thirds. That's 6 times the denominator of 3. And in this case, we would divide by the numerator. But that's just 1 so nothing really happens there. My answer is 18.

Let's look at the next one. 2 circles are needed here and I'm wondering how many fifths are in 2. Let me cut these into fifths. So many fifths!

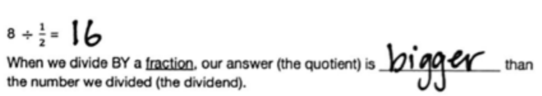
In fact, there are 2 groups of 5 fifths. That's 2 times the denominator of 5. And in this case, we would divide by the numerator. But that's just 1 so nothing really happens there. My answer is 10.

Let's Think (Slide 6): There's one other thing that is super important to think about. We answer this question in our last lesson. That is, "What do we notice about the size of the quotient compared to the size of the dividend?" Remember our quotient is the answer to a division problem. And our dividend is the number we are dividing; it is the number before the division symbol. Is it the total amount that we start with before we divide.

We have 8 divided by 2 and we know the answer is 4. That's smaller. So when we divided by a whole number, our answer, the quotient, is SMALLER than the number we divided, the dividend. That makes sense because we are splitting something. That's what we're used to. Usually when you split something, it gets smaller.



But look out for this. We did 8 divided by half on a previous slide and we got 16! ALERT! ALERT! Our division answer got bigger! Wow! This is a surprise! When we divide by a fraction, the quotient is BIGGER than the number we divided, the dividend. We always have to wonder, "Why does this make sense?" It makes sense because we are dividing by pieces not whole amount. When you split something by something that has already been split, you get lots and lots of splits! You get a big amount. Your answer is more.



Let's Try it (Slides 7): You will see a bigger answer in every problem we do today because we are always going to divide by a fraction. Let's practice together!

WARM WELCOME

Today we will divide a whole number by a unit fraction.

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Let's Review:

We can think of division as splitting 8 into 2 groups. But we can also think of it as splitting 8 into groups of 2.

Solve. $8 \div 2 = ?$

Let's draw a picture. Let's tell a story. Let's relate it to multiplication.

This is like asking, ____.

Let's Talk:

We can use the question, "how many times is __ inside __" to divide.

Solve. $8 \div \frac{1}{2} = ?$

This is like asking, ____.

Let's draw a picture. Let's tell a story. Let's relate it to multiplication.

Let's use the inverse.

Let's Talk: We can represent the pattern we see with the multiplicative inverse.

$3 \div \frac{1}{4} =$ ____ ◯ _____ ◯ _____ = _____

$6 \div \frac{1}{3} =$ ____ ◯ _____ ◯ _____ = _____

$2 \div \frac{1}{5} =$ ____ ◯ _____ ◯ _____ = _____

Let's Think: What do we notice about the size of the quotient compared to the size of the dividend?

$8 \div 2 =$

When we divide BY a whole number, our answer (the quotient) is _______________ than the number we divided (the dividend).

$8 \div \frac{1}{2} =$

When we divide BY a fraction, our answer (the quotient) is _______________ than the number we divided (the dividend).

Let's Try It: Let's practice together.

Name: ______________________________ G5 U5 Lesson 13 - Let's Try It

Sammy has 5 dollars. He is going to spend $\frac{1}{2}$ dollar on a lollipop. How many lollipops can he buy if he spends all his money?

1. This problem is really like asking: ____

2. Draw a picture to solve.

3. Represent the problem with numbers.

_____ ÷ ______ = _____ x _____ ÷ ______ = ______

How many eighths are in 2 whole?

4. Draw a picture to solve.

On your Own: Now it's time for you to do it on your own.

Name: ______________________________ G5 U4 Lesson 14 - Independent Work

Draw a diagram to justify your answer. Then represent it with numbers.

1. John has 3 subs for the meeting. He wants to give $\frac{1}{2}$ sub to each person at the meeting. How many people can he serve? _____ ÷ ______ = _____ x _____ ÷ ______ = ______	2. How many thirds are in 4 wholes? _____ ÷ ______ = _____ x _____ ÷ ______ = ______
3. Maria cuts the pies that she sells at her shop into $\frac{1}{8}$ size pieces. Today she has 3 pies. How	4. Solve. $5 \div \frac{1}{4} = ?$

Sammy has 5 dollars. He is going to spend $\frac{1}{2}$ dollar on a lollipop. How many lollipops can he buy if he spends all his money?

1. This problem is really like asking: ____

2. Draw a picture to solve.

3. Represent the problem with numbers.

_______ ÷ ________ = ______ x ______ ÷ _______ = _______

How many eighths are in 2 wholes?

4. Draw a picture to solve.

5. Represent the problem with numbers.

_______ ÷ ________ = ______ x ______ ÷ _______ = _______

Solve. $3 \div \frac{1}{3} =$

6. Draw a picture to solve.

7. Represent the problem with numbers.

_______ ÷ ________ = ______ x ______ ÷ _______ = _______

Draw a diagram to justify your answer. Then represent it with numbers.

1. John has 3 subs for the meeting. He wants to give $\frac{1}{2}$ sub to each person at the meeting. How many people can he serve? ______ ÷ ______ = ______ x ______ ÷ ______ = ______	2. How many thirds are in 4 wholes? ______ ÷ ______ = ______ x ______ ÷ ______ = ______
3. Maria cuts the pies that she sells at her shop into $\frac{1}{8}$ size pieces. Today she has 3 pies. How many pieces of pie does she have to sell? ______ ÷ ______ = ______ x ______ ÷ ______ = ______	4. Solve. $5 \div \frac{1}{4} = ?$ ______ ÷ ______ = ______ x ______ ÷ ______ = ______

Draw a diagram to justify your answer. Then represent it with a number.

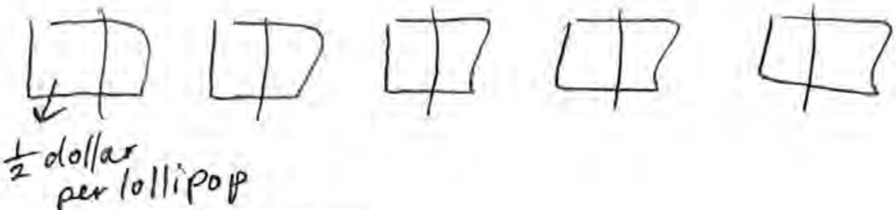
5. Pedro is going to cut a 6 foot rope into $\frac{1}{5}$ foot pieces. How many pieces can he make? ________ ÷ _________ = _______ x _______ ÷ ________ = ________	6. How many eighths are in 2 wholes? ________ ÷ _________ = _______ x _______ ÷ ________ = ________
7. Travis has 3 Liters of soda. He wants to pour it into $\frac{1}{4}$ Liter bottles. How many bottles can he fill? ________ ÷ _________ = _______ x _______ ÷ ________ = ________	8. Solve. $6 \div \frac{1}{3} = ?$ ________ ÷ _________ = _______ x _______ ÷ ________ = ________

Name: ANSWER KEY

Sammy has 5 dollars. He is going to spend $\frac{1}{2}$ dollar on a lollipop. How many lollipops can he buy if he spends all his money?

1. This problem is really like asking: How many halves are in 5?

2. Draw a picture to solve.

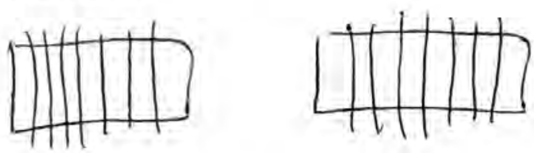


3. Represent the problem with numbers.

$5 \div \frac{1}{2} = 5 \times 2 \div 1 = 10$

How many eighths are in 2 wholes?

4. Draw a picture to solve.

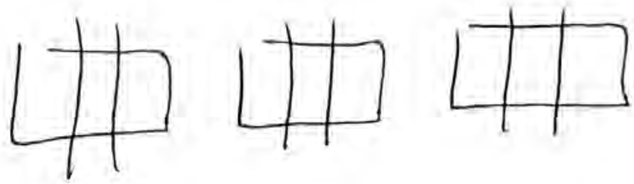


5. Represent the problem with numbers.

$2 \div \frac{1}{8} = 2 \times 8 \div 1 = 16$

Solve. $3 \div \frac{1}{3} =$

6. Draw a picture to solve.



7. Represent the problem with numbers.

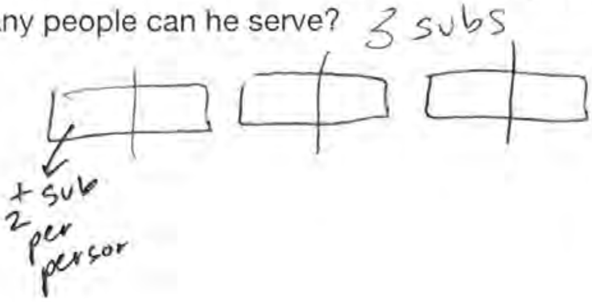
$3 \div \frac{1}{3} = 3 \times 3 \div 1 = 9$

Name: ANSWER KEY

G5 U4 Lesson 14 - Independent Work

Draw a diagram to justify your answer. Then represent it with numbers.

1. John has 3 subs for the meeting. He wants to give $\frac{1}{2}$ sub to each person at the meeting. How many people can he serve?



$3 \div \frac{1}{2} = 6$

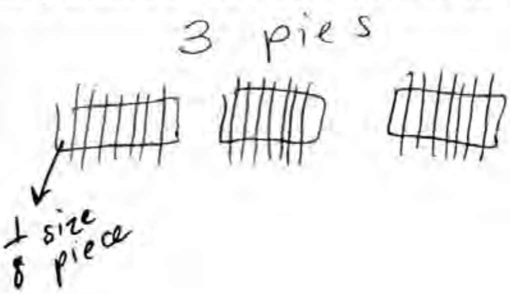
$3 \times 2 \div 1 = 6$

2. How many thirds are in 4 wholes?

$4 \div \frac{1}{3} = 12$

$4 \times 3 \div 1 = 12$

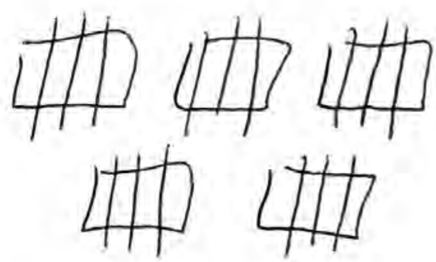
3. Maria cuts the pies that she sells at her shop into $\frac{1}{8}$ size pieces. Today she has 3 pies. How many pieces of pie does she have to sell?



$3 \div \frac{1}{8} = 24$

$3 \times 8 \div 1 = 24$

4. Solve. $5 \div \frac{1}{4} = ?$



$5 \div \frac{1}{4} = 20$

$5 \times 4 \div 1 = 20$

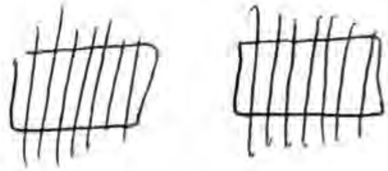
Draw a diagram to justify your answer. Then represent it with a number.

5. Pedro is going to cut a 6 foot rope into $\frac{1}{5}$ foot pieces. How many pieces can he make?

$6 \div \frac{1}{5} = 30$

$6 \times 5 \div 1 = 30$

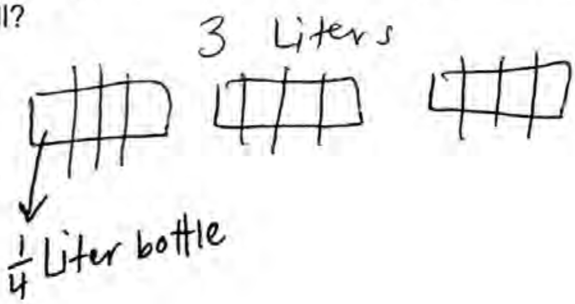
6. How many eighths are in 2 wholes?



$2 \div \frac{1}{8} = 16$

$2 \times 8 \div 1 = 16$

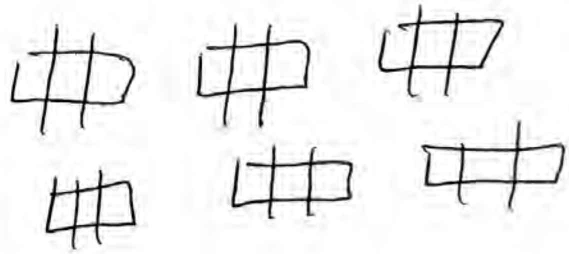
7. Travis has 3 Liters of soda. He wants to pour it into $\frac{1}{4}$ Liter bottles. How many bottles can he fill?



$3 \div \frac{1}{4} = 12$

$3 \times 4 \div 1 = 12$

8. Solve. $6 \div \frac{1}{3} = ?$



$6 \div \frac{1}{3} = 18$

$6 \times 3 \div 1 = 18$

G5 U4 Lesson 15

Solve problems involving fraction division

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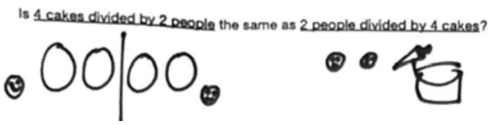
G1 U4 Lesson 15 - Today we will solve problems involving fraction division.

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): Today we will solve problems involving fraction division. We're not really learning anything new today. This is just putting together what we learned from the last two lessons.

Let's Review (Slide 3): When we are doing fractions divided by whole numbers AND whole numbers divided by fractions, it is helpful to review one basic idea that you probably started learning in 3rd grade: Division is NOT commutative. That means you cannot switch the order and get the same answer. You can switch the order is addition like 1 cat plus 2 dogs is the same as 2 dogs plus 1 cat. But you can't do that in division.



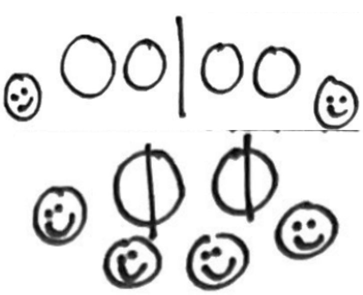
- You can't share people between cakes.

Let's explore. This says, Is 4 cakes divided by 2 people the same as 2 people divided by 4 cakes? I hope you think this is a little silly. Why is it so silly?

Possible Student Answers, Key Points:

- Cakes can't divide people.

Write a big NO. Draw a very silly little picture of a cake with a serving knife. These are not the same! How silly! Cakes can be divided by people but people can't be divided by cakes. So we can pay close attention to the words and make sure we know what is being divided by what.

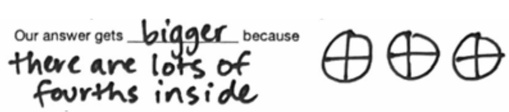


Now, is 4 cakes divided by 2 people the same as 2 cakes divided by 4 people? Here we have cakes shared by people and we just switch the order of the number. Let's imagine this with a picture. I have 4 cakes and I have two people. That would be nice! They can each get 2 cakes!

Let's imagine 2 cakes and 4 people though. Uh-oh! Look what has to happen. There isn't enough for everyone to have their own cake, is there? We'd have to cut these cakes and each person would just get a fraction. So we can't just put the words in any order we want and we can't just put the numbers in any order we want. We have to do in the order that actually matches the story being told in the problem. This is the big idea so I'm going to say it again, "we have to put the numbers in the order that matches the story being told in the problem." And just so you know, sometimes the problem might tell the story out of order so I really have to think.

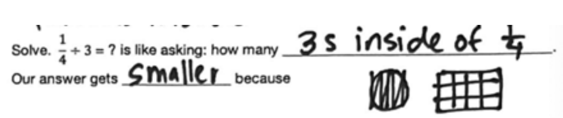
Let's Talk (Slide 4): Now let's see how two problems in a different order will get different answer by thinking of them as "how many times" problems. In our class, we learned to turn each division problem into a missing multiplier question.

This says, "Solve three divided by one fourth." That is like asking: how many times is one fourth inside 3?



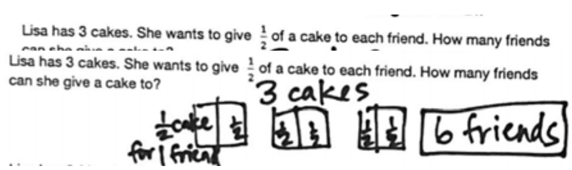
Our answer gets BIGGER because a little fraction is in our whole number lots of times. I can draw it.

But this says, "Solve one fourth divided by three." That is like asking: how many times is three inside one fourth? Three is big compare to one fourth! It isn't in there any times at all. It's too big. That's why our answer gets SMALLER because our whole number is barely in there at all. I have to split these fourths even smaller and I see I get a small answer. That will help us as we go. If I divide by a fraction, I should get the opposite of what we'd expect - a BIGGER answer. If I divide by a whole number, I should get what I usually get with division - a SMALLER answer.



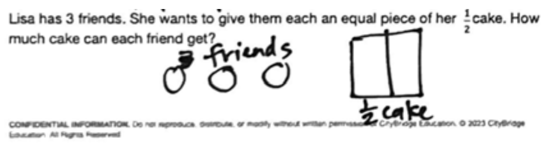
Let's Think (Slide 5): There's one final thing that can help us today. We have to use a tape diagram WITH WORDS to understand what is happening before we do the math. We have to have words because we want to think about what is getting split by what or what we are looking for inside what.

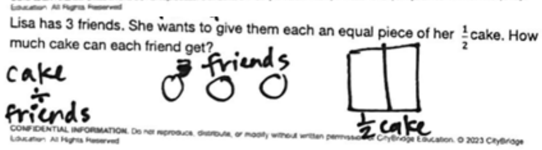
Let’s try. Put your eyes on the words and read in your head while I read. *Read the first problem.* I will start by drawing 3 cakes. Let me write “3 cakes.”



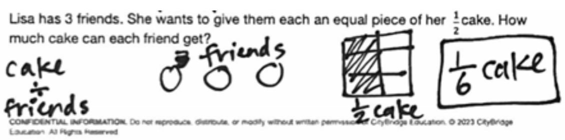
Now, Lisa wants to give half of a cake to each friend. Let me turn these into half. I will label the first one. ½ cake for 1 friend. The next one is ½ cake for 1 friend. And it would keep going. There are 6 halves for 6 friends. I am really asking, how many halves are in 3 so that is 3 divided by half, which is the same as 3 times 2 divided by 1. My answer is 6 friends.

Let’s do the next one. Put your eyes on the words and read in your head while I read. *Read the second problem.* Lisa has 3 friends. I will draw 3 circles and label it 3 friends. Now, the minute I write 3 friends, I already have a thought. I am not going to cut up the friends. They are people. If I cut them up, they will die! Let’s draw the next piece. She wants to give them each an equal piece of her half cake. I am going to draw the half cake.





I start to see. I am sharing the cake with the friends. Let’s write that down. Cake divided by friends. That’s 1 half divided by 3.



Before I get an answer, let me draw it. I have to cut this half up for my friends. And to see what fraction that really is I’ll cut the other side. These pieces are small. And they are still pieces. They are fractions. My answer is 1 sixth. 1 half divided by 3 is 1 sixth.

Let’s Try it (Slides 6): Let’s create a comparison chart together and then you will be able to try some of these problems on your own.

WARM WELCOME

Today we will solve problems involving fraction division.

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Let's Review:

Division is NOT commutative. You cannot switch the order and get the same answer.

Is <u>4 cakes divided by 2 people</u> the same as <u>2 people divided by 4 cakes</u>?

Is <u>4 cakes divided by 2 people</u> the same as <u>2 cakes divided by 4 people</u>?

Let's Talk:

In our class, we learned to turn each division problem into a missing multiplier question.

Solve. $3 \div \frac{1}{4} = ?$ is like asking: how many ________________________________.

Our answer gets ______________ because

Solve. $\frac{1}{4} \div 3 = ?$ is like asking: how many ________________________________.

Our answer gets ______________ because

Let's Think:

We have to use a tape diagram WITH WORDS to understand what is happening before we start doing the math.

Lisa has 3 cakes. She wants to give $\frac{1}{2}$ of a cake to each friend. How many friends can she give a cake to?

Lisa has 3 friends. She wants to give them each an equal piece of her $\frac{1}{2}$ cake. How much cake can each friend get?

Let's Review:

Division is NOT commutative. You cannot switch the order and get the same answer.

Is <u>4 cakes divided by 2 people</u> the same as <u>2 people divided by 4 cakes</u>?

Is <u>4 cakes divided by 2 people</u> the same as <u>2 cakes divided by 4 people</u>?

Let's Talk:

In our class, we learned to turn each division problem into a missing multiplier question.

Solve. $3 \div \frac{1}{4} = ?$ is like asking: how many ________________________________.

Our answer gets _____________ because

Solve. $\frac{1}{4} \div 3 = ?$ is like asking: how many ________________________________.

Our answer gets _____________ because

Let's Think:

We have to use a tape diagram WITH WORDS to understand what is happening before we start doing the math.

Lisa has 3 cakes. She wants to give $\frac{1}{2}$ of a cake to each friend. How many friends can she give a cake to?

Lisa has 3 friends. She wants to give them each an equal piece of her $\frac{1}{2}$ cake. How much cake can each friend get?

Let's Try It: Let's practice together.

Name: ______________________________ G5 U5 Lesson 15 - Let's Try It

Compare and contrast the two ways we have seen fractions in division.

$\frac{1}{3} \div 5$	$5 \div \frac{1}{3}$
What kind of story helps us understand this?	What kind of story helps us understand this?
Draw a picture:	Draw a picture:

On your Own: Now it's time for you to do it on your own.

Name: ______________________________ G5 U4 Lesson 15 - Independent Work

Draw a diagram to justify your answer. Then represent it with a number.

1. Sunny Elementary School is having a 4 mile relay race. Each team must have a different person run each $\frac{1}{2}$ mile. How many people are needed for a team?	2. How many $\frac{1}{5}$ are in 4?
3. Niklas has $\frac{1}{2}$ of a pizza. He wants to eat an equal amount for the three meals in a day -	4. Solve. $\frac{1}{8} \div 3 = ?$

Compare and contrast the two ways we have seen fractions in division.

$\frac{1}{3} \div 5$	$5 \div \frac{1}{3}$
What kind of story helps us understand this?	What kind of story helps us understand this?
Draw a picture:	Draw a picture:
Represent with numbers:	Represent with numbers:
How does the size of the quotient compare to the size of the dividend?	How does the size of the quotient compare to the size of the dividend?

Name: ____

Draw a diagram to justify your answer. Then represent it with a number.

1. Sunny Elementary School is having a 4 mile relay race. Each team must have a different person run each $\frac{1}{2}$ mile. How many people are needed for a team?	2. How many $\frac{1}{5}$ are in 4?
3. Niklas has $\frac{1}{2}$ of a pizza. He wants to eat an equal amount for the three meals in a day - breakfast, lunch and dinner. How much pizza can he eat for each meal?	4. Solve. $\frac{1}{4} \div 3 = ?$

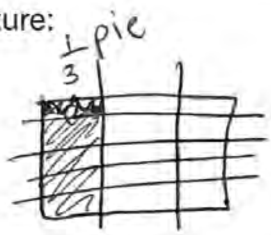
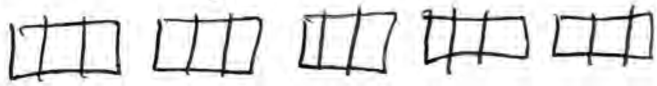
Draw a diagram to justify your answer. Then represent it with a number.

5. Jesse made a batch of 6 cupcakes. The batch used $\frac{1}{2}$ cup of sugar. How much sugar was in each batch?	6. How many threes are in $\frac{1}{4}$?
7. Wendell has 2 pounds of seed that he wants to spread across the rows in his garden. If he spreads $\frac{1}{4}$ pound across each row, how many rows can he plant?	8. Solve. $5 \div \frac{1}{2} = ?$

Name: ANSWER KEY

G5 U4 Lesson 15 - Let's Try It

Compare and contrast the two ways we have seen fractions in division.

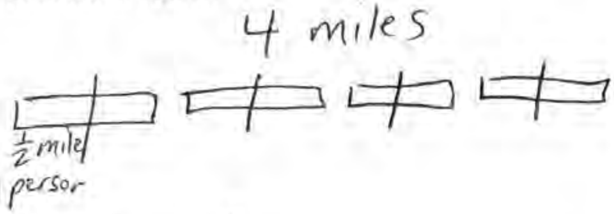
$\frac{1}{3} \div 5$	$5 \div \frac{1}{3}$
What kind of story helps us understand this? I have $\frac{1}{3}$ pie shared by 5 people. How much pie can each person get?	What kind of story helps us understand this? I have 5 pies. I cut each one into thirds. How many $\frac{1}{3}$ pieces do I have?
Draw a picture:  $\frac{1}{15}$	Draw a picture: 5 pies  15
Represent with numbers: $\frac{1}{3} \div 5 = \frac{1}{3} \times \frac{1}{5} = \frac{1}{15}$	Represent with numbers: $5 \div \frac{1}{3} = 5 \times 3 \div 1 = 15$
How does the size of the quotient compare to the size of the dividend? The quotient is SMALLER	How does the size of the quotient compare to the size of the dividend? The quotient is BIGGER

Name: ANSWER KEY

G5 U4 Lesson 15 - Independent Work

Draw a diagram to justify your answer. Then represent it with a number.

1. Sunny Elementary School is having a 4 mile relay race. Each team must have a different person run each $\frac{1}{2}$ mile. How many people are needed for a team?



$4 \div \frac{1}{2} = 8$

$4 \times 2 \div 1 = 8$

$\boxed{8 \text{ people}}$

2. How many $\frac{1}{5}$ are in 4?

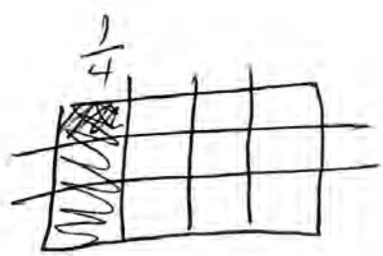
$4 \div \frac{1}{5} = 20$

$4 \times 5 \div 1 = \boxed{20}$

3. Niklas has $\frac{1}{2}$ of a pizza. He wants to eat an equal amount for the three meals in a day - breakfast, lunch and dinner. How much pizza can he eat for each meal?

$\boxed{\frac{1}{6} \text{ pizza per meal}}$

4. Solve. $\frac{1}{4} \div 3 = ?$

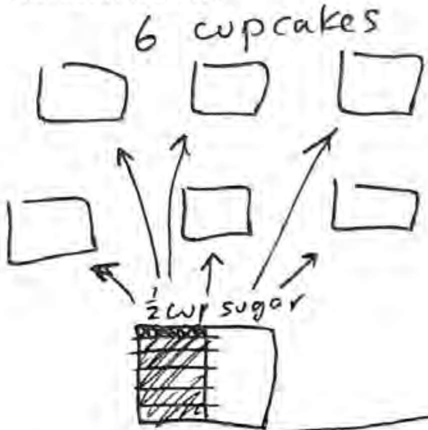


$\frac{1}{4} \div 3 = \frac{1}{12}$

$\frac{1}{4} \times \frac{1}{3} = \boxed{\frac{1}{12}}$

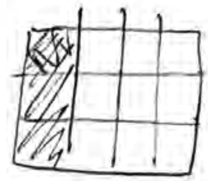
Draw a diagram to justify your answer. Then represent it with a number.

5. Jesse made a batch of 6 cupcakes. The batch used $\frac{1}{2}$ cup of sugar. How much sugar was in each batch?



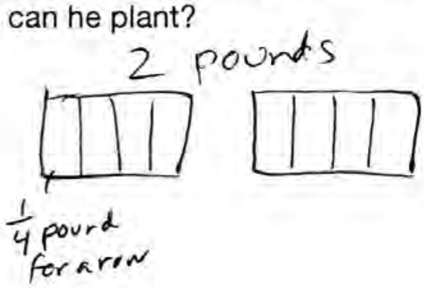
$\frac{1}{2} \div 6 = \boxed{\frac{1}{12} \text{ cup of sugar}}$

6. How many threes are in $\frac{1}{4}$?



$\frac{1}{4} \div 3 = \boxed{\frac{1}{12}}$

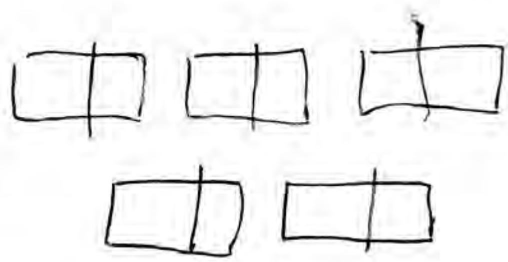
7. Wendell has 2 pounds of seed that he wants to spread across the rows in his garden. If he spreads $\frac{1}{4}$ pound across each row, how many rows can he plant?



$2 \div \frac{1}{4} = 8$

$2 \times 4 \div 1 = \boxed{8 \text{ rows}}$

8. Solve. $5 \div \frac{1}{2} = ?$



$5 \div \frac{1}{2} = 10$

$5 \times 2 \div 1 = \boxed{10}$

G5 U4 Lesson 16

Divide by 1 tenth and 1 hundredth as a fraction and decimal

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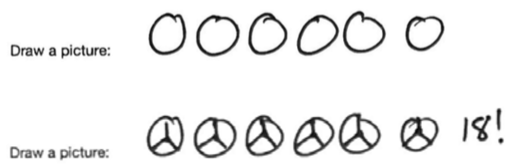
G1 U4 Lesson 16 - Today we will divide by 1 tenth and 1 hundredth as a fraction and decimal.

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): Today we will divide by 1 tenth and 1 hundredth as a fraction and decimal. We are going to use what we learned about dividing by fractions, of course! Let's go!

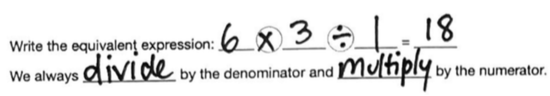
Let's Review (Slide 3): We learned to divide by a fraction using the multiplicative inverse, which means the opposite operation times the opposite thing. Let's review what I mean with this problem. It says, "Solve 6 divided by one third." First, let's draw a picture.



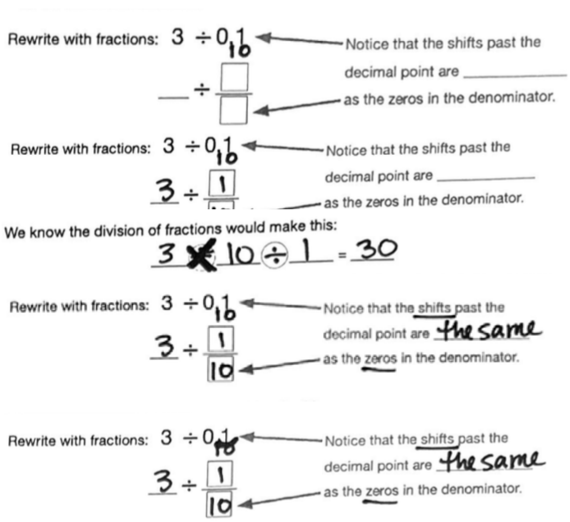
I am going to draw 6 separate wholes.

I want to know how many thirds there are so I'll cut this one into 3 thirds and then this is 3 and this is 3 and this is 3 and this is 3 and this is 3. Altogether, I have have 6 groups of 3 thirds, which is 18.

We really used multiplication there, right? We had repeated addition of the 3 in each whole. We had that "groups of" language you learned way back in 3rd grade. It was 6 times 3. That's where the multiplicative inverse comes in. Instead of dividing by the denominator, we multiplied it like a regular number. And then we would divide by 1, which is the numerator but that doesn't really change anything here. When we divide by a fraction, we always DIVIDE by the denominator and MULTIPLY by the numerator.



Let's Talk (Slide 4): How can we use that idea to divide by decimals. The first thing to remember is that decimals are really just secret fractions. That is sooooo important. If you forget that then none of the rest makes sense.



I'm going to put a little one under the decimal and a zero so we can see that secret hidden denominator.

So, this 3 divided by zero point one is really 3 divided by one tenth.

We know the division of fractions would make this 3 times 10 divided by 1 because we use the multiplication inverse that we just used on the last slide.

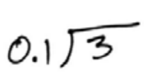
But here's the big thing we have to see. *Read this from the slide now.* Notice that the shifts past the decimal point are THE SAME as the zeros in the denominator.

Here's one shift. Here's one zero.

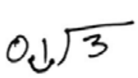
And this is the most important thing I'm going to say today: Since we use zeros to multiply, we can use this shift after the decimal point to multiply too. Then my problem becomes way easier.

Let's Think (Slide 5): What does this look like when we show our work? *Read from the slide.* We said: In the case of tenths and hundredths, multiplying by the denominator is the same as shifting the decimal.

Remember this is because we already noticed that the shifts past the decimal point are THE SAME as the zeros in the denominator.



Let me show you how I will show my work for this. I will set this problem up like long division since we're going to need that in our next lesson.



There is a secret denominator here that I want to multiply by. It is shown by one shift under the decimal point.

0.1)3.0

I will multiply that times my number, which means just one shift under the decimal point. Remember how on the last slide we did 3 x 10 and got 30? That's really what's happening here expect with shifts of the decimal instead of fractions.

30
1)30
-3
00

Let me rewrite this division now. It is 30 divided by 1. That's 30. It's the same as what I got on the last slide.

Let's Think (Slide 6): We will do the same thing for hundredths. Once again, we said, "In the case of tenths and hundredths, multiplying by the denominator is the same as shifting the decimal point."

Rewrite as long division: $2 \div 0.01$ ← Notice that the shifts past the decimal point are the same as the zeros in the denominator.

Once again, we can notice that the shifts past the decimal point are THE SAME as the zeros in the denominator.

0.01)2

I am going to write this problem in a division box.

0.01)2.00

Now I can see the shift after the decimal means this secretly has a denominator of 100. I am going to shift the decimal of 2 the same way. That's the same as if I was multiplying by 100 in the denominator.

200
1)200
-2
000

Let me rewrite my new problem. I have 200 divided by 1. That's 200.

Let's Try it (Slides 7): It's time to do some of these together. I will walk you through it step by step.

WARM WELCOME

Today we will divide by 1 tenth and 1 hundredth as a fraction and decimal.

Let's Review:

We learned to divide by a fraction using the multiplicative inverse (the opposite operation).

Solve. $6 \div \frac{1}{3}$

Draw a picture:

Write the equivalent expression: ____ ◯ ____ ◯ ____ = ____

We always ____________ by the denominator and ____________ by the numerator.

Let's Talk:

How can we use that idea to divide by decimals?

Rewrite with fractions: $3 \div 0.1$

$\_\_\_ \div \frac{\square}{\square}$

Notice that the shifts past the decimal point are ____________ as the zeros in the denominator.

We know the division of fractions would make this:

____ ◯ ____ ◯ ____ = ____

In the case of tenths and hundredths, multiplying by the denominator is the same as shifting the dividend by the same number of shifts in our divisor.

Let's Think: What does this look like when we show our work?

We said: <u>In the case of tenths and hundredths, multiplying by the denominator is the same as shifting the decimal point.</u>

Rewrite as long division: $3 \div 0.1$

Notice that the shifts past the decimal point are ______________ as the zeros in the denominator.

Let's Think: We will do the same thing for hundredths.

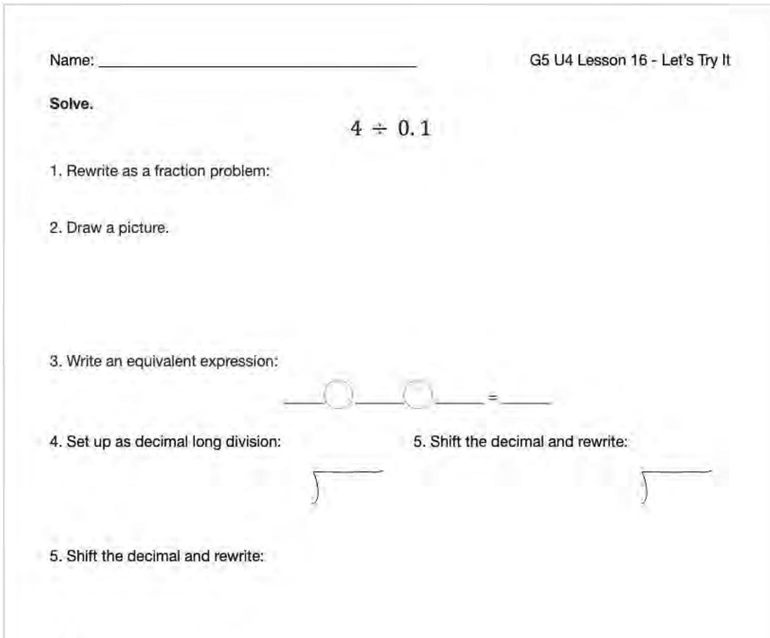
We said: <u>In the case of tenths and hundredths, multiplying by the denominator is the same as shifting the decimal point.</u>

Rewrite as long division: $2 \div 0.01$

Notice that the shifts past the decimal point are ______________ as the zeros in the denominator.

Let's Try It:

Let's practice together.



Name: ______________________ G5 U4 Lesson 16 - Let's Try It

Solve.

$$4 \div 0.1$$

1. Rewrite as a fraction problem:

2. Draw a picture.

3. Write an equivalent expression:

____ ◯ ____ ◯ ____ = ____

4. Set up as decimal long division:

5. Shift the decimal and rewrite:

5. Shift the decimal and rewrite:

On your Own:

Now it's time for you to do it on your own.

Name: ____ G5 U4 Lesson 16 - Let's Try It

Solve.

$$4 \div 0.1$$

1. Rewrite as a fraction problem:

2. Draw a picture.

3. Write an equivalent expression:

_____ ◯ _____ ◯ _____ = _____

4. Set up as decimal long division:

5. Shift the decimal and rewrite:

5. Shift the decimal and rewrite:

Solve.

$$2 \div 0.01$$

5. Rewrite as a fraction problem:

6. Write an equivalent expression:

_____ ◯ _____ ◯ _____ = _____

7. Set up as decimal long division:

8. Shift the decimal and rewrite:

Solve.

$$3.45 \div 0.1$$

9. Rewrite as a fraction problem:

10. Write an equivalent expression:

_____ ◯ _____ ◯ _____ = _____

11. Set up as decimal long division:

12. Shift the decimal and rewrite:

Name: ____ G5 U4 Lesson 16 - Independent Work

Remember: Shifting the decimal point of the dividend is like multiplying by the denominator of a fraction.

1. $7 \div 0.1$ Solve as a fraction: Shift the decimal in long division and rewrite:	2. $3 \div 0.01$ Solve as a fraction: Shift the decimal in long division and rewrite:
3. $4 \div 0.01$ Solve as a fraction: Shift the decimal in long division and rewrite:	4. $5 \div 0.1$ Solve as a fraction: Shift the decimal in long division and rewrite:

5. $16 \div 0.1$ Solve as a fraction: Shift the decimal in long division and rewrite:	6. $30 \div 0.1$ Solve as a fraction: Shift the decimal in long division and rewrite:
7. $4.1 \div 0.01$ Solve as a fraction: Shift the decimal in long division and rewrite:	8. $3.25 \div 0.01$ Solve as a fraction: Shift the decimal in long division and rewrite:

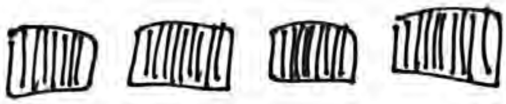
Name: ANSWER KEY

Solve.

$$4 \div 0.1$$

1. Rewrite as a fraction problem: $4 \div \frac{1}{10}$

2. Draw a picture.



3. Write an equivalent expression:

$4 \times 10 \div 1 = 40$

4. Set up as decimal long division:

$0.1 \overline{)\,4.0}$

5. Shift the decimal and rewrite:

$$\begin{array}{r} 40 \\ 1 \overline{)\,40} \\ -4 \\ \hline 00 \end{array}$$

5. Shift the decimal and rewrite:

Solve.

$$2 \div 0.01$$

5. Rewrite as a fraction problem: $2 \div \frac{1}{100}$

6. Write an equivalent expression:

$2 \times 100 \div 1 = 200$

7. Set up as decimal long division:

$0.01 \overline{)\,2.00}$

8. Shift the decimal and rewrite:

$$\begin{array}{r} 200 \\ 1 \overline{)\,200} \\ -2 \\ \hline 000 \end{array}$$

Solve.

$$3.45 \div 0.1$$

9. Rewrite as a fraction problem: $3.45 \div \frac{1}{10}$

10. Write an equivalent expression:

$3.45 \times 10 \div 1 = 34.5$

11. Set up as decimal long division:

$0.1\overline{)3.45}$

12. Shift the decimal and rewrite:

$$\begin{array}{r} 34.5 \\ 1\overline{)34.5} \\ -3 \\ \hline 04 \\ -4 \\ \hline 05 \\ -5 \\ \hline 0 \end{array}$$

Name: ANSWER KEY

G5 U4 Lesson 16 - Independent Work

Remember: Shifting the decimal point of the dividend is like multiplying by the denominator of a fraction.

1. $7 \div 0.1$ (10) Solve as a fraction: $7 \div \frac{1}{10}$ $7 \times 10 \div 1 = 70$ Shift the decimal in long division and rewrite: $0.1 \overline{)\,7.0}$ $\begin{array}{r} 70 \\ 1\overline{)70} \\ -7\downarrow \\ \hline 00 \end{array}$	2. $3 \div 0.01$ (100) Solve as a fraction: $3 \div \frac{1}{100}$ $3 \times 100 \div 1 = 300$ Shift the decimal in long division and rewrite: $0.01 \overline{)\,3.00}$ $\begin{array}{r} 300 \\ 1\overline{)300} \\ -3\downarrow\downarrow \\ \hline 000 \end{array}$
3. $4 \div 0.01$ (100) Solve as a fraction: $4 \div \frac{1}{100}$ $4 \times 100 \div 1$ Shift the decimal in long division and rewrite: $0.01 \overline{)\,4.00}$ $\begin{array}{r} 400 \\ 1\overline{)400} \\ -4\downarrow\downarrow \\ \hline 000 \end{array}$	4. $5 \div 0.1$ (10) Solve as a fraction: $5 \div \frac{1}{10}$ $5 \times 10 \div 1 = 50$ Shift the decimal in long division and rewrite: $0.1 \overline{)\,5.0}$ $\begin{array}{r} 50 \\ 1\overline{)50} \\ -5\downarrow \\ \hline 00 \end{array}$

5. $16 \div 0.1$

Solve as a fraction:

$16 \div \frac{1}{10}$

$16 \times 10 \div 1 = 160$

Shift the decimal in long division and rewrite:

$0.1 \overline{)160}$

$1 \overline{)160}$ = 160

-1
06
-6
00

6. $30 \div 0.1$

Solve as a fraction:

$30 \div \frac{1}{10}$

$30 \times 10 \div 1 = 300$

Shift the decimal in long division and rewrite:

$0.1 \overline{)300}$

$1 \overline{)300}$ = 300

-3
000

7. $4.1 \div 0.01$

Solve as a fraction:

$4.1 \div \frac{1}{100}$

$4.1 \times 100 \div 1 = 410$

Shift the decimal in long division and rewrite:

$0.01 \overline{)4.10}$

$1 \overline{)410}$ = 410

-4
01
-1
00

8. $3.25 \div 0.01$

Solve as a fraction:

$3.25 \div \frac{1}{100}$

$3.25 \times 100 \div 1 = 325$

Shift the decimal in long division and rewrite:

$0.01 \overline{)3.25}$

$1 \overline{)325}$ = 325

-3
02
-2
05
-5
0

G5 U4 Lesson 17

Divide decimals by decimals

G1 U4 Lesson 17 - Today we will divide decimals by decimals.

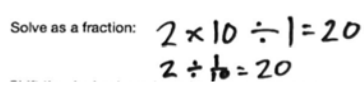
Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): Today we will divide decimals by decimals. We are just going to apply what we learned in the last lesson. It will be the same steps so I know you are going to do great.

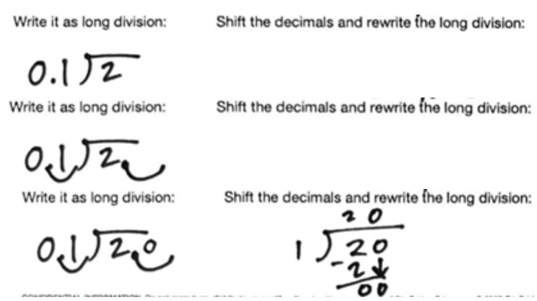
Let's Review (Slide 3): We already learned to shift the decimal when we divide. Why do we do that? Before we answer that question, let's review.

This says solve 2 divided by zero point one. If we draw a picture, we have 2 wholes.

I want to know how many tenths are inside so I cut each whole into tenths. This whole has 10. This whole has 10. I can see that's 2 groups of 10, which is 20. I can already hear the multiplication in there. It was multiplication that happened because the secret denominator of this decimal was 10.



We really thought of it as 2 times 10 divided by 1. Let's write what we did as if it was a fraction. This was secretly 2 divided by one tenth.



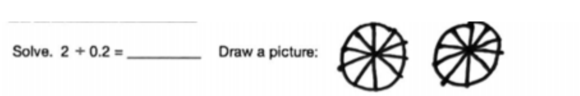
Let's write it as a decimal though. I draw my division symbol and put the numbers inside. 2 divided by 0.1.

I can look at this shift after the decimal and use it to multiply my dividend. One shift here means one shift here.

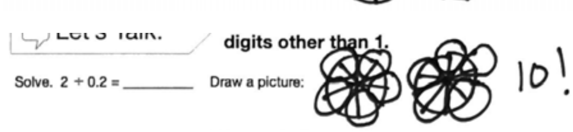
Then we rewrite the problem. It's really 20 divided by 1 which is 20. So, why did we shift the decimal? *Students are very likely to give answers that are true but not correct. For example, they might say that we moved the decimal in one number to match the other number. That is technically true but it doesn't explain why.* Possible Student Answers, Key Points:

- The shifts in the decimal are like multiplying the number by the denominator.
- The decimal is a secret fraction and moving the decimal point is like multiplying by the denominator.

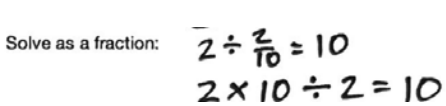
Let's Talk (Slide 4): This same process will continue with digits other than 1. Let's look at 2 divided by zero point two. We know it's still the same question, "How many two tenths are in 2 whole?"



I will draw two separate wholes. I start by turning them into tenths like on the last side. There are 10 tenths in this whole and 10 tenths and this whole. So we still have that "2 groups of 10 thing" happening.

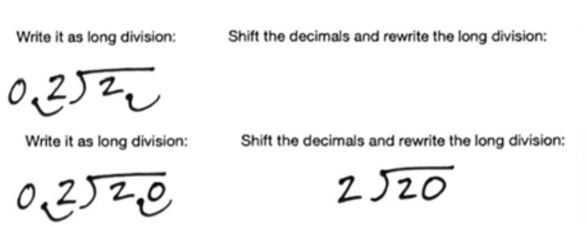


But now I want to know how many TWO tenths so I have to group them into twos. Two tenths here. Two tenths here. Two tenths here… I made 10 circles. That's like I divided the 20 by 2. My answer is 10.

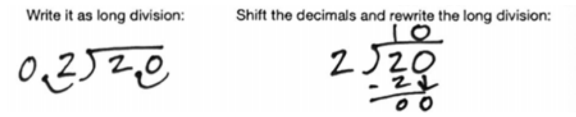


This is the same as 2 divided by 2 tenths. And we can see we did 2 x 10, which was in the denominator like last time. But this time it wasn't divided by 1; it was divided by 2. Same process as before. We just had different digits.

So the long division will look the same. I draw the symbol and write in the numbers. I still need to multiply by that secret hidden denominator so I will shift the decimals here and here. That's just the same as when I cut each whole into ten in my picture. It's like when I multiplied by the denominator of ten in my fraction.



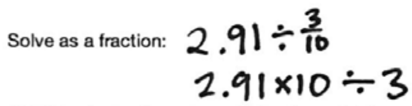
And now when we rewrite it, look what we have. It almost seems like magic but we know that it is the beauty of mathematics always making sense. We get the same division we did before with the circling 2 or the dividing by 2, right? We get 20 divided by 2.



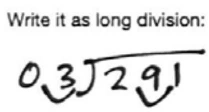
Now I can divide by 2 like regular long division. 2 goes into 2 once. I put 1 on top. I subtract 2. I have zero so I put zero on top. My answer is 10!

Let's Think (Slide 5): I'm going to do one more so you can give all your attention to watching. You will see that this same process will continue when we divide decimals as well.

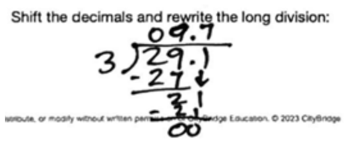
Here we have two point ninety-one divided by point three. That's two and ninety one hundredths divided by three tenths. This says, "Drawing a picture is too cumbersome at this point." As a fraction, this is just like it sounds. 2.91 divided by three over ten. We know that we would multiply by the denominator and divide by the numerator. But this is also starting to get too cumbersome. The long division is going to be soooo much easier here.



I am going to draw the division symbol and put 2.91 inside and 0.3 outside. Now I see my divisor has one shift so I am going to shift the answer in my decimal. Just like I'm multiplying by the denominator.



Let's rewrite this. It's 29.1 inside and 3 outside. We can do this! 3 doesn't go into 2 so I put a zero. 3 goes into 29, 9 times. 3 times 9 is 27. I put 9 on top and subtract 27. Borrow and I get 2. Pull down the 1. 3 goes into 21, 7 times. 3 times 7 is 21. I put 7 on top and subtract 21. Zero is left. I take the decimal in my problem and keep it in my answer. We get 9.7.



Let's Try it (Slides 6): Let's practice together! I will guide you through step by step.

WARM WELCOME

Today we will divide decimals by decimals.

Let's Review:

How is the work we do for multiplication and division of decimals similar?

Solve. 2 ÷ 0.1 = __________

Draw a picture:

Solve as a fraction:

Write it as long division:

Shift the decimals and rewrite the long division:

Let's Talk:

This same process will continue with digits other than 1.

Solve. 2 ÷ 0.2 = __________

Draw a picture:

Solve as a fraction:

Write it as long division:

Shift the decimals and rewrite the long division:

Let's Think:

This same process will continue when we divide decimals as well.

Solve. 2.91 ÷ 0.3 = ________ Drawing a picture is too cumbersome at this point.

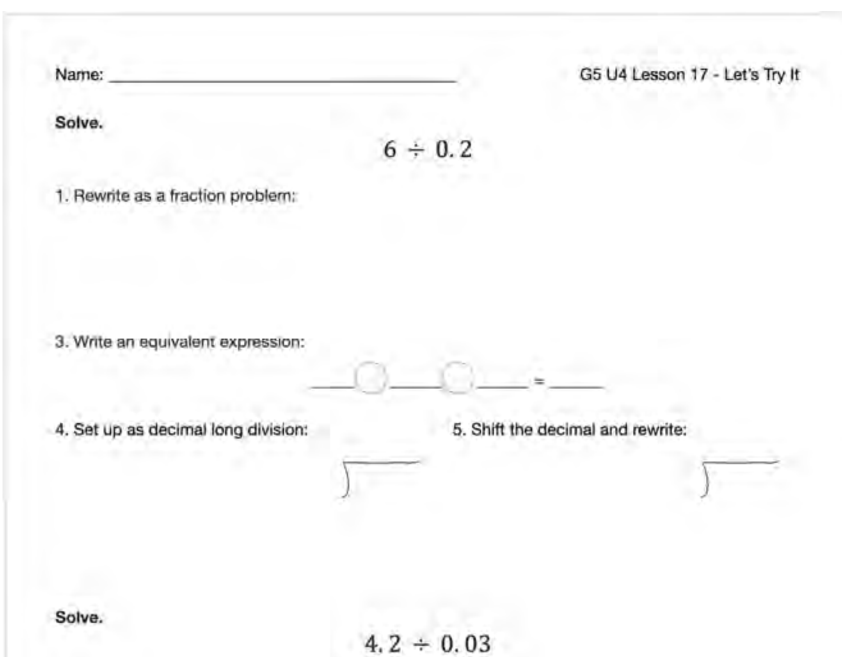
Solve as a fraction:

Write it as long division:

Shift the decimals and rewrite the long division:

Let's Try It:

Let's practice together.



Name: ______________________________ G5 U4 Lesson 17 - Let's Try It

Solve.

$$6 \div 0.2$$

1. Rewrite as a fraction problem:

3. Write an equivalent expression:

____ ○ ____ ○ ____ = ____

4. Set up as decimal long division:

5. Shift the decimal and rewrite:

Solve.

$$4.2 \div 0.03$$

On your Own:

Now it's time for you to do it on your own.

Name: ______________________________ G5 U4 Lesson 17 - Independent Work

Remember: Shifting the decimal point of the dividend is like multiplying by the denominator of a fraction.

Set up the long division. Shift the decimal point and rewrite to solve.

1. $9 \div 0.03$	2. $0.4 \div 0.2$
3. $43.2 \div 0.06$	4. $1.352 \div 0.4$

Solve.

$$6 \div 0.2$$

1. Rewrite as a fraction problem:

3. Write an equivalent expression:

____ ◯ ____ ◯ ____ = ____

4. Set up as decimal long division:

5. Shift the decimal and rewrite:

Solve.

$$4.2 \div 0.03$$

5. Rewrite as a fraction problem:

6. Write an equivalent expression:

____ ◯ ____ ◯ ____ = ____

4. Set up as decimal long division:

5. Shift the decimal and rewrite:

Solve.

$$3.45 \div 0.5$$

5. Rewrite as a fraction problem:

6. Write an equivalent expression:

_____ ◯ _____ ◯ _____ = _____

4. Set up as decimal long division:

5. Shift the decimal and rewrite:

Name: ____

Remember: Shifting the decimal point of the dividend is like multiplying by the denominator of a fraction.

Set up the long division. Shift the decimal point and rewrite to solve.

1. $9 \div 0.03$	2. $0.4 \div 0.2$
3. $43.2 \div 0.06$	4. $1.352 \div 0.4$

Set up the long division. Shift the decimal point and rewrite to solve.

5. $16 \div 0.4$	6. $0.3 \div 0.05$
7. $4.1 \div 0.02$	8. $3.22 \div 0.7$

Name: ANSWER KEY

Solve.

$$6 \div 0.2$$

10

1. Rewrite as a fraction problem:

$6 \div \frac{2}{10}$

3. Write an equivalent expression:

6 × 10 ÷ 2 = 30

4. Set up as decimal long division:

$0.2\overline{)6.0}$

5. Shift the decimal and rewrite:

$$\begin{array}{r} 30 \\ 2\overline{)60} \\ -6\downarrow \\ \hline 00 \\ -00 \\ \hline 00 \end{array}$$

Solve.

$$4.2 \div 0.03$$

100

5. Rewrite as a fraction problem: $4.2 \div \frac{3}{100}$

6. Write an equivalent expression:

4.2 × 100 ÷ 3 = 140

4. Set up as decimal long division:

$0.03\overline{)4.20}$

5. Shift the decimal and rewrite:

$$\begin{array}{r} 140 \\ 3\overline{)420} \\ -3\downarrow \\ \hline 12 \\ -12\downarrow \\ \hline 000 \end{array}$$

Solve.

$$3.45 \div 0.5$$

10

5. Rewrite as a fraction problem: $3.45 \div \frac{5}{10}$

6. Write an equivalent expression:

$3.45 \times 10 \div 5 = 6.9$

4. Set up as decimal long division:

$0.5 \overline{)3.45}$

5. Shift the decimal and rewrite:

$$\begin{array}{r} 06.9 \\ 5\overline{)34.5} \\ -30\downarrow \\ \hline 45 \\ -45 \\ \hline 00 \end{array}$$

Name: ANSWER KEY

Remember: Shifting the decimal point of the dividend is like multiplying by the denominator of a fraction.

Set up the long division. Shift the decimal point and rewrite to solve.

1. $9 \div 0.03 = 300$

$0.03\overline{)9.00}$

$3\overline{)900}$ = 300

-9

000

2. $0.4 \div 0.2 = 2$

$0.2\overline{)0.4}$

$2\overline{)4}$ = 2

-4

0

3. $43.2 \div 0.06 = 720$

$0.06\overline{)43.20}$

$6\overline{)4320}$ = 0720

-42

12

-12

000

4. $1.352 \div 0.4 = 3.38$

$0.4\overline{)1.352}$

$4\overline{)13.52}$ = 03.38

-12

15

-12

32

-32

00

Set up the long division. Shift the decimal point and rewrite to solve.

5. $16 \div 0.4 = 40$ $0.4\overline{)16.0}$ $4\overline{)160}$ = 040 -16 000	6. $0.3 \div 0.05 = 6$ $0.05\overline{)0.30}$ $5\overline{)30}$ = 06 -0 30 -30 00
7. $4.1 \div 0.02 = 205$ $0.02\overline{)4.10}$ $2\overline{)410}$ = 205 -4 01 -0 10 -10 00	8. $3.22 \div 0.7 = 4.6$ $0.7\overline{)3.22}$ $7\overline{)32.2}$ = 04.6 28 042 -42 00

G5 U4 Lesson 18

Fluently use all four decimal operations

CITYTUTOR DC

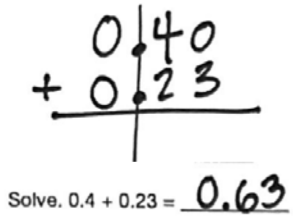
G1 U4 Lesson 18 - Today we will fluently use all four decimal operations.

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): Today we will fluently use all four decimal operations. The operations are addition, subtraction, multiplication and division. So, this is just putting together all the decimal work you've already done this year!

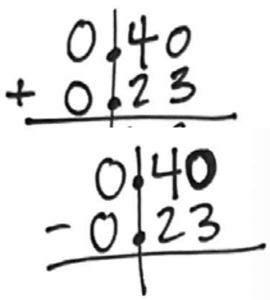
Let's Review (Slide 3): In order to make sure we keep the steps for each operation clear, it is helpful to notice how they are the same and different. Let's start with this - how are addition and subtraction of decimals similar? Possible Student Answers, Key Points:

- You need to line up your decimals for both
- Addition and subtraction are opposites.
- We use a place value chart.
- One is put together and one is take apart.

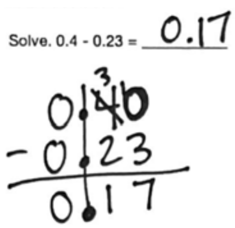


For 0.4 + 0.23, I am going to line up my decimals. Let me draw a straight line with two decimals to start. Then I can put in my numbers, and I will fill in this empty space with a zero just to keep things lined up.

Now I can add like normal and my answer is 0 + 3 makes 3. 4 + 2 makes 6. My answer is 0.63.



Let's do the same numbers but with subtraction. I still draw a straight line with two decimals then fill in my numbers. Here it is REALLY important to put a zero in the empty spot because I am going to need somewhere to subtract from.



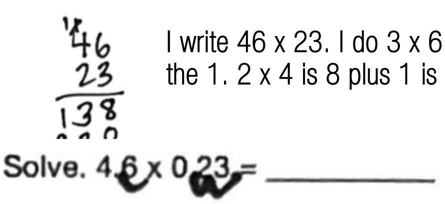
I can see 0 minus 3 and that's not enough so I have to ungroup or borrow. I scratch out the 4; it becomes 3. And I can put one on the side of the zero. Now it is 10 - 3 = 7 and 3 - 2 = 1. My answer is 0.17

Let's look back at how these operations are similar. For both operations, I had to line up my decimals. That's because I can only add "like things" such as cats plus cats or chocolate bars plus chocolate bars or, in this case, tenths plus tenths and hundredths plus hundredths. Same with subtraction! I can't take cats from dogs, right? It would make sense that the work for addition and subtraction look the same because they are just opposite operations.

Let's Talk (Slide 4): Now we're asked, "How are multiplication and division of decimals similar?" What do you think? Possible Student Answers, Key Points:

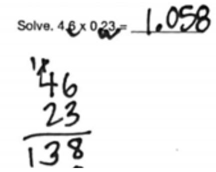
- You DON'T need to line up your decimals for both
- You scoop under the decimal places for both.
- Division is the opposite of multiplication.

Let's do the math and then we'll ask that question again. This is 4 tenths plus 23 hundredths. I can hear the hidden fraction even when I read the problem. So I'm going to multiply just my digits like numerators.

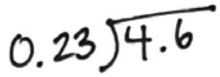


I write 46 x 23. I do 3 x 6 is 18, carry the 1. 3 x 4 is 12 plus 1 is 13. In my next row, I put a zero. Then 2 x 6 is 12, carry the 1. 2 x 4 is 8 plus 1 is 9. I add this up and get 1058.

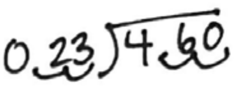
I still need to think about those tenths and hundredths places. If they were fraction denominators, I would multiply them but since they are decimals, I can just count up my scoops. Count with me - 1 - 2 - 3!



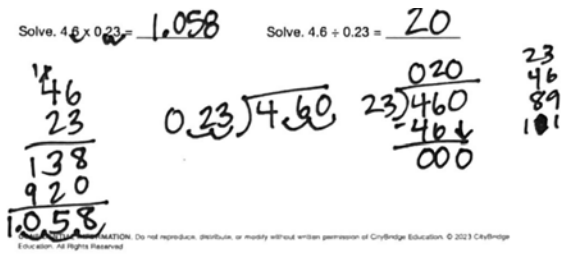
That's how many scoops I need in my answer. I get one point zero five eight or 1 and 58 thousandths.



Let's do the division. I can set it up like a long division problem.



But then I know the decimal spaces here have to get multiplied by the number in my division box. So I count the scoops here and put them in here. Fill in the empty place with a zero.

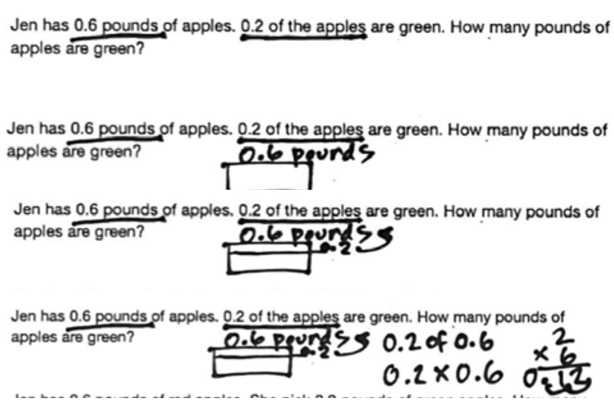


I am going to rewrite my problem. It's 460 divided by 23. I will need to figure out the repeated addition of 23 over here on the side because that's a big number to divide by. But that's okay. 23 + 23 is 46 so I got it. 23 doesn't go into 4. It goes into 46 twice. I subtract 46 and I am left with zero. Pull down the next digits and I get zero. My answer is 20.

So let's take a step back and ask again, "how are multiplication and division of decimals similar?" Do we line up our decimals for either one? No! We use scoops to find the total place values in our answer.

Let's Think (Slide 5): The last thing we want to think about before we practice is, "how will we choose operations for a story problem?" Read the steps silently with your eyes while I read. 1. We will ask, "What is the relationship between ______________ and ______________?" 2. We will draw a tape diagram.

Let's practice with this problem. *Read the first problem.* This problem is talking about 0.6 pounds and 0.2 of the apples. Let me underline that. The first thing I do is ask myself, "What is the relationship between pounds and "of the apples?" I can already hear that this is NOT a pounds and pounds problem. It's 0.2 of the 0.6 so I think this is going to be multiplication.

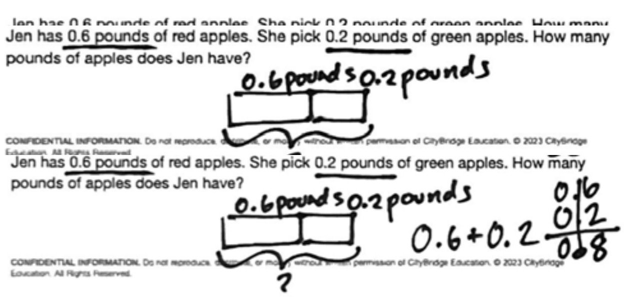


Now let's draw a tape diagram to be super sure. I will draw a rectangle and label it 0.6 pounds.

Then it say 0.2 of them with green. That's 0.2 of this rectangle that I already draw so I would draw it across this way. I am seeing that it is a multiplication problem.

I multiply my digits. Count my scoops and put the scoops in my answer. It's 0.12.

Follow along silently with your eyes while I read the next problem. *Read the next problem.* I am going to underline what we're talking about in this story - 0.6 pounds and 0.6 pounds. The first thing I do is ask myself, "What is the relationship between pounds and pounds?" They are the same thing! So I know I can add or subtract these if I want to.



Let's draw a diagram to think about it some more. I am going to draw a rectangle and call that 0.6 pounds of red. Then separate from that I have 0.2 pounds of green. So I will draw another rectangle beside it.

I want to know how much all these pounds are. My question mark is here. I can see this is an addition problem. I am going to line up my decimals and put the numbers. 6 + 2 is 8 so my answer is 0.8 pounds.

Let's Try it (Slides 6): You are going to practice this mix of addition, subtraction, multiplication and division today. But first, I will walk you through one more set of examples.

WARM WELCOME

Today we will fluently use all four decimal operations.

Let's Review:

How are addition and subtraction of decimals similar?

Solve. 0.4 + 0.23 = __________

Solve. 0.4 - 0.23 = __________

Let's Talk:

How are multiplication and division of decimals similar?

Solve. 4.6 x 0.23 = __________

Solve. 4.6 ÷ 0.23 = __________

Let's Think: How will we choose operations for a story problem?

1. We will ask, "What is the relationship between __________ and __________?"
2. We will draw a tape diagram.

Jen has 0.6 pounds of apples. 0.2 of the apples are green. How many pounds of apples are green?

Jen has 0.6 pounds of red apples. She pick 0.2 pounds of green apples. How many pounds of apples does Jen have?

Let's Review: How are addition and subtraction of decimals similar?

Solve. 0.4 + 0.23 = __________

Solve. 0.4 - 0.23 = __________

Let's Talk: How are multiplication and division of decimals similar?

Solve. $4.6 \times 0.23 =$ __________

Solve. $4.6 \div 0.23 =$ __________

Let's Think: How will we choose operations for a story problem?

1. We will ask, "What is the relationship between __________ and __________?"
2. We will draw a tape diagram.

Jen has 0.6 pounds of apples. 0.2 of the apples are green. How many pounds of apples are green?

Jen has 0.6 pounds of red apples. She pick 0.2 pounds of green apples. How many pounds of apples does Jen have?

Let's Try It: Let's practice together.

Name: ______________________ G5 U4 Lesson 18 - Let's Try It

Complete the problems and compare.

Solve. 5.76 + 1.8 = ________	Solve. 5.76 - 1.8 = ________
Did my answer get bigger or smaller?	Did my answer get bigger or smaller?
Did I need to line up my decimals?	Did I need to line up my decimals?

Solve. 5.76 x 1.8 = ________	Solve. 5.76 ÷ 1.8 = ________

On your Own: Now it's time for you to do it on your own.

Name: ______________________ G5 U4 Lesson 18 - Independent Work

Show your work with numbers to solve.

1. $0.51 \div 0.3$	2. 0.51×0.3
3. $0.51 + 0.3$	4. $0.51 - 0.3$

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Name: ____ G5 U4 Lesson 18 - Let's Try It

Complete the problems and compare.

Solve. 5.76 + 1.8 = _______________	Solve. 5.76 - 1.8 = _______________
Did my answer get bigger or smaller?	Did my answer get bigger or smaller?
Did I need to line up my decimals?	Did I need to line up my decimals?

Solve. 5.76 x 1.8 = _______________	Solve. 5.76 ÷ 1.8 = _______________
Did my answer get bigger or smaller?	Did my answer get bigger or smaller?
Did I need to line up my decimals?	Did I need to line up my decimals?

Show your work with numbers to solve.

1. $0.51 \div 0.3$	2. 0.51×0.3
3. $0.51 + 0.3$	4. $0.51 - 0.3$

Draw a tape diagram then show your work with numbers to solve.

5. Jeffrey ran 3.5 miles in the school race. Each mile took 13.5 minutes to run. How long did it take Jeffrey to complete the race?	6. Sammy has 2.8 gallons of red paint. He used 0.76 gallons to paint his bathroom. How much paint does Sammy have left?
7. Joellen has 2.8 Liters of soda. She is pouring the soda into cups that can hold 0.4 Liters. How many cups can Joellen fill?	8. Richard used 0.6 pounds of beans to make chili. Then he used 0.25 pounds of beans to make beans and rice. How many pounds of beans did Richard use in his cooking?

Name: ANSWER KEY

Complete the problems and compare.

Solve. 5.76 + 1.8 = 7.56 $\begin{array}{r} 5.76 \\ +\ 1.80 \\ \hline 7.56 \end{array}$	Solve. 5.76 - 1.8 = 3.96 $\begin{array}{r} 5.76 \\ -\ 1.80 \\ \hline 3.96 \end{array}$
Did my answer get bigger or smaller? bigger	Did my answer get bigger or smaller? smaller
Did I need to line up my decimals? yes	Did I need to line up my decimals? yes

Solve. 5.76 x 1.8 = 10.368 $\begin{array}{r} 576 \\ \times\ 18 \\ \hline 4608 \\ 5760 \\ \hline 10.368 \end{array}$	Solve. 5.76 ÷ 1.8 = 3.2 $1.8\overline{)5.76}$ $18\overline{)57.6}$ = 03.2 $\begin{array}{r} 57.6 \\ -54 \\ \hline 36 \\ -36 \\ \hline 00 \end{array}$ 18, 36, 54, 72, 90, 108
Did my answer get bigger or smaller? bigger	Did my answer get bigger or smaller? smaller
Did I need to line up my decimals? no	Did I need to line up my decimals? no

Name: ANSWER KEY

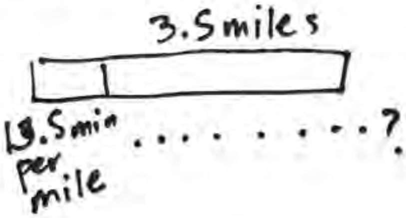
G5 U4 Lesson 18 - Independent Work

Show your work with numbers to solve.

1. $0.51 \div 0.3 = 1.7$ $0.3\overline{)0.51}$ $3\overline{)5.1}$ = 1.7 -3 21 -21 00	2. $0.51 \times 0.3 = 0.153$ $51 \times 3 = 153$
3. $0.51 + 0.3 = 0.81$ 0.51 $+\ 0.30$ 0.81	4. $0.51 - 0.3 = 0.21$ 0.51 $-\ 0.3$ 0.21

Draw a tape diagram then show your work with numbers to solve.

5. Jeffrey ran 3.5 miles in the school race. Each mile took 13.5 minutes to run. How long did it take Jeffrey to complete the race?

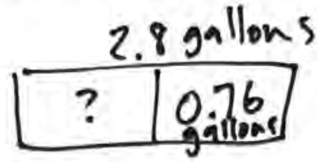


3.5×13.5

$$\begin{array}{r} 135 \\ \times\ 35 \\ \hline 675 \\ 4050 \\ \hline 47.25 \end{array}$$

$\boxed{47.25 \text{ minutes}}$

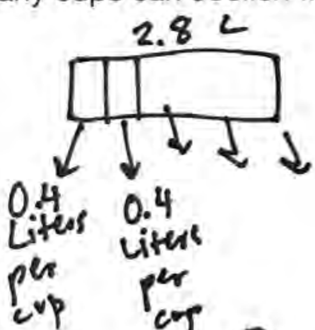
6. Sammy has 2.8 gallons of red paint. He used 0.76 gallons to paint his bathroom. How much paint does Sammy have left?



$$\begin{array}{r} 2.80 \\ -\ 0.76 \\ \hline 2.04 \end{array}$$

$\boxed{2.04 \text{ gallons}}$

7. Joellen has 2.8 Liters of soda. She is pouring the soda into cups that can hold 0.4 Liters. How many cups can Joellen fill?



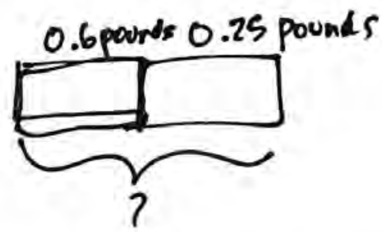
$\boxed{7 \text{ cups}}$

$2.8 \div 0.4$

$0.4 \overline{)2.8}$

$$\begin{array}{r} 07 \\ 4\overline{)28} \\ -28 \\ \hline 00 \end{array}$$

8. Richard used 0.6 pounds of beans to make chili. Then he used 0.25 pounds of beans to make beans and rice. How many pounds of beans did Richard use in his cooking?



$$\begin{array}{r} 0.6 \\ +\ 0.25 \\ \hline 0.85 \end{array}$$

$\boxed{0.85 \text{ pounds}}$

G5 Unit 5:

Area and Volume

G5 U5 Lesson 1

Find the volume of a right rectangular prism by packing with cubic units and counting.

G5 U5 Lesson 1 - Students will find the volume of a right rectangular prism by packing with cubic units and counting

Warm Welcome (Slide 1): Tutor choice

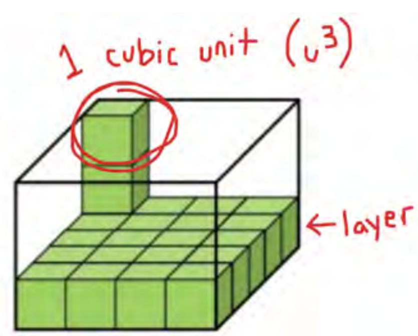
Frame the Learning/Connect to Prior Learning (Slide 2): Today is our first lesson of a new unit all about volume and area. Today, we'll focus on the concept of volume. The term volume has several meanings in everyday life. For instance, you can control the volume on your iPad or the TV. The volume we're exploring in this unit is different. When we talk about volume in math, we're talking about the amount of three-dimensional space an object takes up. For instance, a swimming pool has volume. We can think of how much water it would take to fill the swimming pool as its volume. A balloon has volume. We can think of how much air is inside the balloon as its volume. Can you think of other things that have volume? Possible Student Answers, Key Points:

- The room we're in right now has volume.
- A soda can or a water bottle has volume.

Examples of things that have volume are everywhere. Today, we're going to focus on finding the volume of right rectangular prisms by packing with cubic units and counting.

Let's Talk (Slide 3): Before we work on a few problems, take a second and look at these images. What do you notice? What do you wonder? Possible Student Answers, Key Points:

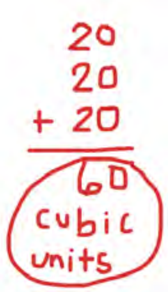
- I notice they're all box-shaped. I see they're all examples of rectangular prisms. I notice they are all objects that are 3D.
- I wonder if these are all examples of things that have volume. I wonder how much fits inside each. I wonder why the last picture isn't full of cubes.



These are all examples of rectangular prisms. Since rectangular prisms are three-dimensional, or 3D, figures, we can find their volume. We measure the volume of objects using cubic units or unit cubes. *(circle and label the top cubic unit in the rightmost figure)* This is one cubic unit, or one unit cube. We sometimes see cubic units abbreviated as u^3. *(write u^3)*

The number of cubic units it takes to completely pack a figure without any gaps is its volume. Let's think about how many cubes it would take to pack this rectangular prism. Take a look at how many cubes are already packed in just the bottom layer. *(label the bottom layer)*

I see 5 rows of 4 cubes are packed into the bottom layer. *(trace and count each row of 4 with your finger)* How many cubes are in just the bottom layer? (20) There are 20 cubes in the bottom layer. That's not the volume of the prism yet, because the stack of cubes in the back of this prism show me that we could fit two more layers of cubes.

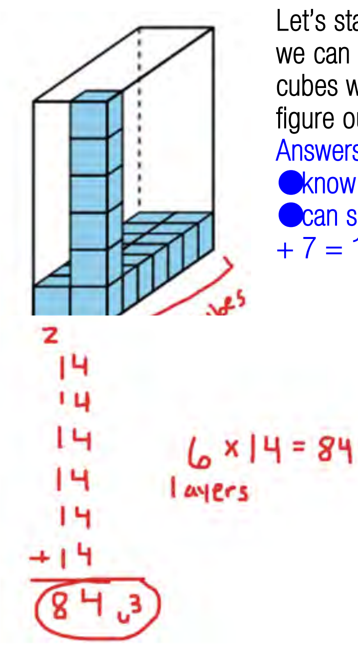


If the bottom layer has 20 cubes, I know we could back another layer of 20 cubes on top of that. Then, we could pack 20 more cubes on top of that. 20 cubes in the bottom layer, 20 cubes in the middle layer, and 20 cubes in the top layer. *(write 20 + 20 + 20 vertically to mimic the layers in the prism)* How many cubes could we pack into this rectangular prism? (60) Great, we can say the volume of this rectangular prism is 60 cubic units, because we could pack the entire figure with 60 unit cubes. We just found the volume of a rectangular prism!

Let's Think (Slide 4): Take a look at this next rectangular prism. What can we already tell about this figure based on the image? Possible Student Answers, Key Points:

- I know it has volume, because it is three-dimensional. We can pack it with cubes.
- I know the figure is 6 cubes tall, because I see the stack of 6 cubes. I know the figure is 2 cubes across. I see it goes 6 cubes back.
- I know the bottom layer is packed with cubes.

We see some unit cubes already packed into this rectangular prism. This problem shows use the bottom layer completely packed in, and it also shows us a tower of cubes so we know how tall the prism is. This helps us think about how many layers we'll need to stack to consider the volume.



Let's start by looking at just the bottom layer. The tower of cubes blocks our view of some of that layer, but we can still figure out how many cubes are packed into the bottom of our prism. I see the bottom layer is 2 cubes wide and 7 cubes long, or deep. *(label 2 cubes and 7 cubes with brackets)* Knowing this, how can I figure out the number of cubes in the bottom layer even though some are obscured? Possible Student Answers, Key Points:

- I know 7 rows of 2 is 14. I can think 7 x 2 or 2 x 7.
- I can see one column of 7 cubes, so I know the other column that is blocked by the tower is also 7 cubes. 7 + 7 = 14

7 rows of 2 cubes, means the bottom layer is packed with 14 cubes. Look at the stack of cubes from the bottom to top of the prism. How many layers will we need to fill this rectangular prism completely? (6 layers) We would need to pack this box with 6 layers of 14 cubes to fill it completely. *(write 14 + 14 + 14 + 14 + 14 + 14 vertically to mimic the layers)* If we add up 6 layers of 14 cubes, we get a volume of 84 cubic units. *(write 84 u^3)* That much repeated addition can be time-consuming. If we wanted to be more efficient, we can find 6 layers of 14 cubes using multiplication. *(write 6 layers x 14 = 84)*

We just found the volume of the rectangular prism. What thinking did we have to do to arrive at our volume? How would you describe this process to a friend? Possible Student Answers, Key Points:

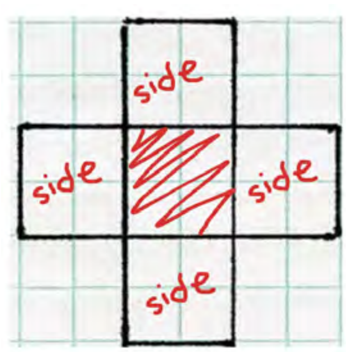
- We looked at the picture and thought about how many cubes were in the bottom layer and how many layers we need to pack the rectangular prism to the top.
- We found the number of cubes packed into the bottom. Since each layer is the same size, we could just keep adding layers or use multiplication to help us find how many cubes pack the whole box.

Excellent work. Let's look at one more example.

Let's Think (Slide 5): *(read the problem aloud)* Does this flat drawing have volume? Possible Student Answers, Key Points:

- No, you can't pack cubes into something flat.
- No, volume is the amount of 3D space an object takes up. The drawing is two-dimensional.

A flat drawing does not have volume, but Tina is going to take this flat drawing, cut it out, and fold it up so that it forms a rectangular prism. Our job is to figure out how many cubes can fit into the figure once she folds it into a box.



We can think of this middle square as being the bottom of Tina's box if she folds it. *(lightly shade the middle square so the grid lines are still visible)* The other squares will fold up to form the sides of the box. *(label the other squares as sides)*

TEACHER NOTE: If possible, having a physical replica of Tina's figure to actually fold can make visualizing the rectangular prism easier.

We can imagine the bottom of the box, with the four other squares folded up to make the sides of the rectangular prism. Tina's box wouldn't have a top. Now let's think about how many cubes we could pack in the figure. How many cubes could we put into the bottom layer, and how do you know? Possible Student Answers, Key Points:

- We can pack four cubes in the bottom layer.
- The bottom layer looks like a square that has lengths of 2 units. 2 x 2 = 4

Four cubes can fit in the bottom layer. If we packed 4 cubes in the bottom layer, would the rectangular prism be full? (No.) The sides that Tina will fold up have side lengths of 2 units, which means the box she makes would be 2 units tall. We could pack in another layer of 4 cubes to fill the prism. If we packed in another layer of 4 cubes on top of the original layer, how could we find the volume of Tina's folded figure? Possible Student Answers, Key Points:

- The bottom layer is 4, and the top layer is 4. If I counted all the cubes, it would take 8 to fill the box.
- The volume is 8 cubic units. There are 2 layers of 4 cubes, so I can think of 2 x 4 = 8.

$$\begin{array}{r} 4 \\ +\,4 \\ \hline 8 \end{array} \qquad 2 \times 4 = 8$$

layers

$8u^3$

The volume of Tina's figure is 8 cubic units, or 8 u^3. A layer of 4 cubes plus a layer of 4 cubes, means it takes 8 cubes to pack the box. *(write 4 + 4 = 8 vertically to mimic the layers of the prism)* We can also think of it as 2 layers of 4, and we can multiply 2 x 4 to find the volume. *(write 2 layers x 4 = 8, then write 8 cubic units as the answer)*

Great work!

Let's Try it (Slides 6 - 7): Now let's work on finding the volume of right rectangular prisms by packing with unit cubes and counting together. To find the volume of a rectangular prism, we just need to determine how many unit cubes it takes to completely pack the figure. Thinking about the cubes in one layer and how many layers we need to completely pack the prism can help us find the volume. When can count cubes individually or we can find more efficient ways of counting by thinking of equal groups of cubes. Looking at rows, columns, and stacks of cubes can help us find efficient ways to count cubic units. Let's try out what we've been learning.

WARM WELCOME

Today we will **find the volume of a right rectangular prism by packing with cubic units and counting.**

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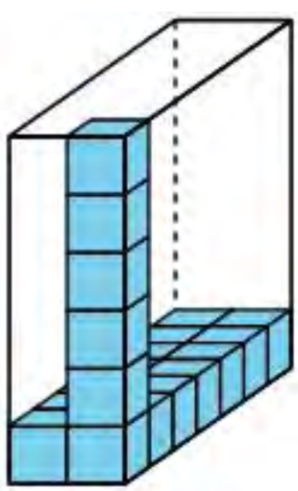
Let's Talk:

What do you notice? What do you wonder?

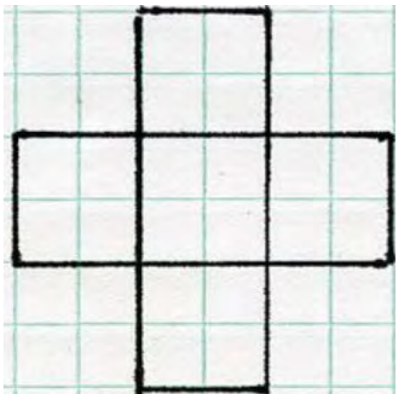
Let's Think:

How many cubes would fill the box?



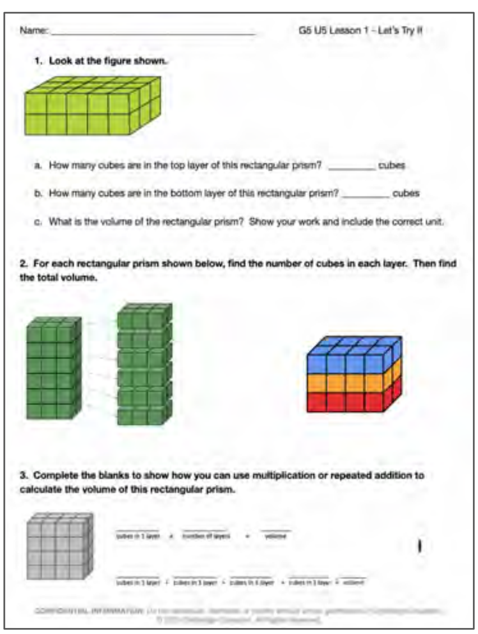
Let's Think:

Tina is going to cut out the figure and fold it to make a box. How many cubes would fit in the box? What is the volume?



Let's Try It:

Let's explore finding the volume of a right rectangular prism by packing with cubic units and counting together.



Name: ____________ G5 U5 Lesson 1 - Let's Try It

1. Look at the figure shown.

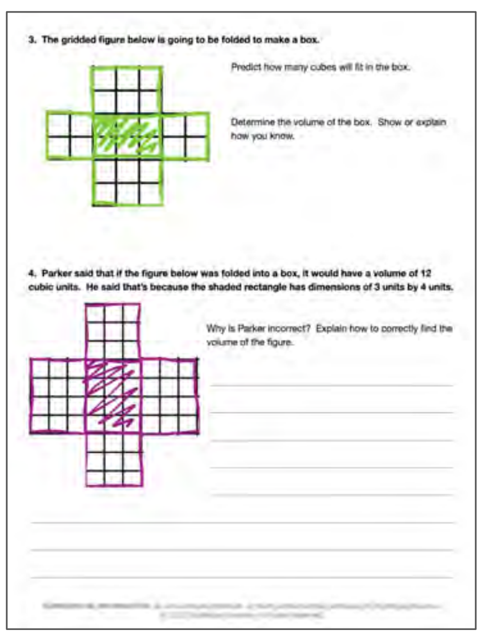
a. How many cubes are in the top layer of this rectangular prism? ________ cubes

b. How many cubes are in the bottom layer of this rectangular prism? ________ cubes

c. What is the volume of the rectangular prism? Show your work and include the correct unit.

2. For each rectangular prism shown below, find the number of cubes in each layer. Then find the total volume.

3. Complete the blanks to show how you can use multiplication or repeated addition to calculate the volume of this rectangular prism.



3. The gridded figure below is going to be folded to make a box.

Predict how many cubes will fit in the box.

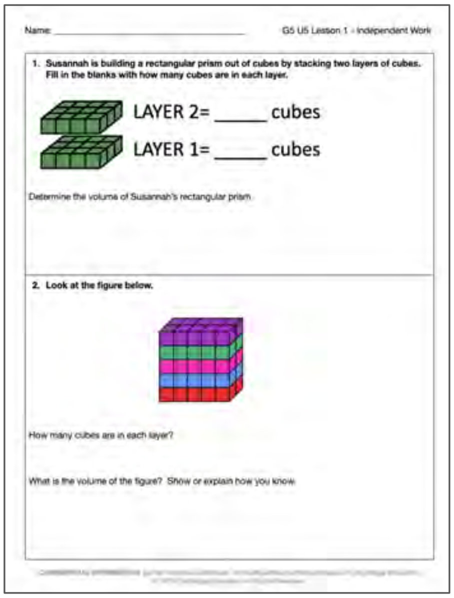
Determine the volume of the box. Show or explain how you know.

4. Parker said that if the figure below was folded into a box, it would have a volume of 12 cubic units. He said that's because the shaded rectangle has dimensions of 3 units by 4 units.

Why is Parker incorrect? Explain how to correctly find the volume of the figure.

On your Own:

Now it's time to find the volume of a rectangular prism by packing with cubic units and counting on your own.



Name: ______________________ G5 U5 Lesson 1 - Independent Work

1. Susannah is building a rectangular prism out of cubes by stacking two layers of cubes. Fill in the blanks with how many cubes are in each layer.

LAYER 2= _____ cubes

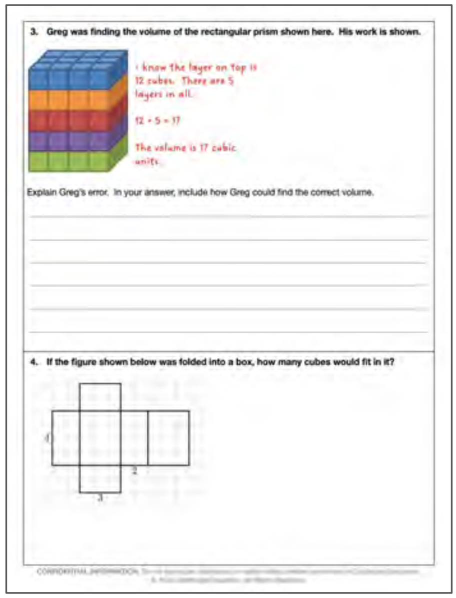
LAYER 1= _____ cubes

Determine the volume of Susannah's rectangular prism.

2. Look at the figure below.

How many cubes are in each layer?

What is the volume of the figure? Show or explain how you know.



3. Greg was finding the volume of the rectangular prism shown here. His work is shown.

I know the layer on top is 12 cubes. There are 5 layers in all.

12 + 5 = 17

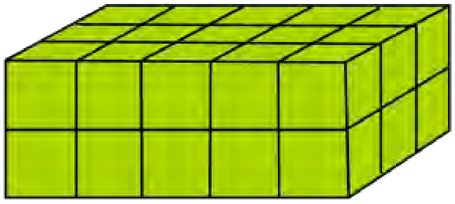
The volume is 17 cubic units.

Explain Greg's error. In your answer, include how Greg could find the correct volume.

4. If the figure shown below was folded into a box, how many cubes would fit in it?

Name: ____ G5 U5 Lesson 1 - Let's Try It

1. Look at the figure shown.

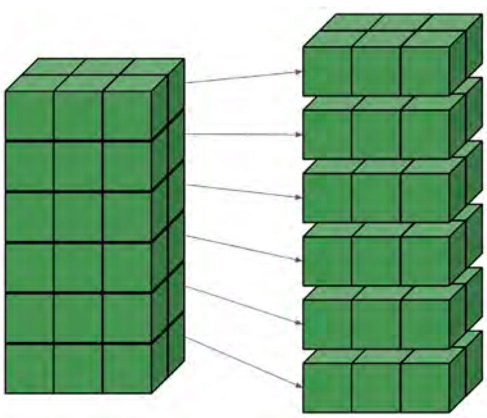


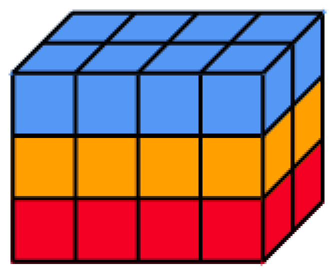
a. How many cubes are in the top layer of this rectangular prism? __________ cubes

b. How many cubes are in the bottom layer of this rectangular prism? __________ cubes

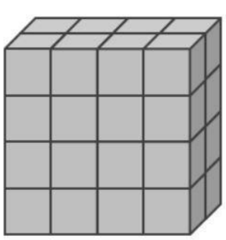
c. What is the volume of the rectangular prism? Show your work and include the correct unit.

2. For each rectangular prism shown below, find the number of cubes in each layer. Then find the total volume.





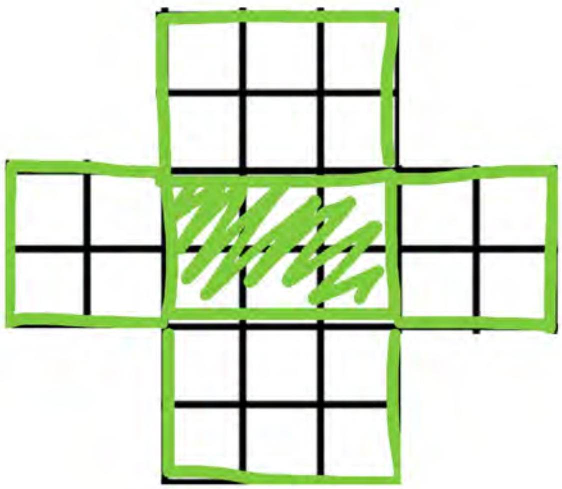
3. Complete the blanks to show how you can use multiplication or repeated addition to calculate the volume of this rectangular prism.



________ x ________ = ________
cubes in 1 layer x number of layers = volume

________ + ________ + ________ + ________ = ________
cubes in 1 layer + cubes in 1 layer + cubes in 1 layer + cubes in 1 layer = volume

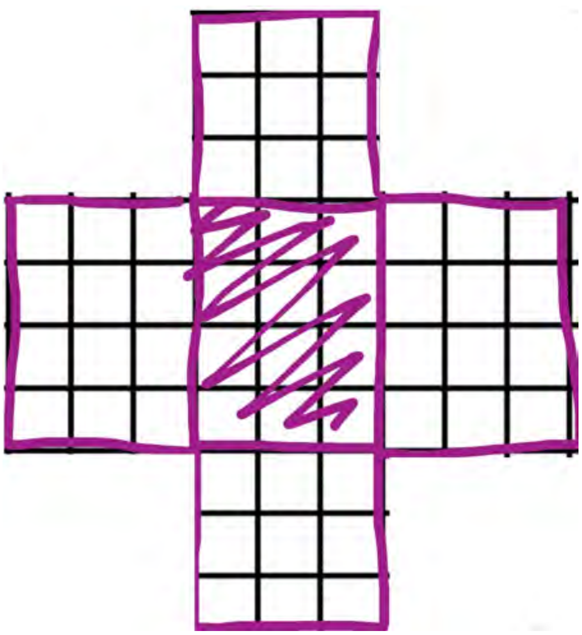
3. The gridded figure
below is going to be
folded to make a box.



Predict how many cubes will fit in the box.

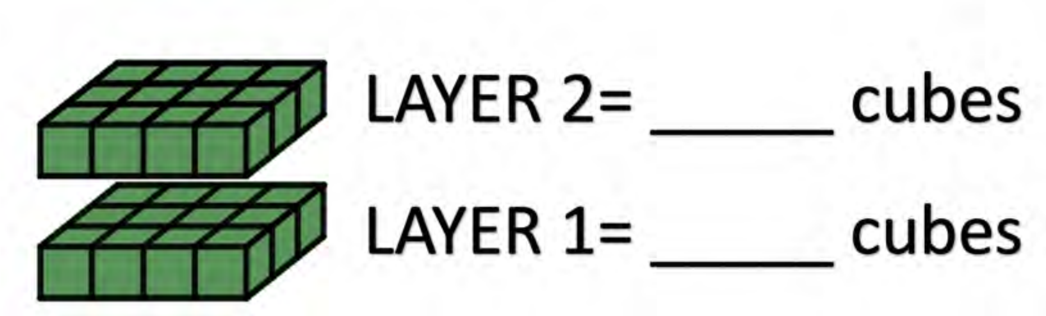
Determine the volume of the box. Show or explain how you know.

4. Parker said that if the figure below was folded into a box, it would have a volume of 12 cubic units. He said that's because the shaded rectangle has dimensions of 3 units by 4 units.



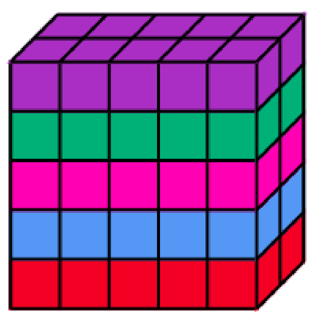
Why is Parker incorrect? Explain how to correctly find the volume of the figure.

1. Susannah is building a rectangular prism out of cubes by stacking two layers of cubes. Fill in the blanks with how many cubes are in each layer.



Determine the volume of Susannah's rectangular prism.

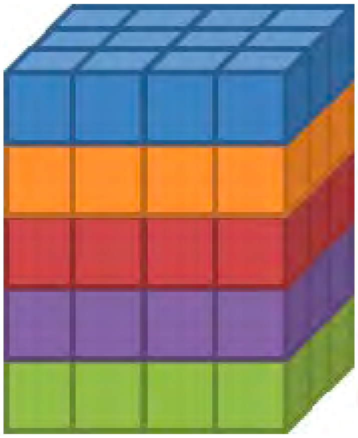
2. Look at the figure below.



How many cubes are in each layer?

What is the volume of the figure? Show or explain how you know.

3. Greg was finding the volume of the rectangular prism shown here. His work is shown.



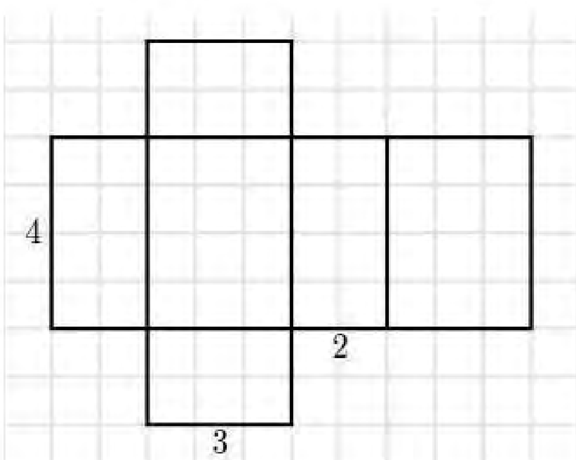
I know the layer on top is 12 cubes. There are 5 layers in all.

$12 + 5 = 17$

The volume is 17 cubic units.

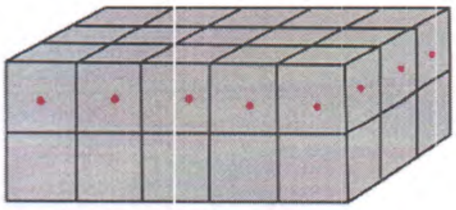
Explain Greg's error. In your answer, include how Greg could find the correct volume.

4. If the figure shown below was folded into a box, how many cubes would fit in it?



Name: KEY

1. Look at the figure shown.



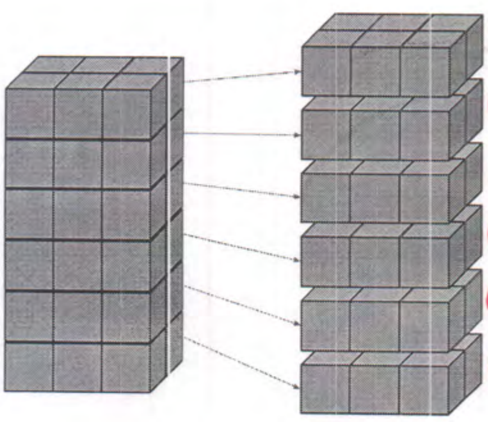
a. How many cubes are in the top layer of this rectangular prism? 15 cubes

b. How many cubes are in the bottom layer of this rectangular prism? 15 cubes

c. What is the volume of the rectangular prism? Show your work and include the correct unit.

15 + 15 = 30 30 cubic units

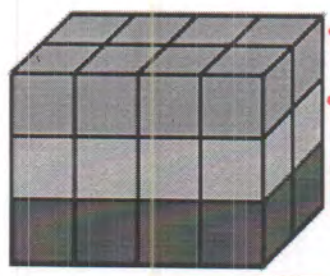
2. For each rectangular prism shown below, find the number of cubes in each layer. Then find the total volume.



6
6
6
6
6
6

6 × 6

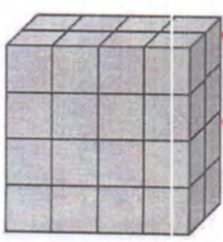
$36u^3$



8
8
8

$8 \times 3 = 24u^3$

3. Complete the blanks to show how you can use multiplication or repeated addition to calculate the volume of this rectangular prism.

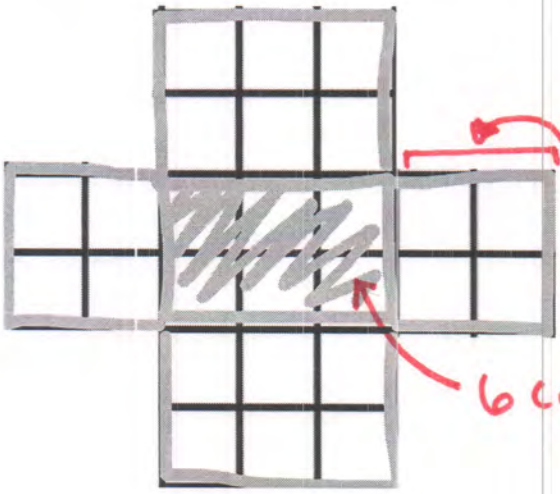


8
8
8
8

8 (cubes in 1 layer) x 4 (number of layers) = $32u^3$ (volume)

8 (cubes in 1 layer) + 8 (cubes in 1 layer) + 8 +8 (cubes in 1 layer) = $32u^3$ (volume)

3. **The gridded figure below is going to be folded to make a box.**



Predict how many cubes will fit in the box.

I know 6 cubes fit in the bottom, so maybe 12 or 18.

Determine the volume of the box. Show or explain how you know.

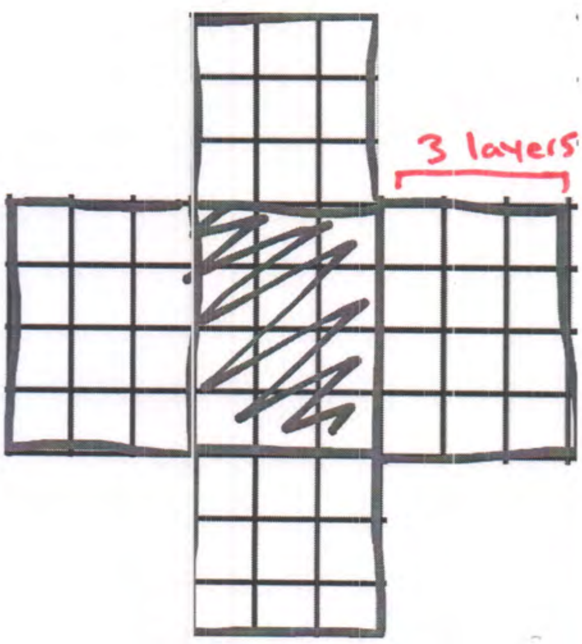
the box would be 2 layers tall

6 cubes in bottom layer

6 cubes + 6 cubes = 12 cubes

$12 u^3$

4. **Parker said that if the figure below was folded into a box, it would have a volume of 12 cubic units. He said that's because the shaded rectangle has dimensions of 3 units by 4 units.**

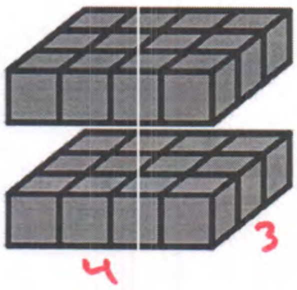


Why is Parker incorrect? Explain how to correctly find the volume of the figure.

The shaded area is just the bottom layer. The bottom layer has 12 cubes, but the prism will have 3 layers. 3 layers of 12 cubes means the volume is 36 cubic units.

Name: KEY

1. Susannah is building a rectangular prism out of cubes by stacking two layers of cubes. Fill in the blanks with how many cubes are in each layer.



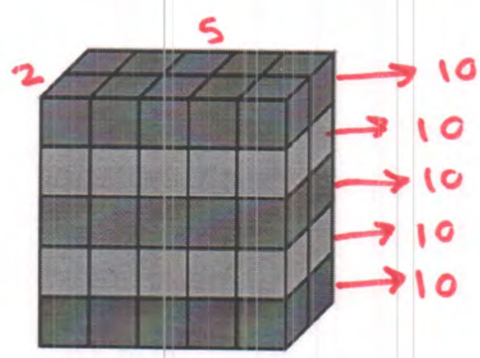
LAYER 2= 12 cubes

LAYER 1= 12 cubes

Determine the volume of Susannah's rectangular prism.

$12 + 12 = 24\ u^3$

2. Look at the figure below.



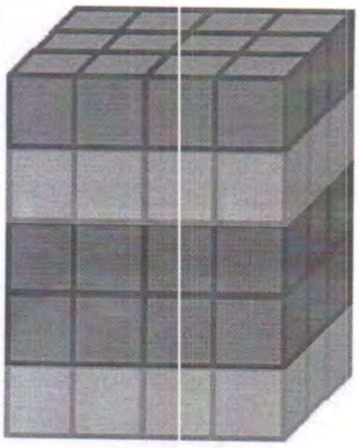
How many cubes are in each layer?

10 cubes

What is the volume of the figure? Show or explain how you know.

5 layers × 10 cubes = 50 cubic units

3. **Greg was finding the volume of the rectangular prism shown here. His work is shown.**



I know the layer on top is 12 cubes. There are 5 layers in all.

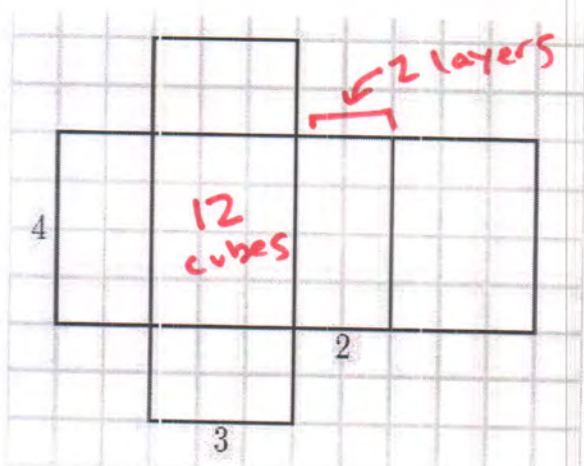
$12 + 5 = 17$

The volume is 17 cubic units.

Explain Greg's error. In your answer, include how Greg could find the correct volume.

Greg added the number of cubes in each layer to the number of layers. Each layer is an equal group of 12 cubes, so Greg should multiply 5×12 to find the volume. The volume is $60\ u^3$.

4. **If the figure shown below was folded into a box, how many cubes would fit in it?**



$12 + 12$

24 cubes

G5 U5 Lesson 2

Compose and decompose right rectangular prisms using layers.

G5 U5 Lesson 2 - Students will compose and decompose right rectangular prisms using layers

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): In our previous lesson, we spent time thinking about the volume of right rectangular prisms. What are some things you remember about our work with volume? What is volume? What units do we use to measure it? How did we find volume? Possible Student Answers, Key Points:

- Volume is the amount of space a three-dimensional figure takes up.
- We measure volume in cubic units. We can write cubic units as u^3.
- Volume is equal to the number of cubic units you can pack in a rectangular prism without gaps.
- In our last lesson, we looked at the bottom layer of cubes to help us think about how many cubes would fill the entire figure.

Excellent thinking! Today, we'll continue exploring volume, and we'll pay extra close attention to the layers in our right rectangular prisms. Thinking about a prism in layers can help us efficiently find its volume. Let's work through some examples together, and I'll show you what I mean.

Let's Talk (Slide 3): Before we look at some problems, take a look at the two figures shown here. What do you notice is the same? What is different? Possible Student Answers, Key Points:

- They're both rectangular prisms. It looks like they're the same size. They both have sections that are shaded with colors.
- They're colors are different. The first rectangular prism is split into two layers. The second rectangular prism is cut into layers going the other way.

I noticed some of the same things! These are the same rectangular prisms. The only difference is that they are partitioned into layers differently. The one on the left is partitioned into a bottom layer, and a top layer. The one on the right is partitioned into layers going left to right. The same rectangular prism can be partitioned into layers in different ways.

$$\begin{array}{r} 15 \\ +\ 15 \\ \hline \end{array}$$

If I look at the first prism, I see the bottom layer is 3 rows of 5 cubes. That means each layer has 15 cubes. I can think of the volume of this prism as being 15 cubes on the bottom and 15 cubes on the top. *(write 15 + 15 vertically to mirror the structure of the layers)*

$$6+6+6+6+6=$$

The second prism shows 5 layers. I can see from the purple layer, that each layer has 6 cubes. I can think of the volume of the prism as being *(point to each layer)* 6 cubes, 6 cubes, 6 cubes, 6 cubes, and 6 cubes. *(write 6 + 6 + 6 + 6 + 6 = horizontally to mirror the structure of the layers)*

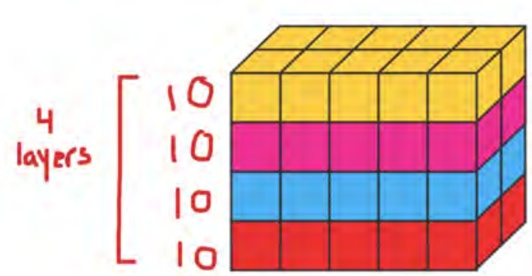
What do you notice about the two ways we can think about this prism's volume? Possible Student Answers, Key Points:

- They use different numbers. One shows two layers of 15, and the other shows 5 layers of 6.
- Both equations total 30. Both figures have the same volume, we're just thinking of it differently.

Both prisms have a volume of 30 cubic units! We know two layers of 15 will give us a total of 30 cubes. We know five layers of 6 will give us a total of 30 cubes. No matter how we decompose a rectangular prism into layers, the prism will have the same volume. Let's apply this thinking to a couple math problems.

Let's Think (Slide 4): Take a look at the rectangular prism shown here. We'll answer a few questions about this prism to think about its volume. The first question asks us to determine how many cubes are in each layer. We can look at any layer, since they're all the same size, but which layer might be easiest to look at and why? Possible Student Answers, Key Points:

- I can look at the yellow layer on top, because I can just count all the cubes.
- I can look at the bottom layer, since that's what we did in our previous lesson. I see it has a length of 5 cubes and a width of 2 cubes.



Let's look at the yellow layer on top, since in this image we can see every cube. I see the top layer is 5 cubes long and 2 cubes wide. There are 10 cubes in the top layer. Great, we've answered the first question! *(label 10 next to each layer)*

The second question asks how many layers are in the figure. What do you think? Possible Student Answers, Key Points:

- There are 4 layers, because each layer is a different color.
- There are 4 layers, because I see the prism is 4 cubes tall.

Correct, there are 4 layers in this figure. *(label the image with a bracket to show there are 4 layers)* So if each layer is 10 cubes, and there are 4 layers, we can find the volume. How could we use that information to determine how many cubes are in the entire prism? Possible Student Answers, Key Points:

- I can think of 4 layers of 10 as 4 x 10. The volume is 40 cubic units.
- I can add 10 + 10 + 10 + 10 to get a total volume of 40 cubic units.

Whether we use repeated addition or multiplication, we can see that the volume of a prism made of 4 layers of 10 cubes is 40 cubic units.

Let's Think (Slide 5): This problem shows the same rectangular prism three times. We're going to decompose the prism into layers in different ways and record our findings in the chart.

When we first started learning about volume, we thought about stacking cubes into the bottom layer of a box and working to fill the box. Let's think of this prism as having a bottom layer first. *(shade bottom layer with one color, middle layer with another, and top layer with another)* We can think of the prism as being decomposed into *(point to each)* a bottom layer, a middle layer, and a top layer. Based on this decomposition, help me fill out the table. How many cubes are in each layer? What is our number of layers? What is the volume? *(fill answers into chart as student shares)* Possible Student Answers, Key Points:

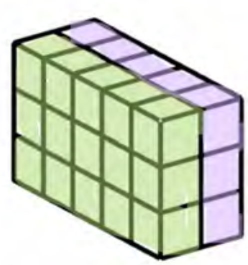
- I see there are three layers, because we shaded them. The top layer is easiest to see, so I can count that there are 10 cubes in that layer. I know 3 layers of 10 is 30. The volume is 30 cubic units.

Now let's think of the same prism decomposed into different layers. We can think about the layers kind of like slicing a cake. In our last example, we sliced so there were layers going from bottom to top. This time, I'll slice the layers so they go from one side to the other side, like this. *(shade each layer with a different color as shown)*

The prism is still the same prism, we're just looking at it differently. What do you notice about how we decomposed it this time? Possible Student Answers, Key Points:

- Our layers look vertical instead of horizontal.
- We have more layers.
- Our last layers were 10 cubes each, but these look like less.

Let's see if we can fill out the chart now. How many cubes are in each layer? (6) I can look at any layer to answer that, but the right hand layer is the easiest to see and count. There are 6 cubes in each layer this time. *(fill answers in chart as student shares)* How many layers compose the prism? (5) We shaded 5 layers this time. If we have 5 layers, and each layer contains 6 cubes, what is the volume of the prism? (30 cubic units)



We have one last decomposition to consider. We sliced from bottom to top, from left to right, and now I'll "slice" the prism from front to back. *(shade the front one color and back another color as shown)* How can I use this decomposition to fill in the information in the chart? *(fill in answers as student shares)* Possible Student Answers, Key Points:

- I can see the green section is 15 cubic units. Each layer contains 15 cubes.
- I see two layers, the front and back.
- I know the volume of the prism is 30 cubic units, because 15 + 15 is 30.

We just decomposed the same rectangular prism into layers three different ways. Take a look at the table we filled in. What do you notice about the information? Possible Student Answers, Key Points:

- The volume is the same each time.
- The first two numbers are factors that we can multiply to get 30.

Cubes in Each Layer	Number of Layers	Volume (in cubic units)
10 ×	3 =	30
6 ×	5 =	30
15 ×	2 =	30

The volume was 30 every time. *(highlight or circle all three volumes)* This makes sense, because the prism was the same each time. No matter how we look at it, it takes up the same amount of space. We can also see patterns in the cubes in each layer and the number of layers. If we know the cubes in each layer, we can multiply that by the number of layers to find the volume. *(fill in multiplication symbol and equal sign in the table as shown)* 3 layers of 10 cubes equals 30 cubes. 5 layers of 6 cubes equals 30 cubes. 2 layers of 15 cubes equals 30 cubes.

Pretty cool! Knowing the number of layers and the number of cubes in each layer can help us quickly find the volume of any rectangular prism. It's extra cool that we can decompose a prism in several different ways and still arrive at the same volume. I think we're ready for you to help me with some more problems.

Let's Try it (Slides 6 - 7):   Now let's work on composing and decomposing right rectangular prisms using layers together. As we work through each example, we'll want to make sure we consider how many cubes are in each layer and how many layers make up the entire rectangular prism. Knowing these two pieces of information can help us efficiently find how many cubic units compose the figure without having to count each unit. We should also keep in mind that there are many ways to decompose the same figure into layers. Whether we think about horizontal or vertical layers, we can still find the volume. Let's try it out with some more examples.

WARM WELCOME

Today we will compose and decompose right rectangular prisms using layers.

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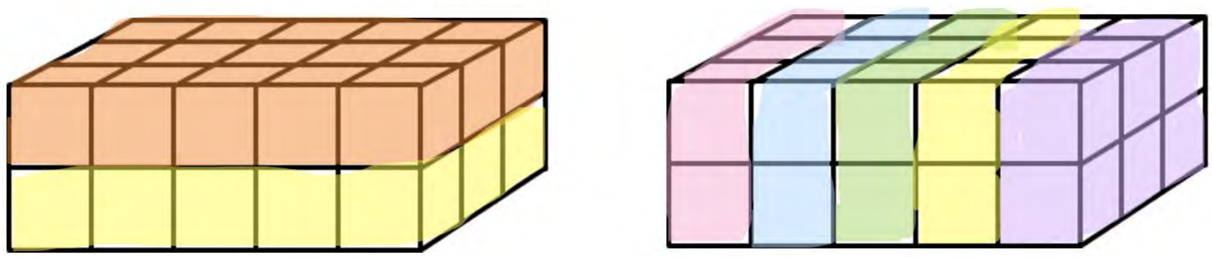
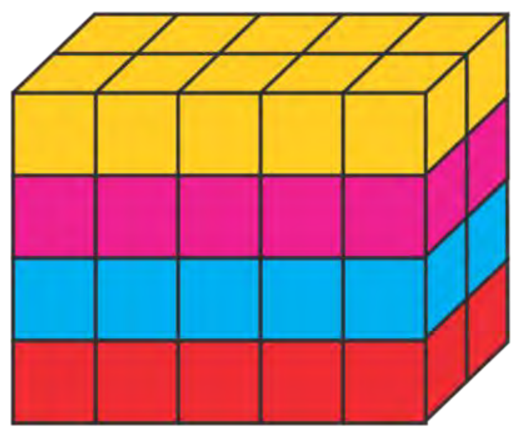
Let's Talk:

What's the same?
What's different?



Let's Think:



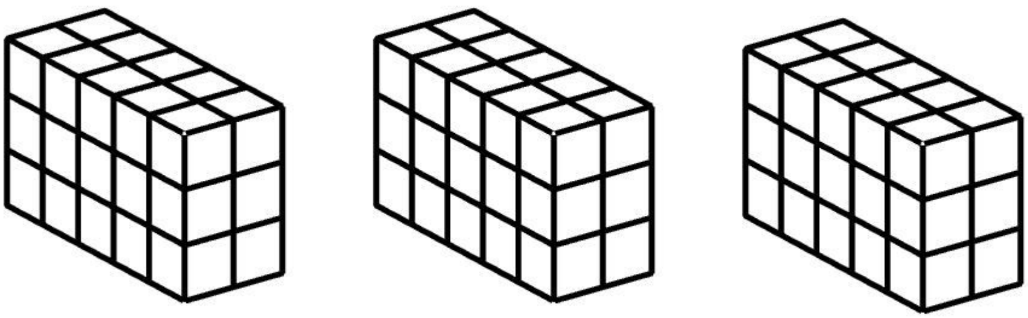
How many cubes are in each layer?

How many layers are in the figure?

What is the volume of the rectangular prism?

Let's Think:

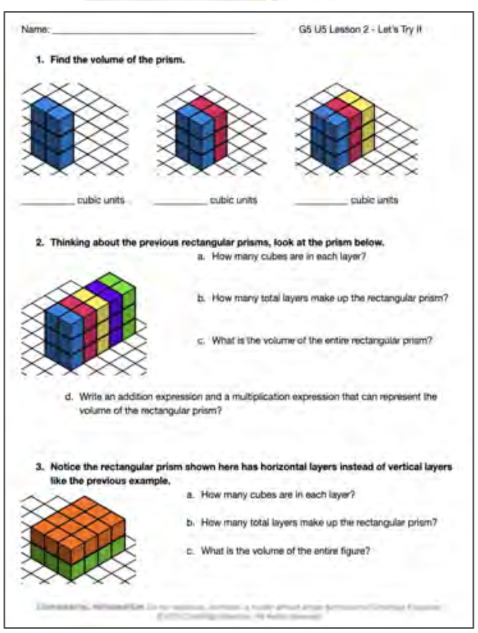
Decompose the rectangle shown here into layers 3 different ways. Record your findings in the table.



Cubes in Each Layer	Number of Layers	Volume (in cubic units)

Let's Try It:

Let's explore composing and decomposing right rectangular prisms into layers together.



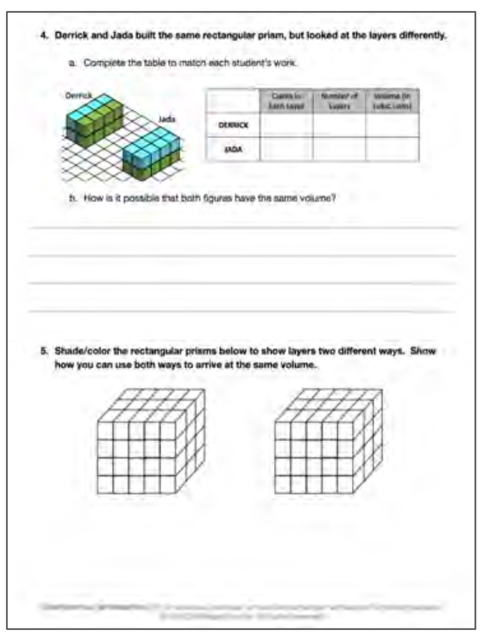
Name: ______________________ G5 U5 Lesson 2 - Let's Try It

1. **Find the volume of the prism.**

_________ cubic units _________ cubic units _________ cubic units

2. **Thinking about the previous rectangular prisms, look at the prism below.**
   a. How many cubes are in each layer?
   b. How many total layers make up the rectangular prism?
   c. What is the volume of the entire rectangular prism?
   d. Write an addition expression and a multiplication expression that can represent the volume of the rectangular prism?

3. **Notice the rectangular prism shown here has horizontal layers instead of vertical layers like the previous example.**
   a. How many cubes are in each layer?
   b. How many total layers make up the rectangular prism?
   c. What is the volume of the entire figure?



4. **Derrick and Jada built the same rectangular prism, but looked at the layers differently.**
   a. Complete the table to match each student's work.

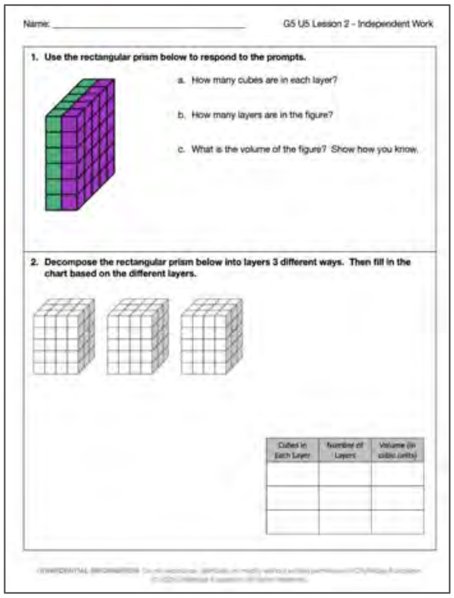
	Cubes in Each Layer	Number of Layers	Volume (in cubic units)
DERRICK			
JADA			

   b. How is it possible that both figures have the same volume?

5. **Shade/color the rectangular prisms below to show layers two different ways. Show how you can use both ways to arrive at the same volume.**

On your Own:

Now it's time to compose and decompose right rectangular prisms using layers on your own.


Name: ______________________ G5 U5 Lesson 2 - Independent Work

1. Use the rectangular prism below to respond to the prompts.

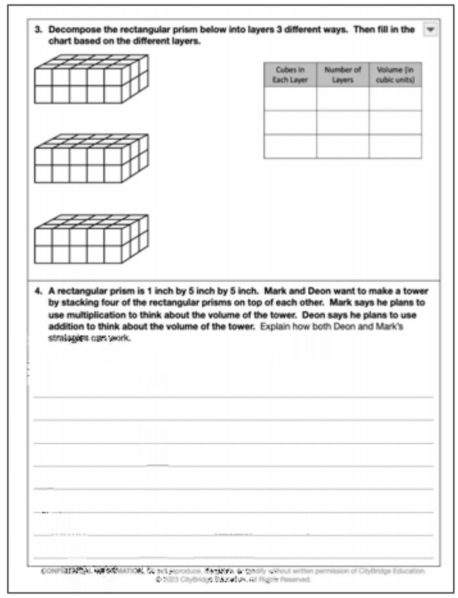
a. How many cubes are in each layer?

b. How many layers are in the figure?

c. What is the volume of the figure? Show how you know.

2. Decompose the rectangular prism below into layers 3 different ways. Then fill in the chart based on the different layers.

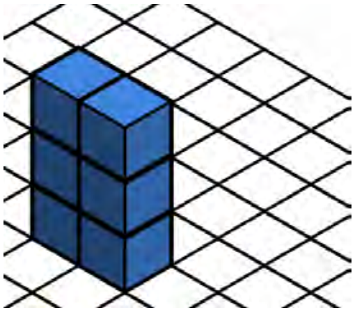
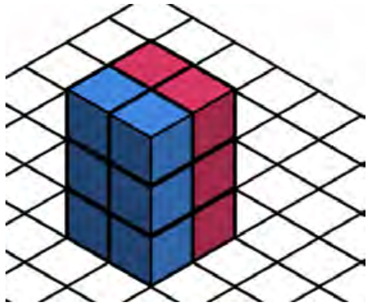
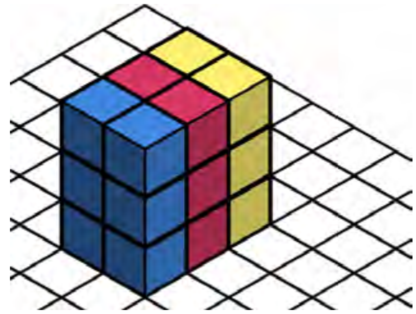
Cubes in Each Layer	Number of Layers	Volume (in cubic units)


3. Decompose the rectangular prism below into layers 3 different ways. Then fill in the chart based on the different layers.

Cubes in Each Layer	Number of Layers	Volume (in cubic units)

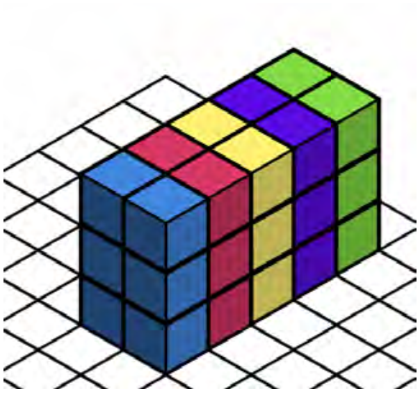
4. A rectangular prism is 1 inch by 5 inch by 5 inch. Mark and Deon want to make a tower by stacking four of the rectangular prisms on top of each other. Mark says he plans to use multiplication to think about the volume of the tower. Deon says he plans to use addition to think about the volume of the tower. Explain how both Deon and Mark's strategies can work.

1. Find the volume of the prism.

_____________ cubic units _____________ cubic units _____________ cubic units

2. Thinking about the previous rectangular prisms, look at the prism below.
   a. How many cubes are in each layer?

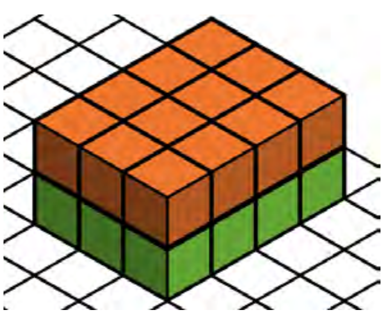


   b. How many total layers make up the rectangular prism?

   c. What is the volume of the entire rectangular prism?

   d. Write an addition expression and a multiplication expression that can represent the volume of the rectangular prism?

3. Notice the rectangular prism shown here has horizontal layers instead of vertical layers like the previous example.
   a. How many cubes are in each layer?

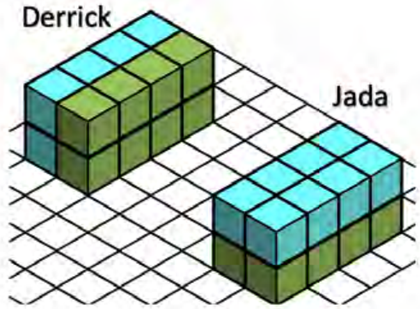


   b. How many total layers make up the rectangular prism?

   c. What is the volume of the entire figure?

4. Derrick and Jada built the same rectangular prism, but looked at the layers differently.

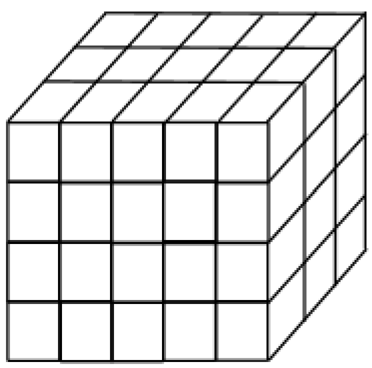
   a. Complete the table to match each student's work.

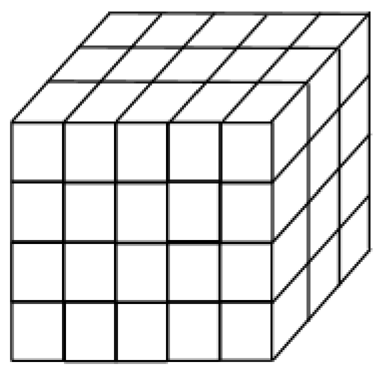


	Cubes in Each Layer	Number of Layers	Volume (in cubic units)
DERRICK			
JADA			

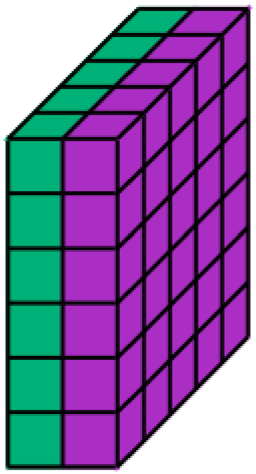
b. How is it possible that both figures have the same volume?

5. Shade or color the rectangular prisms below to show layers two different ways. Show how you can use both ways to arrive at the same volume.





1. Use the rectangular prism below to respond to the prompts.

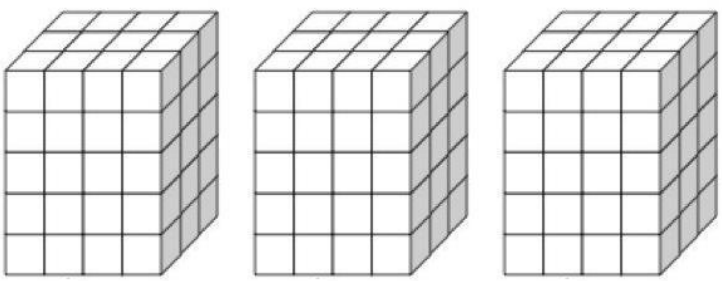


a. How many cubes are in each layer?

b. How many layers are in the figure?

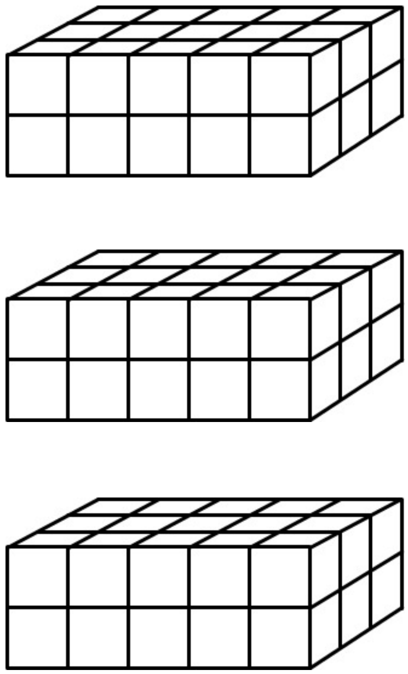
c. What is the volume of the figure? Show how you know.

2. Decompose the rectangular prism below into layers 3 different ways. Then fill in the chart based on the different layers.



Cubes in Each Layer	Number of Layers	Volume (in cubic units)

3. Decompose the rectangular prism below into layers 3 different ways. Then fill in the chart based on the different layers.

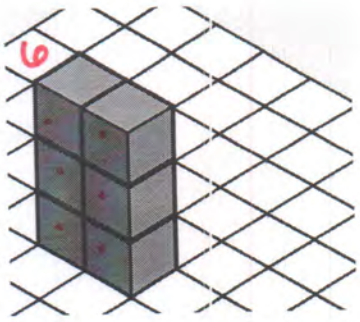


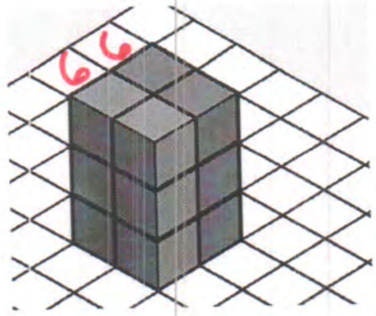
Cubes in Each Layer	Number of Layers	Volume (in cubic units)

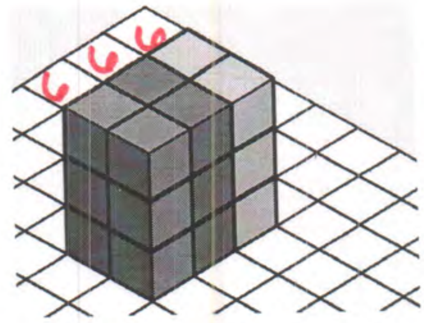
4. A rectangular prism is 1 inch by 5 inch by 5 inch. Mark and Deon want to make a tower by stacking four of the rectangular prisms on top of each other. Mark says he plans to use multiplication to think about the volume of the tower. Deon says he plans to use addition to think about the volume of the tower. Explain how both Deon and Mark's strategies can work.

Name: KEY

1. Find the volume of the prism.





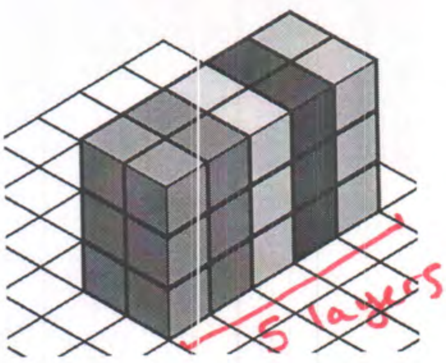


6 cubic units

12 cubic units

18 cubic units

2. Thinking about the previous rectangular prisms, look at the prism below.



a. How many cubes are in each layer?

6 cubes

b. How many total layers make up the rectangular prism?

5 layers

c. What is the volume of the entire rectangular prism?

$6 \times 5 = 30\ u^3$

d. Write an addition expression and a multiplication expression that can represent the volume of the rectangular prism?

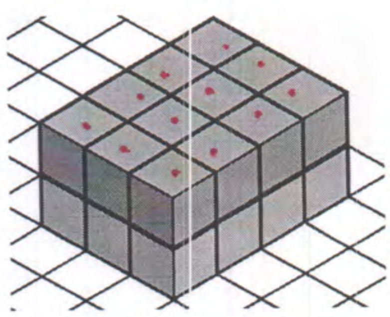
6×5

$30 u^3$

$6 + 6 + 6 + 6 + 6$

$30 u^3$

3. Notice the rectangular prism shown here has horizontal layers instead of vertical layers like the previous example.



a. How many cubes are in each layer?

12 cubes

b. How many total layers make up the rectangular prism?

2 layers

c. What is the volume of the entire figure?

$12 + 12$

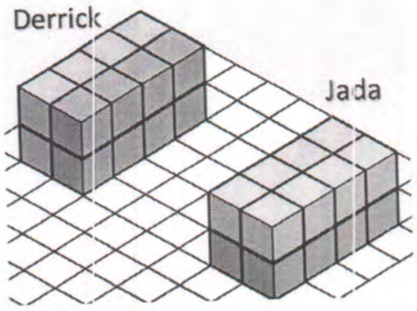
$24 u^3$

2×12

$24 u^3$

4. **Derrick and Jada built the same rectangular prism, but looked at the layers differently.**

a. Complete the table to match each student's work.

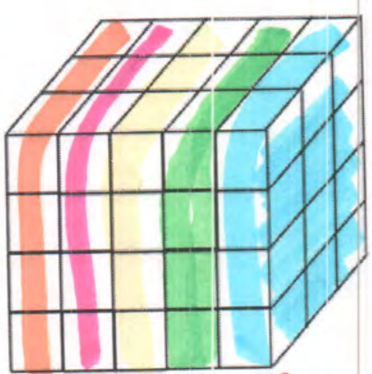


	Cubes in Each Layer	Number of Layers	Volume (in cubic units)
DERRICK	8	2	16
JADA	8	2	16

b. How is it possible that both figures have the same volume?

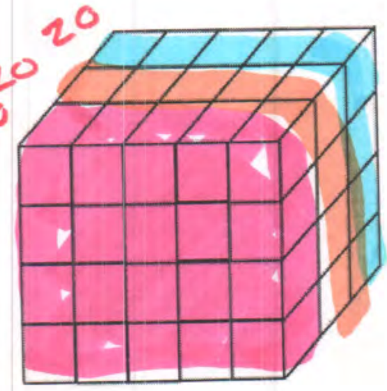
Derrick looked at layers with a vertical cut. Jada looked at layers with a horizontal cut. It's the same prism with the same cubes, they are just looking at the layers differently.

5. **Shade or color the rectangular prisms below to show layers two different ways. Show how you can use both ways to arrive at the same volume.**



5×12

60 u^3

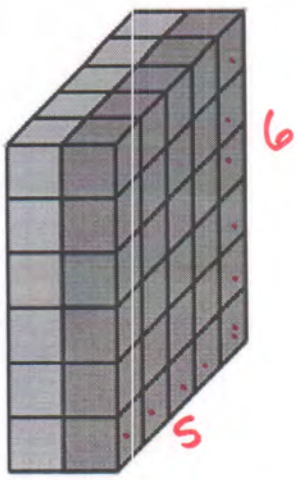


3×20

60 u^3

Name: KEY

1. Use the rectangular prism below to respond to the prompts.



a. How many cubes are in each layer?

30 cubes

b. How many layers are in the figure?

30 + 30 = 60 cubes

c. What is the volume of the figure? Show how you know.

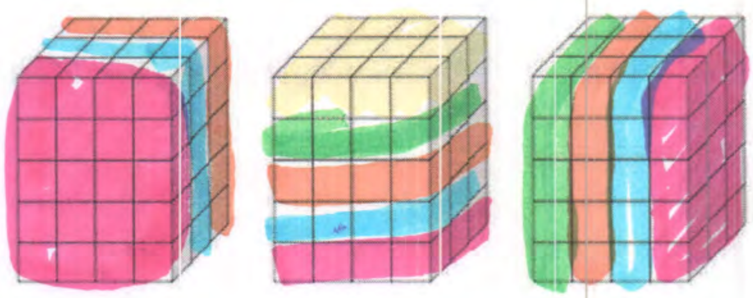
60 u^3

30 + 30

OR

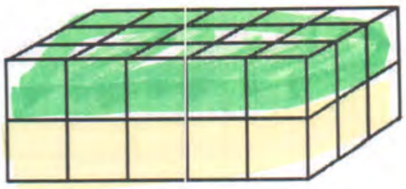
2 × 30

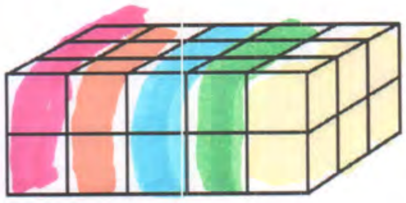
2. Decompose the rectangular prism below into layers 3 different ways. Then fill in the chart based on the different layers.

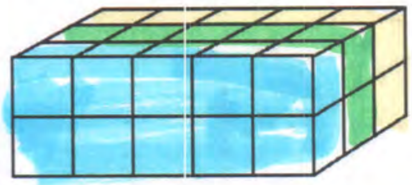


Cubes in Each Layer	Number of Layers	Volume (in cubic units)
20	3	60
12	5	60
15	4	60

3. Decompose the rectangular prism below into layers 3 different ways. Then fill in the chart based on the different layers.







Cubes in Each Layer	Number of Layers	Volume (in cubic units)
15	2	30
6	5	30
10	3	30

4. A rectangular prism is 1 inch by 5 inch by 5 inch. Mark and Deon want to make a tower by stacking four of the rectangular prisms on top of each other. Mark says he plans to use multiplication to think about the volume of the tower. Deon says he plans to use addition to think about the volume of the tower. Explain how both Deon and Mark's strategies can work.

The volume of one prism would be 25 cubic inches. Mark could use multiplication by multiplying 4 layers by 25 cubes. Deon could use repeated addition by doing 25 + 25 + 25 + 25 to show the four layers. Either way the answer is 100 cubic inches.

G5 U5 Lesson 3

Use multiplication to calculate volume.

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G5 U5 Lesson 3 - Students will use multiplication to calculate volume

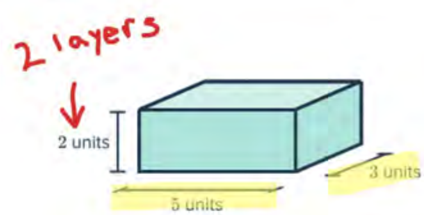
Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): We've been building our understanding of volume for the past couple lessons. We've counted cubes to find the volume of rectangular prisms, and we've spent time decomposing prisms into layers to calculate the volume. Today, we're going to become even stronger as we think through even more efficient ways of calculating the volume of right rectangular prisms.

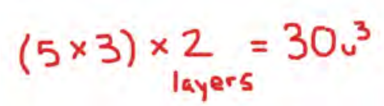
Let's Talk (Slide 3): Take a look at these images representing a rectangular prism. You probably notice that the first image doesn't show any unit cubes. Do you think it's possible to calculate the volume of the rectangular prism, even though we can't visually count the cubes that would go inside? How could we still think about the volume? Possible Student Answers, Key Points:

- We can use the measurements that are labeled to think about how many cubes could fit inside.
- We could calculate how many cubes could go into one layer and work from there.
- We could visualize the cubes, kind of like the second picture shows.

Great thinking! We can use labeled dimensions of length, width, and height to help us consider how many cubes can fit in a figure even when we don't actually *see* the cubes.



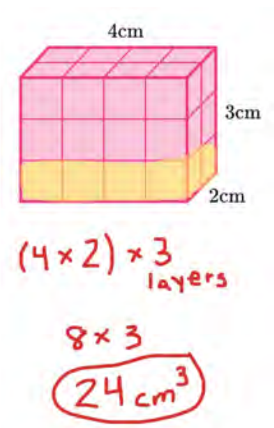
In this example, I can picture the bottom layer being 5 cubic units long and 3 cubic units wide. *(highlight those dimensions)* That means the bottom layer has a volume of 15 cubic units, because 5 x 3 = 15. The height is labeled 2 units, which I can think of as meaning there are two layers in this rectangular prism. *(label that the 2 units can be thought of as 2 layers)* Without having to physically see or count the cubes, I know this prism can be packed with 2 layers of 15 cubes.



What's the volume of this rectangular prism? (30 cubic units) Well done! We can think of 5 x 3 as representing the number of cubes in one layer, then we can multiply that quantity by the number of layers, which in this case is 2. *(write and label equation as shown)* The volume is 30 cubic units.

Today, we'll see how multiplication can be an efficient strategy to help us calculate the volume of rectangular prisms.

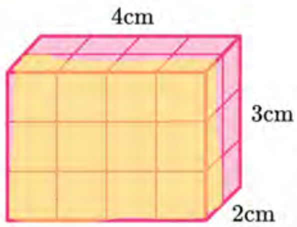
Let's Think (Slide 4): This problem wants us to find the volume of this rectangular prism using multiplication two different ways.



Let's start by thinking of it like our last problem. We'll focus on the bottom layer to start with. *(highlight or shade the bottom layer)* I see the bottom layer measures 4 cm long and 2 cm wide, so there are 8 cubes in the bottom layer. The picture and the height measurement show me we have 3 of those layers. So I can think of 3 layers of 8 cubes. I know that would be 24 cubes.

I can use multiplication to show that thinking. (*write (4 x 2) x 3)* The bottom layer can be thought of as 4 x 2. I can multiply that quantity by the 3 layers. 4 x 2 is 8. *(write 8 x 3 underneath the previous expression)* So the volume of the prism is 24 cubic centimeters. *(write answer)*

That's one way to find the volume. Let's try looking at it another way!



What if instead of looking at the bottom as one layer, we looked at the front as one layer? *(highlight or shade the front layer)* How many cubes are in this layer, and how many layers compose the entire rectangular prism? Possible Student Answers, Key Points:

- There are 12 cubes in the front layer. I can count them, or I can see 3 rows of 4.
- When we look at the prism this way, there are two layers. I see the front layer and one layer behind it.

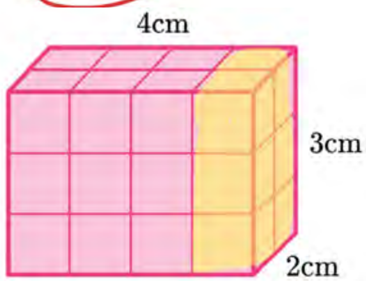
$(4 \times 3) \times 2$ layers

12×2

$24\ cm^3$

We can represent this decomposition using multiplication too. *(write and evaluate the expression as you narrate)* The front layer is 3 rows of 4, so we can think of that as 4 x 3. We need two layers of that quantity, so I can multiply that quantity by 2. 4 x 3 gives us 12, and 12 x 2 layers gives us a volume of 24 cubic centimeters.

We just solved for the volume of this rectangular prism two different ways using multiplication. Both times we got the same area, we just changed how we thought about the layers.



I know this problem only asked for two ways to find the volume, but I just thought of another way somebody might decompose this rectangular prism. *(highlight or shade the right-hand layer as shown)* How could somebody use multiplication to find the volume if they looked at the right side as a layer? Possible Student Answers, Key Points:

- The layer is 6 cubes, because 3 x 2 = 6.
- There are 4 layers if we decompose the rectangular prism this way.
- I can think of (3 x 2) x 4, which is 6 x 4. The volume is 24 cubic units.

Excellent thinking. We can use multiplication to find the volume of rectangular prisms in a variety of ways depending on how we look at the dimensions and think about the layers.

Let's Think (Slide 5): *(read the problem)* This problem wants us to find the volume of Kevin's cardboard box, but I notice they didn't include a picture so we can see the box.

I'll sketch a box so we can at least picture the sides. It's okay if the box isn't the exact right dimensions for now. *(sketch a box similar to the one shown)* Whenever a problem involving 2D or 3D figures doesn't include an image, it can be helpful to make a sketch so you at least have something to refer to as you work.

What information do we know about Kevin's box? Possible Student Answers, Key Points:

- It's made of cardboard.
- The area of the base is 4 square feet. The height is 3 feet.

Let's think about what we know and label our drawing. The height is 3 feet, that's important. *(label 3 feet as the height)* The area of the base is 4 square feet. If we picture 4 squares in the base, can you picture how many cubes would fit in that bottom layer? (4 cubes) If the area of the base is 4 square feet, that means we could place 1 cubic foot on top of each of those squares. So the bottom layer of this prism could hold 4 cubes. *(label that on the image)*

4×3 layers

$12\ ft^3$

That's enough information to help us find the volume of Kevin's box. The bottom layer can be packed with 4 cubic units. There are 3 layers in this prism. I know 3 groups of 4 cubes can be thought of as 3 x 4 using multiplication. *(write 4 x 3 layers)* What is the volume of the rectangular prism? (12 cubic feet) Nice work. *(write the answer)*

What was the same and different about this problem compared to the one we did before this? Possible Student Answers, Key Points:

- This one didn't have a picture with it, so we had to draw our own.
- The other problem asked us to find the volume in more than one way.
- This problem gave us the area of the base and the height. It didn't tell us the exact length and width.
- We used multiplication in both problems.

Whether we have a picture or not, we can use multiplication to find the volume of a rectangular prism. Whether we know the length, width, and height or just one layer and the other dimension, we can use multiplication to find the volume of a rectangular prism. It is an efficient way to calculate how much space a rectangular prism takes up.

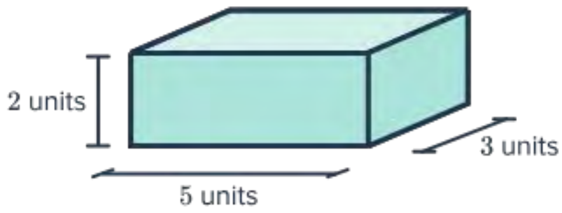
Let's Try it (Slides 6 - 7): Now let's try using multiplication to find the volume of rectangular prisms together. Remember, we can look at the layers of a rectangular prism in a way that makes most sense to us. We also know that we can sketch a picture of the figure if one is not provided. No matter what, multiplication can be a handy tool to help us efficiently arrive at the volume of a prism. Let's go for it. I'll be here to support you as needed.

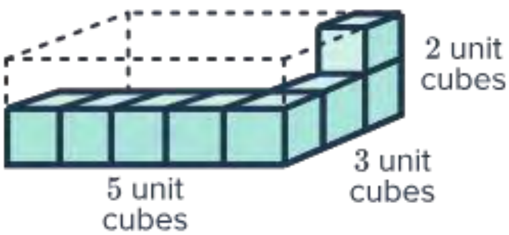
WARM WELCOME

Today we will use multiplication to calculate volume.

Let's Talk:

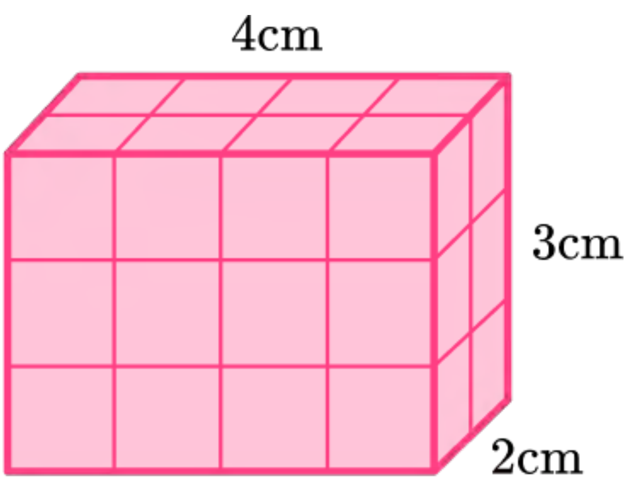
Help! The first image of the rectangular prism doesn't show any unit cubes!





Let's Think:

Use multiplication to find the volume of the rectangular prism. Show your work in two different ways.



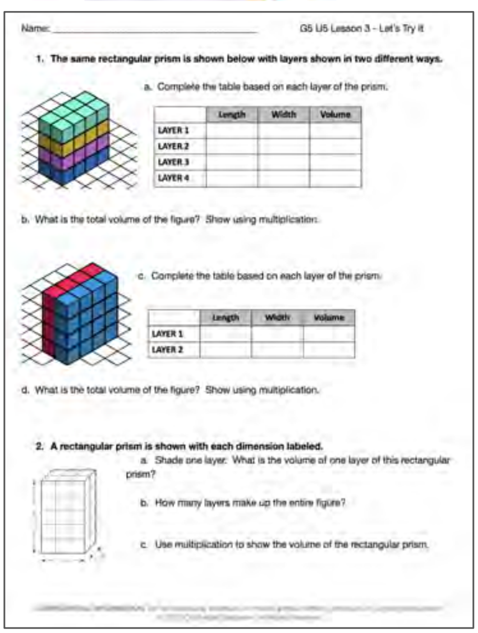
Let's Think:

Kevin is trying to find the volume of a cardboard box. The area of the base of the box is 4 square feet. The height of the box is 3 feet.

What is the volume of the cardboard box?

Let's Try It:

Let's explore using multiplication to calculate volume together.



Name: ______________________ G5 U5 Lesson 3 - Let's Try It

1. The same rectangular prism is shown below with layers shown in two different ways.

a. Complete the table based on each layer of the prism.

	Length	Width	Volume
LAYER 1			
LAYER 2			
LAYER 3			
LAYER 4			

b. What is the total volume of the figure? Show using multiplication.

c. Complete the table based on each layer of the prism.

	Length	Width	Volume
LAYER 1			
LAYER 2			

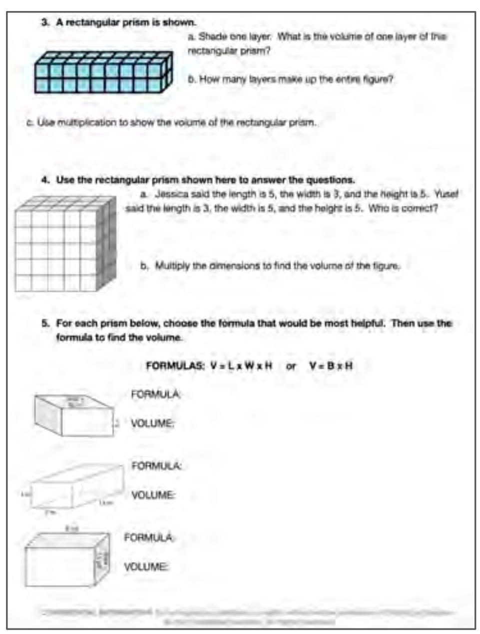
d. What is the total volume of the figure? Show using multiplication.

2. A rectangular prism is shown with each dimension labeled.

a. Shade one layer. What is the volume of one layer of this rectangular prism?

b. How many layers make up the entire figure?

c. Use multiplication to show the volume of the rectangular prism.



3. A rectangular prism is shown.

a. Shade one layer. What is the volume of one layer of the rectangular prism?

b. How many layers make up the entire figure?

c. Use multiplication to show the volume of the rectangular prism.

4. Use the rectangular prism shown here to answer the questions.

a. Jessica said the length is 5, the width is 3, and the height is 5. Yusef said the length is 3, the width is 5, and the height is 5. Who is correct?

b. Multiply the dimensions to find the volume of the figure.

5. For each prism below, choose the formula that would be most helpful. Then use the formula to find the volume.

FORMULAS: V = L x W x H or V = B x H

FORMULA:

VOLUME:

FORMULA:

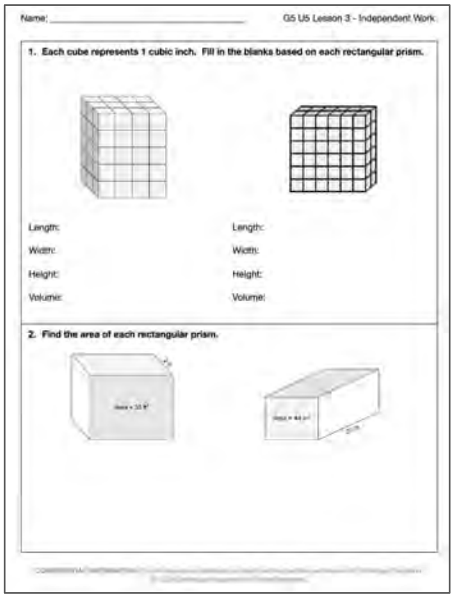
VOLUME:

FORMULA:

VOLUME:

On your Own:

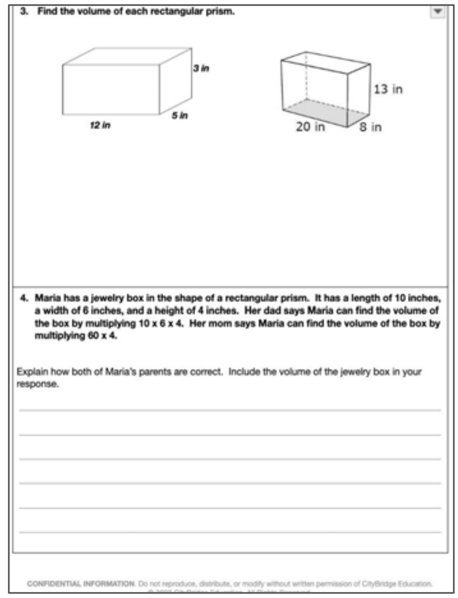
Now it's time to use multiplication to calculate volume on your own.


Name: ______________________ G5 U5 Lesson 3 - Independent Work

1. Each cube represents 1 cubic inch. Fill in the blanks based on each rectangular prism.

Length:	Length:
Width:	Width:
Height:	Height:
Volume:	Volume:

2. Find the area of each rectangular prism.


3. Find the volume of each rectangular prism.

4. Maria has a jewelry box in the shape of a rectangular prism. It has a length of 10 inches, a width of 6 inches, and a height of 4 inches. Her dad says Maria can find the volume of the box by multiplying 10 x 6 x 4. Her mom says Maria can find the volume of the box by multiplying 60 x 4.

Explain how both of Maria's parents are correct. Include the volume of the jewelry box in your response.

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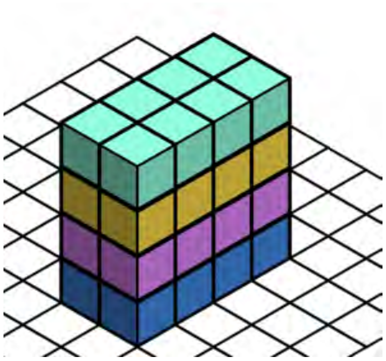
Name: ____ G5 U5 Lesson 3 - Let's Try It

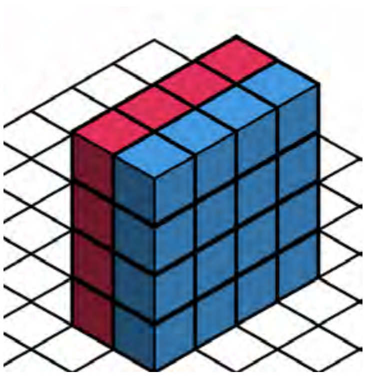
1. The same rectangular prism is shown below with layers shown in two different ways.



a. Complete the table based on each layer of the prism.

	Length	Width	Volume
LAYER 1			
LAYER 2			
LAYER 3			
LAYER 4			

b. What is the total volume of the figure? Show using multiplication.

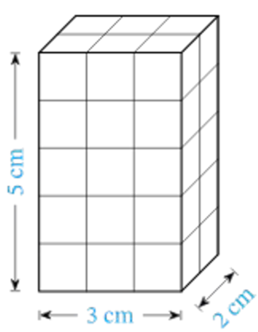


c. Complete the table based on each layer of the prism.

	Length	Width	Volume
LAYER 1			
LAYER 2			

d. What is the total volume of the figure? Show using multiplication.

2. A rectangular prism is shown with each dimension labeled.

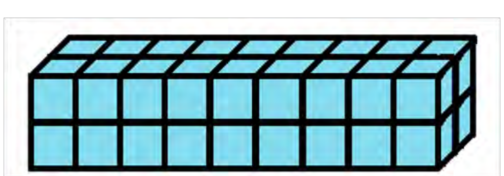


a. Shade one layer. What is the volume of one layer of this rectangular prism?

b. How many layers make up the entire figure?

c. Use multiplication to show the volume of the rectangular prism.

3. A rectangular prism is shown.

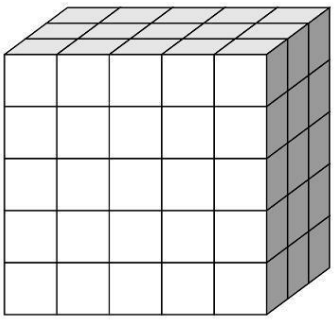


a. Shade one layer. What is the volume of one layer of this rectangular prism?

b. How many layers make up the entire figure?

c. Use multiplication to show the volume of the rectangular prism.

4. Use the rectangular prism shown here to answer the questions.

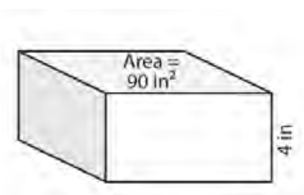


a. Jessica said the length is 5, the width is 3, and the height is 5. Yusef said the length is 3, the width is 5, and the height is 5. Who is correct?

b. Multiply the dimensions to find the volume of the figure.

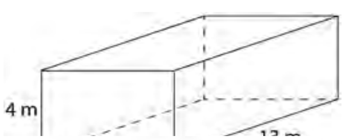
5. For each prism below, choose the formula that would be most helpful. Then use the formula to find the volume.

FORMULAS: V = L x W x H or V = B x H



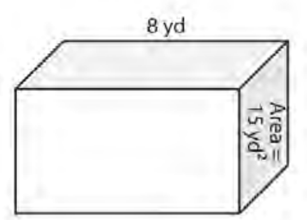
FORMULA:

VOLUME:



FORMULA:

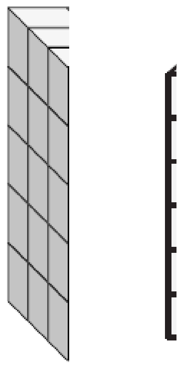
VOLUME:



FORMULA:

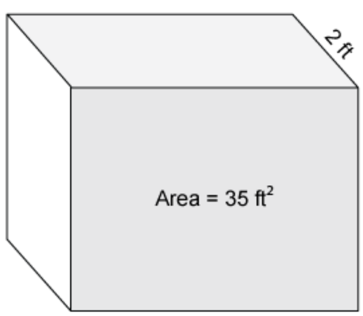
VOLUME:

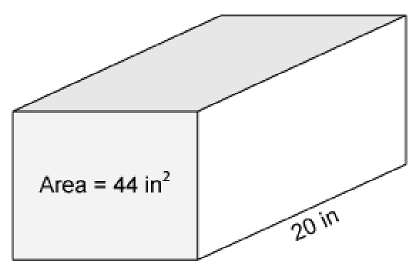
1. Each cube represents 1 cubic inch. Fill in the blanks based on each rectangular prism.



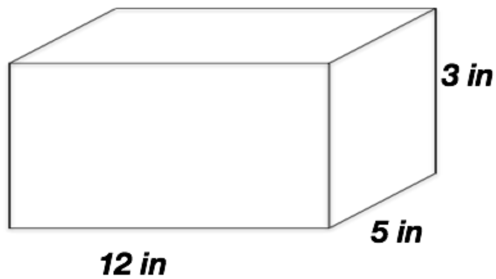
Length:	Length:
Width:	Width:
Height:	Height:
Volume:	Volume:

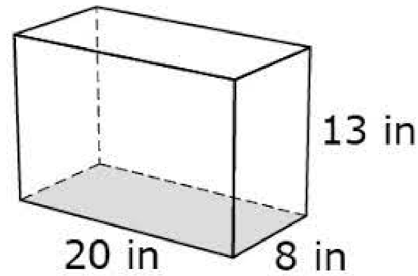
2. Find the volume of each rectangular prism.





3. Find the volume of each rectangular prism.



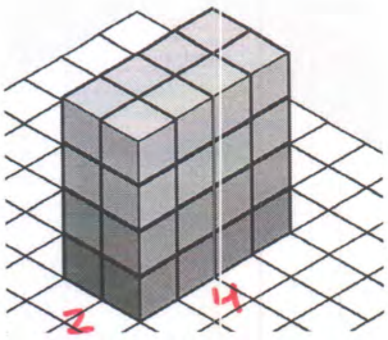


4. Maria has a jewelry box in the shape of a rectangular prism. It has a length of 10 inches, a width of 6 inches, and a height of 4 inches. Her dad says Maria can find the volume of the box by multiplying 10 x 6 x 4. Her mom says Maria can find the volume of the box by multiplying 60 x 4.

Explain how both of Maria's parents are correct. Include the volume of the jewelry box in your response.

Name: KEY

1. The same rectangular prism is shown below with layers shown in two different ways.

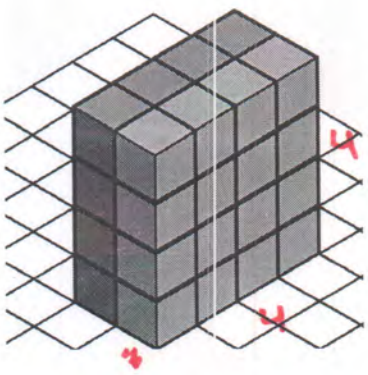


a. Complete the table based on each layer of the prism.

	Length	Width	Volume
LAYER 1	2	4	8
LAYER 2	2	4	8
LAYER 3	2	4	8
LAYER 4	2	4	8

b. What is the total volume of the figure? Show using multiplication.

8 × 4 = 32 u³
cubes layers



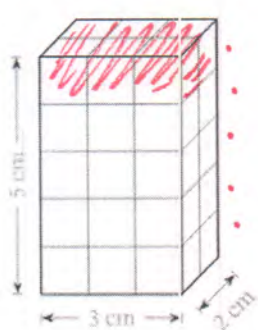
c. Complete the table based on each layer of the prism.

	Length	Width	Volume
LAYER 1	4	4	16
LAYER 2	4	4	16

d. What is the total volume of the figure? Show using multiplication.

16 × 2 = 32 u³
cubes layers

2. A rectangular prism is shown with each dimension labeled.



a. Shade one layer. What is the volume of one layer of this rectangular prism?

6 cm³

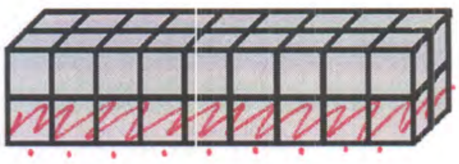
b. How many layers make up the entire figure?

5 layers

c. Use multiplication to show the volume of the rectangular prism.

5 × 6 = 30 cm³

3. A rectangular prism is shown.



a. Shade one layer. What is the volume of one layer of this rectangular prism?

18 u^3

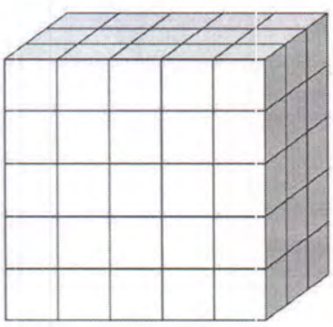
b. How many layers make up the entire figure?

2 layers

c. Use multiplication to show the volume of the rectangular prism.

$18 \times 2 = 36\ u^3$

4. Use the rectangular prism shown here to answer the questions.



a. Jessica said the length is 5, the width is 3, and the height is 5. Yusef said the length is 3, the width is 5, and the height is 5. Who is correct?

They are both correct. Length and width are interchangeable.

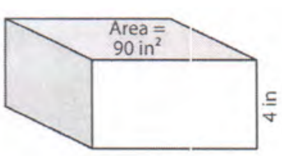
b. Multiply the dimensions to find the volume of the figure.

$5 \times 3 \times 5$

$15 \times 5 = 75\ u^3$

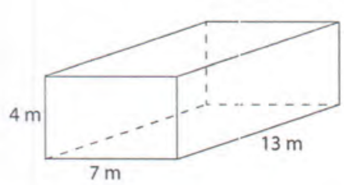
5. For each prism below, choose the formula that would be most helpful. Then use the formula to find the volume.

FORMULAS: V = L x W x H or V = B x H



FORMULA: $V = B \times H$

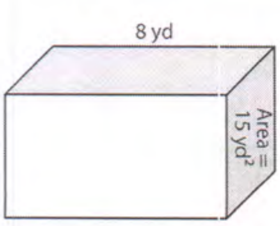
VOLUME: $V = 90 \times 4 \rightarrow 360\ in^3$



FORMULA: $V = L \times W \times H$

VOLUME: $V = 7 \times 13 \times 4$

$91 \times 4 \rightarrow 364\ m^3$

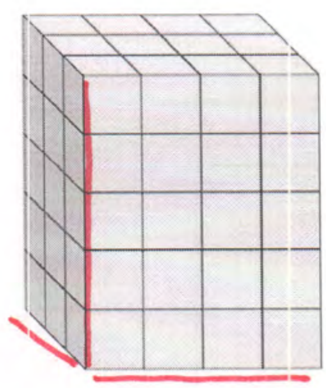


FORMULA: $V = B \times H$

VOLUME: $V = 15 \times 8 \rightarrow 120\ yd^3$

Name: KEY

1. Each cube represents 1 cubic inch. Fill in the blanks based on each rectangular prism.

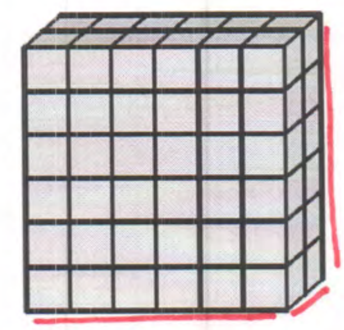


Length: 4

Width: 3

Height: 5

Volume: $4 \times 3 \times 5$
$12 \times 5 = 60 \text{ in}^3$



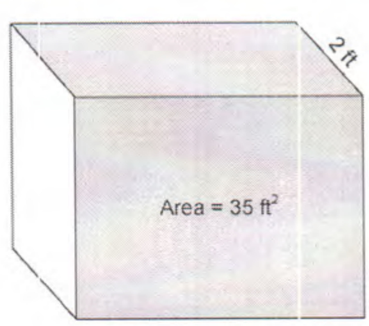
Length: 6

Width: 2

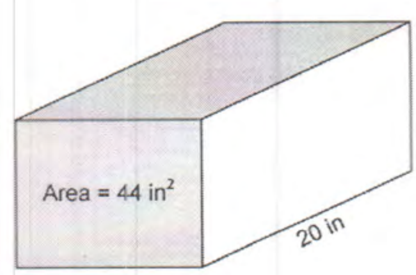
Height: 6

Volume: $6 \times 2 \times 6$
12×6
72 in^3

2. Find the volume of each rectangular prism.



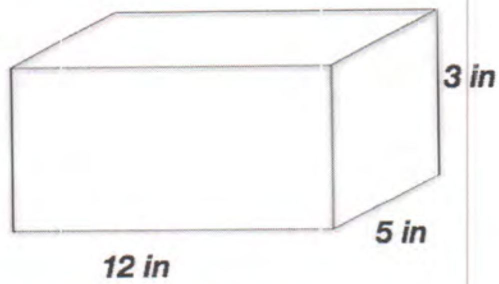
$V = B \times h$
35×2
70 ft^3



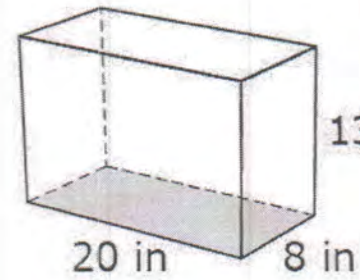
$V = B \times h$
44×20
880 in^3

3. **Find the volume of each rectangular prism.**

160
× 13
480
1600
2080



V = L × W × H
12 × 5 × 3
60 × 3
180 in^3



V = L × W × H
20 × 8 × 13
160 × 13
$2{,}080 \text{ in}^3$

4. **Maria has a jewelry box in the shape of a rectangular prism. It has a length of 10 inches, a width of 6 inches, and a height of 4 inches. Her dad says Maria can find the volume of the box by multiplying 10 x 6 x 4. Her mom says Maria can find the volume of the box by multiplying 60 x 4.**

Explain how both of Maria's parents are correct. Include the volume of the jewelry box in your response.

Maria can find the volume by multiplying length, width, and height. She can also find the volume by multiplying the area of the base (60 in^2) by the height. Either way, the volume will be 240 cubic inches.

G5 U5 Lesson 4

Find the total volume of solid figures composed of two non-overlapping rectangular prisms.

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G5 U5 Lesson 4 - Students will find the volume of solid figures composed of two non-overlapping rectangular prisms

Warm Welcome (Slide 1): Tutor choice

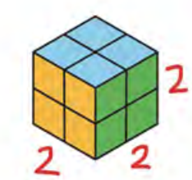
Frame the Learning/Connect to Prior Learning (Slide 2): The past several lessons have been all about volume of rectangular prisms, and we're going to continue that train of thought today. When you think about the work we've done so far with volume, what stands out to you? Possible Student Answers, Key Points:

- Volume is how much space an object takes up, or how many cubic units we can fit in a figure.
- We measure volume in cubic units.
- We can count cubes, think about layers in a figure, and/or use multiplication to help us calculate the area of rectangular prisms.

We've learned a lot about volume already! The only difference in today's work is that our figures will involve two rectangular prisms stacked or pushed side-by-side. We'll use a lot of the same thinking, but our problems will be *twice* the fun!

Let's Talk (Slide 3): Check out this rectangular prism. If I wanted to stack 3 of these together, how could I think about the volume of the entire tower I build? Possible Student Answers, Key Points:

- You could find the volume of one of the prisms, then repeatedly add or multiply to find the entire tower's volume.
- You could draw a picture of the taller tower and label it with the measurements based on what we know about the prism.



$(2 \times 2) \times 2$

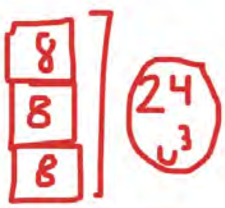
4×2

$8\ u^3$

Interesting thinking. Let's see if you're right. We'll consider just the rectangular prism we see for now. The prism we're shown measures 2 units long, 2 units wide, and 2 units tall. *(label each dimension with 2)* How could I find the volume of this prism? Possible Student Answers, Key Points:

- I can count the 4 cubes on top, and I know there are 4 cubes underneath those. The volume is 8 cubic units.
- I know 2 x 2 x 2 = 8 cubic units.

The volume is 8 cubic units. I can think of one layer as 2 x 2, and then I can multiply that value by 2 since there are 2 layers. *(write and simplify equation as shown)*



Now that we know the volume of this prism, it's not hard to picture what a stack of three of them might look like. *(draw a simple sketch showing a stack of three squares each labeled with a volume of 8)* If there were three of these stacked on top of one another, I know 8 + 8 + 8 or 8 x 3 would mean the total volume is 24 cubic units.

Some mathematicians refer to a combined figure like our tower as a composite figure or a composed figure. To find the volume of any composite figure, we can simply add the volumes of each part of the figure together. Let's try out a few more examples.

Let's Think (Slide 4): This problem wants us to find the total volume of the composite figure. Before we calculate, what do you notice about the figure? Possible Student Answers, Key Points:

- It's made of two rectangular prisms stacked on top of each other. They both look the same size.
- The length of each prism is 14 cm, the width is 3 cm, and the height is 5 cm.

$(3 \times 14) \times 5$

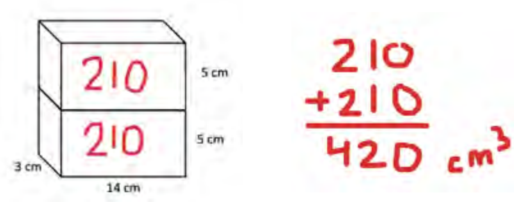
42×5

$210\ cm^3$

Let's start by finding the volume of just the bottom prism. I can think of the bottom prism as having a bottom layer that is equal to 3 x 14 cubes. It would take 5 layers to fill that bottom prism, so I'll use the expression (3 x 14) x 5 to represent the volume. *(write expression and show work as you narrate)* 3 x 14 = 42, and then 42 x 5 is 210. The volume of the rectangular prism on the bottom of our composed figure is 210 cubic centimeters. Is 210 cubic centimeters our final answer? How do you know? Possible Student Answers, Key Points:

- It is not our final answer. That's just the bottom prism.
- We're not done. We have to find the volume of the entire composite figure, so we need to think about the top prism too.

In this problem, both prisms are identical. The bottom is 210 cubic centimeters, so the top is too. *(label both prisms with 210)* To find the volume of the entire figure, we can combine the two volumes. *(write 210 + 210 in vertical form)* What is 210 + 210? (420) The volume of the composite figure is 420 cubic centimeters. *(write sum with units)*

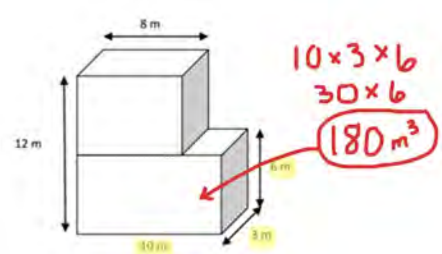


We found the volume of each rectangular prism, and then we added them together to find the volume of the entire composite figure.

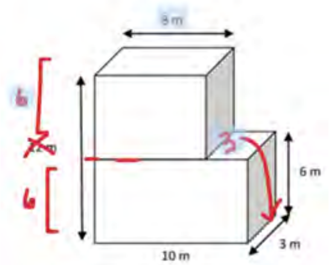
Let's Think (Slide 5): Let's try one more. You'll notice in this problem, the two rectangular prisms are not identical. That's okay, we'll still use similar thinking. Let's find the volume of each rectangular prism, then add them together.

Look at the bottom prism. *(highlight each dimension as you name it)* I see it has a length of 10 meters, a width of 3 meters, and a height of 6 meters. I also see a height measurement on the left that says 12 meters. Why is the height of the bottom prism not 12 meters? Possible Student Answers, Key Points:

- That's the height of both prisms combined.
- It's too big. The arrow with the 12 m goes past the bottom prism.

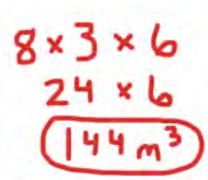


We want to be careful as we work with composite figures that we're using the measurements that pertain to the part of the figure we're looking at. If the dimensions for the bottom prism are 10 meters, 3 meters, and 6 meters, we can use multiplication to find the volume. *(write and evaluate expression as you narrate)* I can think of the volume as 10 x 3 x 6. I know 10 x 3 is 30, and 30 x 6 is 180. The volume is 180 cubic meters.

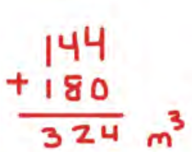


Now we'll find the volume of the top rectangular prism. I see the length is 8 meters, but the other dimensions aren't labeled as clearly. The top prism doesn't have the width labeled, but I can see from the picture it is the same width as the bottom prism. I can label the width as being 3 meters. *(label and draw an arrow to show it's the same as the 3-meter width of the bottom prism)*

The height is also not labeled clearly. I know the height of the bottom prism is 6 meters, and the height of the entire figure is 12 meters. How tall is the top prism if the bottom prism is 6 meters, and both prisms combined measure 12 meters? (6 meters, because 6 + 6 = 12 or 12 - 6 = 6) Great, now that our dimensions are clearly labeled, let's efficiently find the volume.



I know the prism has a length of 8 meters, a width of 3 meters, and a height of 6 meters. *(write and evaluate expression as you narrate)* I can think of the volume as 8 x 3 x 6. I know 8 x 3 is 24. What is 24 x 6? Take your time, and let me know when you have it. (144) 24 x 6 = 144. The volume of the top prism is 144 cubic meters.



The bottom prism is 180 cubic meters. The top prism is 144 cubic meters. If we need to find the volume of the entire composite figure, we've done all the hard work. Now we just need to add the volumes together. *(write 144 + 180 in vertical form)* I know 144 plus 180 is 324. The volume of the entire figure is 324 cubic meters. We did it!

Finding the volume of a figure composed of multiple rectangular prisms isn't harder than finding the volume of a single rectangular prism; it's just a bit more work, because you need to find both volumes. In your own words, how would you describe how to find the volume of a composite figure? Possible Student Answers, Key Points:

- To find the volume of a composite figure made of rectangular prisms, you just need to find the volume of each rectangular prism that makes up the figure. Once you have the volume of each figure, you can add them together to get the total volume.

Let's Try it (Slides 6 - 7): Now let's try finding the volume of solid figures composed of two non-overlapping rectangular prisms together. With each problem, we'll identify the unique rectangular prisms we see in the figure, calculate the volume of each figure, then combine their volumes by adding them together. We can calculate the volume of the individual prisms using any method we've learned, but remember that multiplication can be an efficient strategy to use in most cases. Let's give it a try.

WARM WELCOME

Today we will find the volume of solid figures composed of two non-overlapping rectangular prisms.

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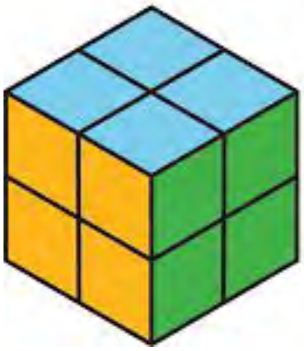
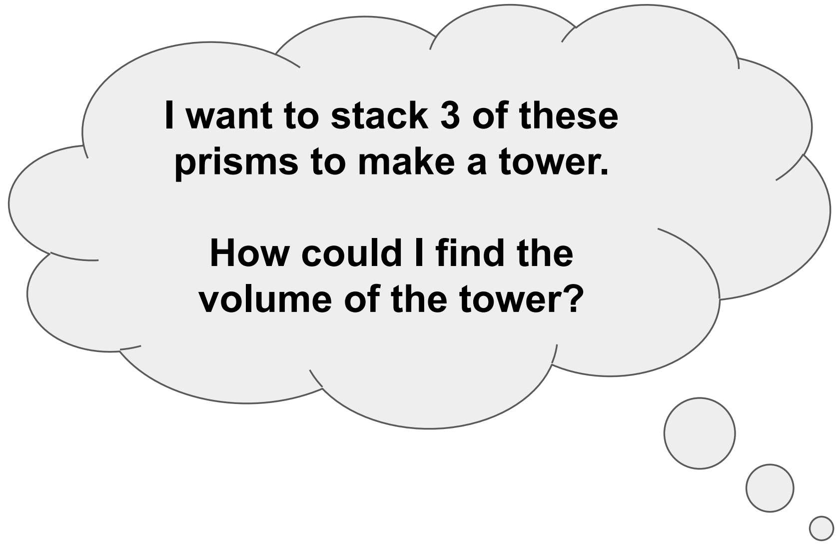
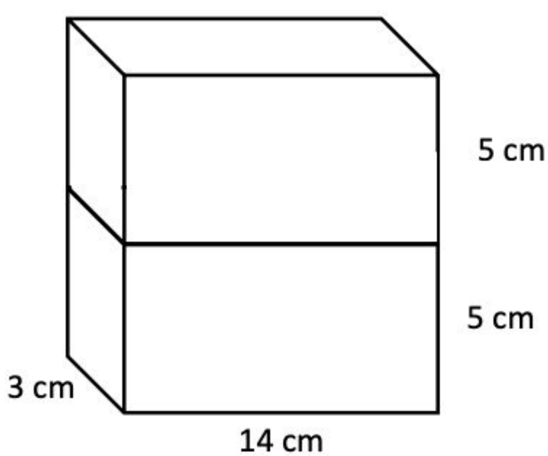
Let's Talk:





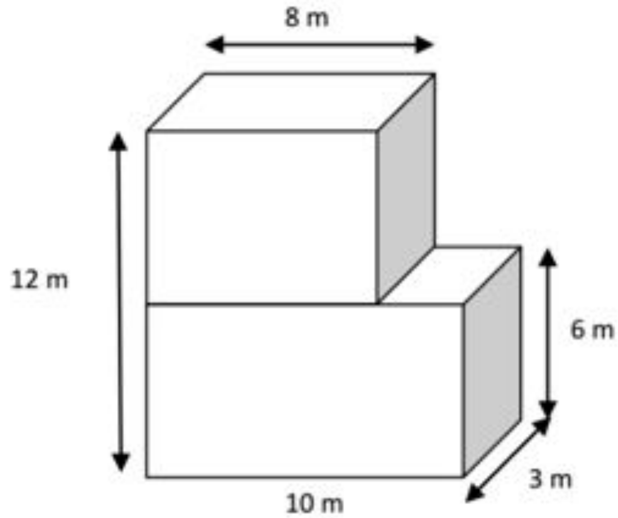
Let's Think:

What's the volume of the composite figure?



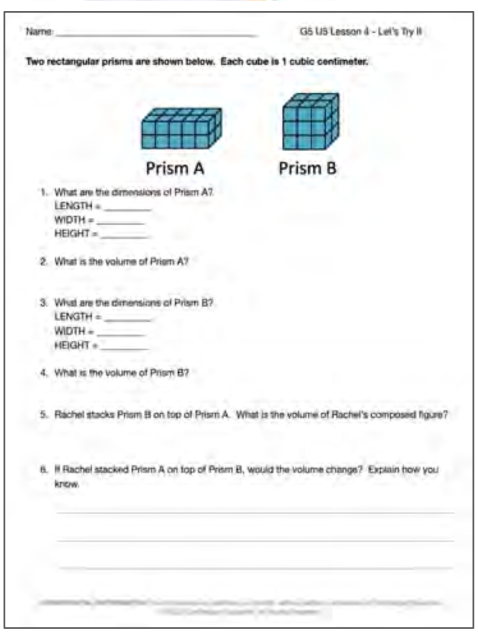
Let's Think:

Find the volume of the figure shown here.



Let's Try It:

Let's explore finding the volume of solid figures composed of two non-overlapping rectangular prisms together.

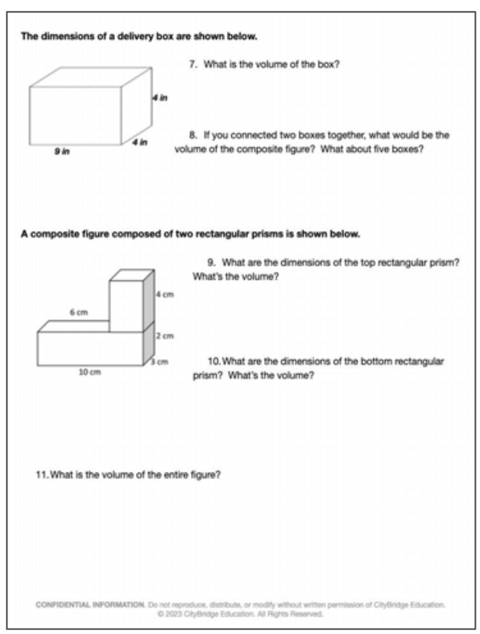


Name: ____________________ G5 U5 Lesson 4 - Let's Try It

Two rectangular prisms are shown below. Each cube is 1 cubic centimeter.

Prism A Prism B

1. What are the dimensions of Prism A?
   LENGTH = ________
   WIDTH = ________
   HEIGHT = ________
2. What is the volume of Prism A?
3. What are the dimensions of Prism B?
   LENGTH = ________
   WIDTH = ________
   HEIGHT = ________
4. What is the volume of Prism B?
5. Rachel stacks Prism B on top of Prism A. What is the volume of Rachel's composed figure?
6. If Rachel stacked Prism A on top of Prism B, would the volume change? Explain how you know.



The dimensions of a delivery box are shown below.

4 in
4 in
9 in

7. What is the volume of the box?
8. If you connected two boxes together, what would be the volume of the composite figure? What about five boxes?

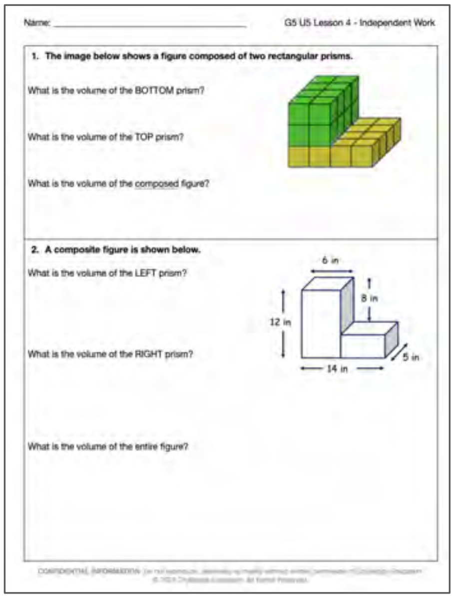
A composite figure composed of two rectangular prisms is shown below.

6 cm
4 cm
2 cm
3 cm
10 cm

9. What are the dimensions of the top rectangular prism? What's the volume?
10. What are the dimensions of the bottom rectangular prism? What's the volume?
11. What is the volume of the entire figure?

On your Own:

Now it's time to find the volume of solid figures composed of two non-overlapping rectangular prisms on your own.


Name: ______________________ G5 U5 Lesson 4 - Independent Work

1. The image below shows a figure composed of two rectangular prisms.

What is the volume of the BOTTOM prism?

What is the volume of the TOP prism?

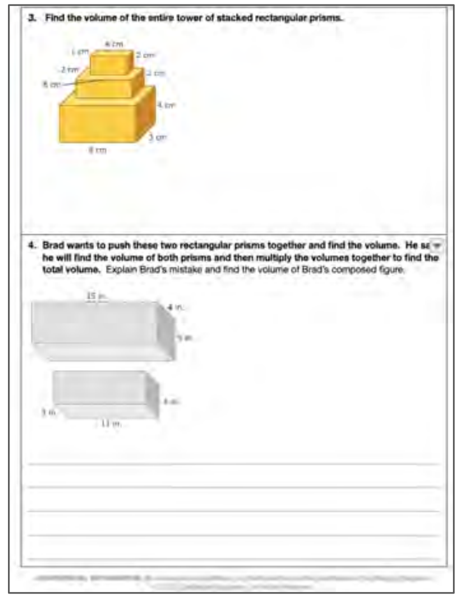
What is the volume of the composed figure?

2. A composite figure is shown below.

What is the volume of the LEFT prism?

What is the volume of the RIGHT prism?

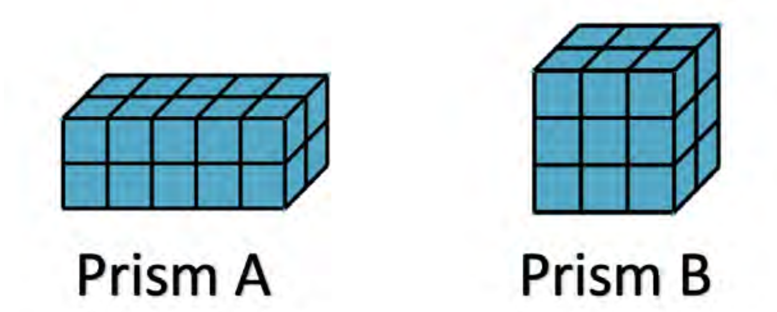
What is the volume of the entire figure?


3. Find the volume of the entire tower of stacked rectangular prisms.

4. Brad wants to push these two rectangular prisms together and find the volume. He sa[ys] he will find the volume of both prisms and then multiply the volumes together to find the total volume. Explain Brad's mistake and find the volume of Brad's composed figure.

Name: ____ G5 U5 Lesson 4 - Let's Try It

Two rectangular prisms are shown below. Each cube is 1 cubic centimeter.



1. What are the dimensions of Prism A?
   LENGTH = ___________
   WIDTH = ___________
   HEIGHT = ___________

2. What is the volume of Prism A?

3. What are the dimensions of Prism B?
   LENGTH = ___________
   WIDTH = ___________
   HEIGHT = ___________

4. What is the volume of Prism B?

5. Rachel stacks Prism B on top of Prism A. What is the volume of Rachel's composed figure?

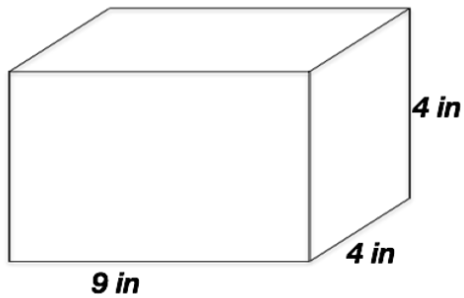
6. If Rachel stacked Prism A on top of Prism B, would the volume change? Explain how you know.

____

____

____

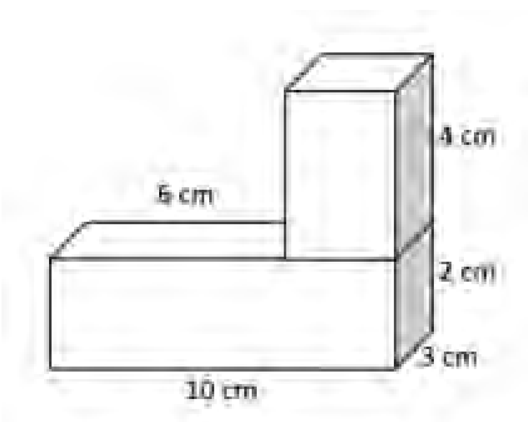
The dimensions of a delivery box are shown below.



7. What is the volume of the box?

8. If you connected two boxes together, what would be the volume of the composite figure? What about five boxes?

A composite figure composed of two rectangular prisms is shown below.



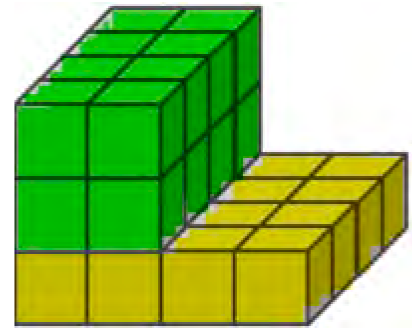
9. What are the dimensions of the top rectangular prism? What's the volume?

10. What are the dimensions of the bottom rectangular prism? What's the volume?

11. What is the volume of the entire figure?

1. The image below shows a figure composed of two rectangular prisms.

What is the volume of the BOTTOM prism?

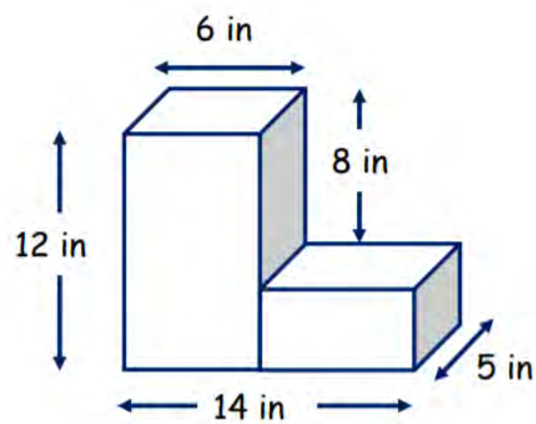


What is the volume of the TOP prism?

What is the volume of the composed figure?

2. A composite figure is shown below.

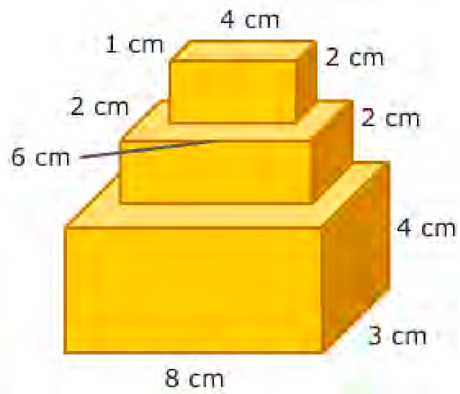
What is the volume of the LEFT prism?



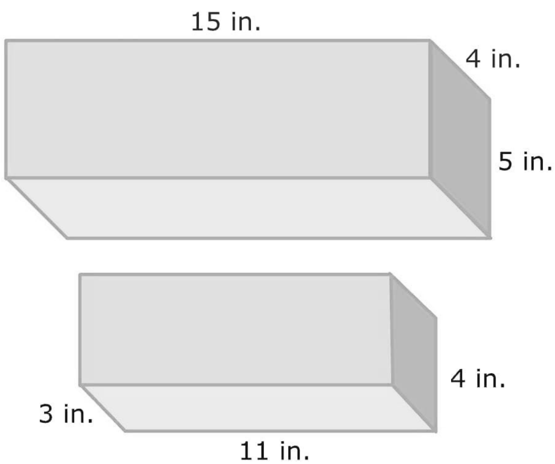
What is the volume of the RIGHT prism?

What is the volume of the entire figure?

3. Find the volume of the entire tower of stacked rectangular prisms.

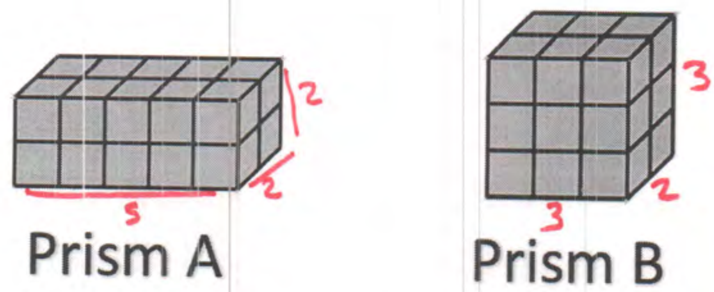


4. Brad wants to push these two rectangular prisms together and find the volume. He says he will find the volume of both prisms and then multiply the volumes together to find the total volume. Explain Brad's mistake and find the volume of Brad's composed figure.



Name: KEY

Two rectangular prisms are shown below. Each cube is 1 cubic centimeter.



1. What are the dimensions of Prism A?
   LENGTH = 5
   WIDTH = 2
   HEIGHT = 2

2. What is the volume of Prism A?
   $5 \times 2 \times 2$
   10×2
   20 u^3

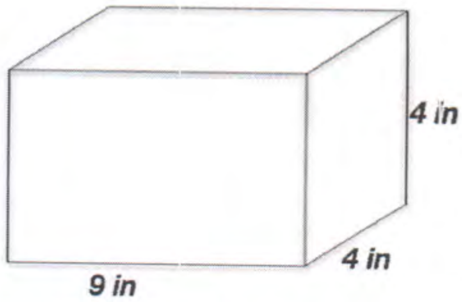
3. What are the dimensions of Prism B?
   LENGTH = 3
   WIDTH = 2
   HEIGHT = 3

4. What is the volume of Prism B?
   $3 \times 2 \times 3$
   6×3
   18 u^3

5. Rachel stacks Prism B on top of Prism A. What is the volume of Rachel's composed figure?
   B 18
   A 20 > $20 + 18 = 38\ u^3$

6. If Rachel stacked Prism A on top of Prism B, would the volume change? Explain how you know.
   No. The figure might look different, but it would still be composed of 38 total cubes.

The dimensions of a delivery box are shown below.



7. What is the volume of the box?

$9 \times 4 \times 4$

36×4

144 in^3

$36 \times 4 = 144$

8. If you connected two boxes together, what would be the volume of the composite figure? What about five boxes?

2 boxes

$2 \times 144 = 288 \text{ u}^3$

boxes

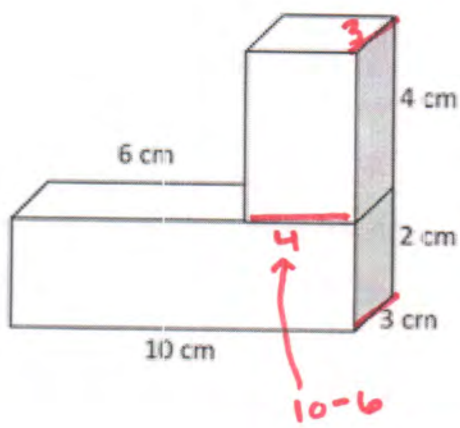
5 boxes

5×144

720 u^3

$144 \times 5 = 720$

A composite figure composed of two rectangular prisms is shown below.



9. What are the dimensions of the top rectangular prism? What's the volume?

length = 4 cm
width = 3 cm
height = 4 cm

$4 \times 3 \times 4$

12×4

48 cm^3

10. What are the dimensions of the bottom rectangular prism? What's the volume?

length = 10 cm
width = 3 cm
height = 2 cm

$10 \times 3 \times 2$

30×2

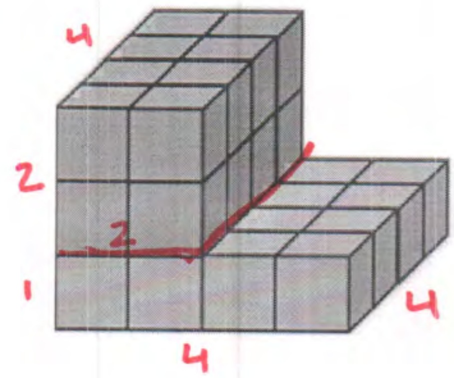
60 cm^3

11. What is the volume of the entire figure?

$48 + 60 = 108 \text{ cm}^3$

Name: KEY

1. The image below shows a figure composed of two rectangular prisms.



What is the volume of the BOTTOM prism?

1 × 4 × 4
4 × 4
16 u³

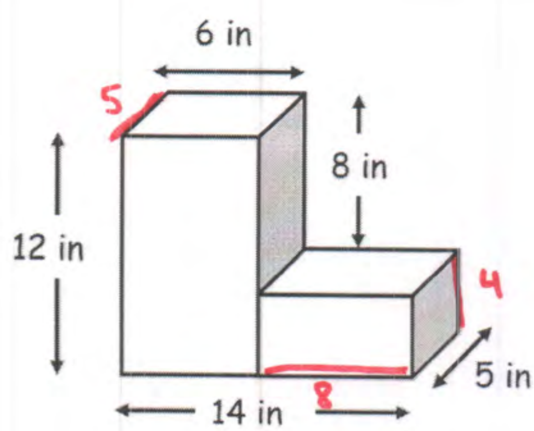
What is the volume of the TOP prism?

2 × 4 × 2
8 × 2
16 u³

What is the volume of the composed figure?

16 + 16 = 32 u³

2. A composite figure is shown below.



What is the volume of the LEFT prism?

5 × 6 × 12
30 × 12
360 in³

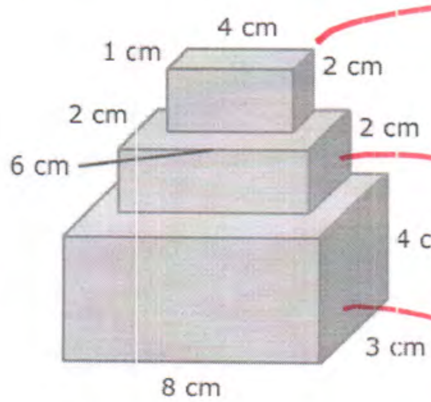
What is the volume of the RIGHT prism?

8 × 5 × 4
40 × 4
160 in³

What is the volume of the entire figure?

360 + 160 = 520 in³

3. **Find the volume of the entire tower of stacked rectangular prisms.**



$1 \times 4 \times 2$
4×2
$8 u^3$

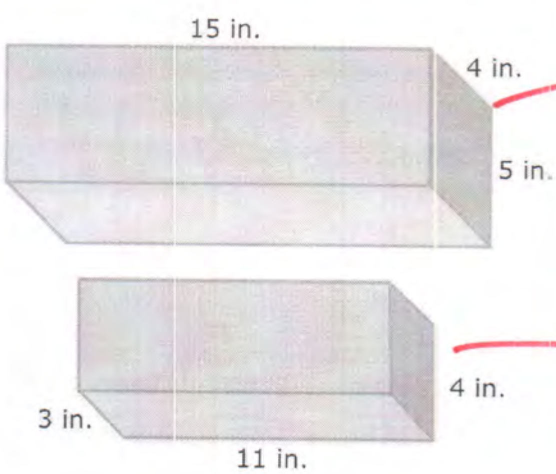
$6 \times 2 \times 2$
12×2
$24 u^3$

$8 \times 3 \times 4$
24×4
$96 u^3$

$96 + 24 + 8 = 128$

$128 u^3$
TOTAL

4. **Brad wants to push these two rectangular prisms together and find the volume. He says he will find the volume of both prisms and then multiply the volumes together to find the total volume.** Explain Brad's mistake and find the volume of Brad's composed figure.



$15 \times 4 \times 5$
60×5
300 in^3

$11 \times 3 \times 4$
33×4
132 in^3

$300 + 132$
432 in^3

Brad needs to add the two volumes together, not multiply. The first volume is 300 in³ and the second volume is 132 in³. The total combined volume is 432 in³. 300 × 132 would be way too big!

G5 U5 Lesson 5

Find the area of rectangles with whole-by-mixed and whole-by-fractional number side lengths by tiling, record by drawing, and relate to fraction multiplication.

CITYTUTOR DC

G5 U5 Lesson 5 - Students will find the area of rectangles with whole-by-mixed and whole-by-fractional number side lengths by tiling, record by drawing, and relate to fraction multiplication

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): We've been working so hard on finding the volume of rectangular prisms. For our lesson today, we're switching gears! For the next few lessons, we'll focus on finding the *area* of rectangles. You've likely worked with area in math class since around third grade. What are some things you already know about area? Possible Student Answers, Key Points:

- Area is the amount of space a 2D figure takes up.
- We measure area in square units.
- To find the area of a rectangle, I can multiply the length by the width.

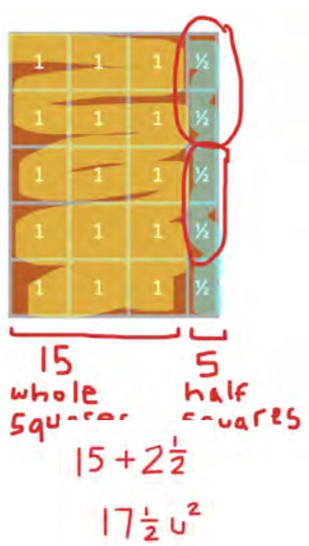
Great! You already know some important things about finding the area of rectangles, but let's quickly recap. Area is the amount of space a two-dimensional figure takes up. When your first learned about area, you probably tiled using squares to cover figures without gaps or overlaps. Similar to how we measure volume using cubic units, we measure area using square units. Let's lean on what we already know to help us find the area of rectangles with fractional side lengths.

Let's Talk (Slide 3): Take a look at the rectangles shown here. What do you notice about them? What do you wonder? Possible Student Answers, Key Points:

- I notice they get bigger each time. I notice the area of the first one is 5 square units. I notice the last one has half-squares in it.
- I wonder what they represent. I wonder why the last one includes fractions. I wonder how to find the area if some of the pieces are fractions.

The area of the first three rectangles is pretty simple to calculate, because each of the rectangles only includes whole unit squares. I can count or multiply the length by the width to find the first area is 5 square units, the second area is 10 square units, and the third area is 15 square units. The last rectangle is where we'll focus our attention today. With your help, I'll show you how to find the area of a rectangles with fractional dimensions.

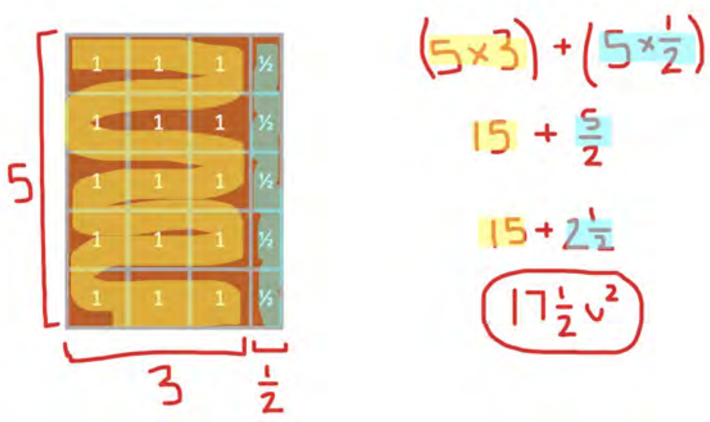
Let's Think (Slide 4): We'll find the area of this rectangle two ways.



Let's start by simply counting. How many whole unit squares do you see in this rectangle, and how many half unit squares to you see? (There are 15 whole squares and 5 half squares) *(highlight the wholes in one color and the halves in another, then label the sections as 15 whole squares and 5 half squares)*

We know that two halves make a whole, so 5 half squares would be 2 ½ squares. *(circle pairs of half square units)*

The area of the whole squares is 15 square units. The area of the half squares is 2 ½ square units. *(write 15 + 2 ½)* So, 15 plus 2 ½ means the area of the entire rectangle is 17 ½ square units. We just counted the whole square units and added them to the half square units to find the area of the figure.



We can also use multiplication to help us find the area of rectangles with fractional units. I know this rectangle has a length of 5. *(label length)* The width is 3 ½, but let's break that up to make it easier to think about. *(label width as 3 and ½ separately as shown)*

We can think of the rectangle as being decomposed into two smaller rectangles. The larger section has a length of 5 and a width of 3. *(write 5 x 3 +)* The smaller section has a length of 5 and a width of ½. *(write 5 x ½)* Let's multiply to find the area of each section. *(show work as you narrate, color-coding it if that's helpful)* 5 times 3 is 15. 5 times ½ is 5/2. We know 5/2 is equivalent to 2 ½. When we add those two areas together, we end up with 17 ½ square units.

In your own words, how would you describe the work we just did to calculate the area of a rectangle with fractional side lengths? Possible Student Answers, Key Points:

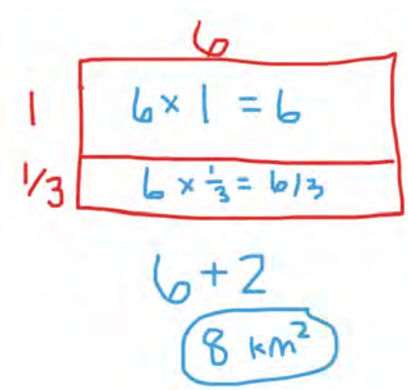
- We counted up the whole squares and the half squares and put them together.
- We multiplied length and width to find the area of one part of the rectangle. We multiplied length and width again to find the area of the other part of the rectangle. Then, we added those areas together.

We can count whole units and fractional units to find the area of a rectangle, or we can break apart the rectangle and use multiplication to find the area of each section. Let's try another example.

Let's Think (Slide 5): *(read problem)* What do you notice is the same and different about this problem compared to the previous one? Possible Student Answers, Key Points:

- It's an area problem about a rectangle. One of the side lengths has a fraction in it.
- It's different because it's a story problem. It's different because the rectangle is not tiled. We can't see the units.

We can help the architects find the area of this rectangle even though we can't see the units. We won't be able to use our counting strategy, so let's use multiplication. I know to find the area of a rectangle, I can multiply the length by the width. In this case, I'm going to decompose 1 ⅓ into a whole number and a fraction, so I can multiply in easy pieces. I'll draw an area model to help me keep track of my work. *(draw a partitioned rectangular area model as shown, labeling one side as 6 and the other side as 1 and ⅓*



I can multiply 6 x 1 to find the area of the top rectangle. *(write 6 x 1 = 6 inside the area model)* How can I find the area of the bottom rectangle? (multiply 6 x ⅓) I know 6 times ⅓ is 6/3. *(write 6 x ⅓ = 6/3 inside the area model)* 6/3 is the same as 2 wholes.

The area of the top section of our area model is 6 square kilometers. The area of the bottom section of our area model is 2 square kilometers. That means the area of the entire plot of land is 8 square kilometers, since 6 plus 2 equals 8.

Even though we didn't have squares to count, we were still able to find the area of the rectangle by decomposing the fractional side length and multiplying using an area model.

Let's Try it (Slides 6 - 7): Now it's our turn to practice finding the area of rectangles with fractional side lengths a little more. If the problems involve unit squares, we can count them to find the area of the figure. If the problems don't involve unit squares we can count, or if we just want to be a bit more efficient, we can use multiplication to calculate the area of sections of each rectangle. Once we know the area of each section, we'll add them together to find the area of the composed rectangle. I think you're ready!

WARM WELCOME

Today we will find the area of rectangles with whole-by-mixed and whole-by-fractional number side lengths by tiling, record by drawing, and relate to fraction multiplication.

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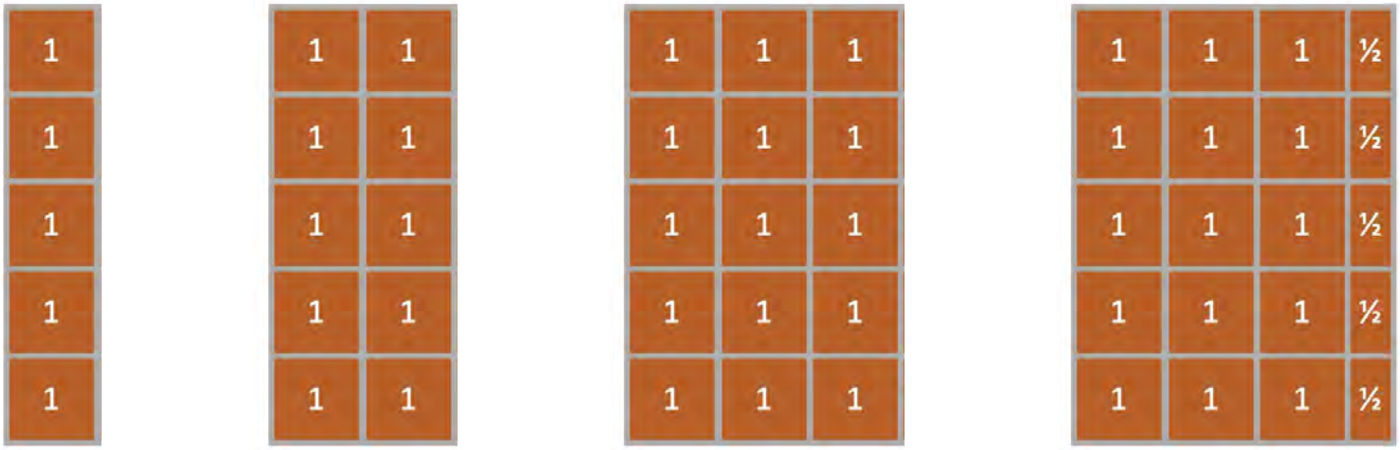
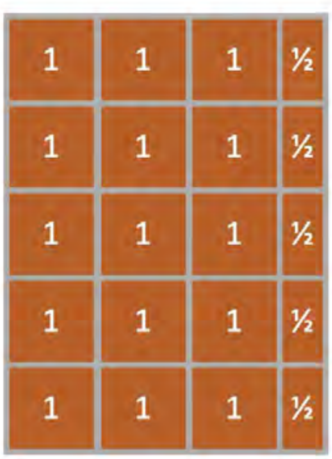
Let’s Talk:



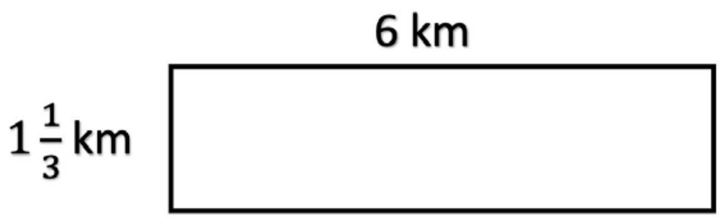
Let’s Think:

What is the area of the rectangle?



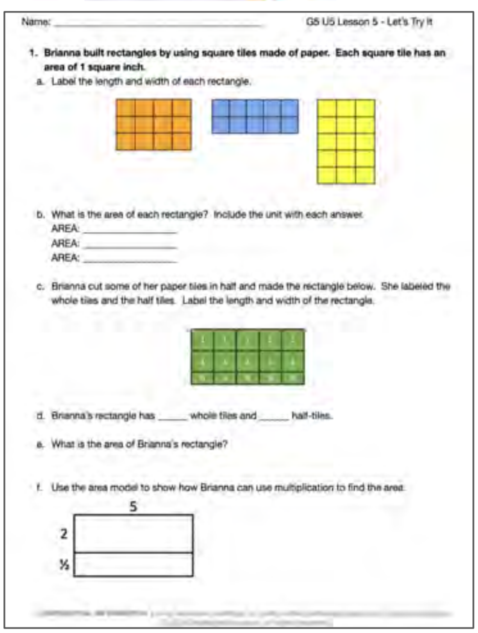
Let's Think:

A museum is being built on a large plot of land. The architects drew a model of the land to start thinking of designs for the museum. What is the area of the plot of land?



Let's Try It:

Let's explore finding the area of rectangles with whole-by-mixed and whole-by-fractional number side lengths together.



Name: ______________________ G5 U5 Lesson 5 - Let's Try It

1. Brianna built rectangles by using square tiles made of paper. Each square tile has an area of 1 square inch.

a. Label the length and width of each rectangle.

b. What is the area of each rectangle? Include the unit with each answer.
AREA: ____________
AREA: ____________
AREA: ____________

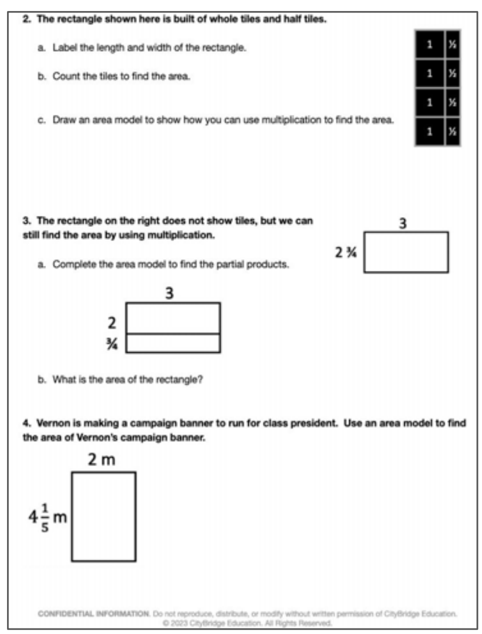
c. Brianna cut some of her paper tiles in half and made the rectangle below. She labeled the whole tiles and the half tiles. Label the length and width of the rectangle.

d. Brianna's rectangle has _____ whole tiles and _____ half-tiles.

e. What is the area of Brianna's rectangle?

f. Use the area model to show how Brianna can use multiplication to find the area.

5
2
½



2. The rectangle shown here is built of whole tiles and half tiles.

a. Label the length and width of the rectangle.

b. Count the tiles to find the area.

c. Draw an area model to show how you can use multiplication to find the area.

3. The rectangle on the right does not show tiles, but we can still find the area by using multiplication.

3
2 ¾

a. Complete the area model to find the partial products.

3
2
¾

b. What is the area of the rectangle?

4. Vernon is making a campaign banner to run for class president. Use an area model to find the area of Vernon's campaign banner.

2 m
$4\frac{1}{5}$ m

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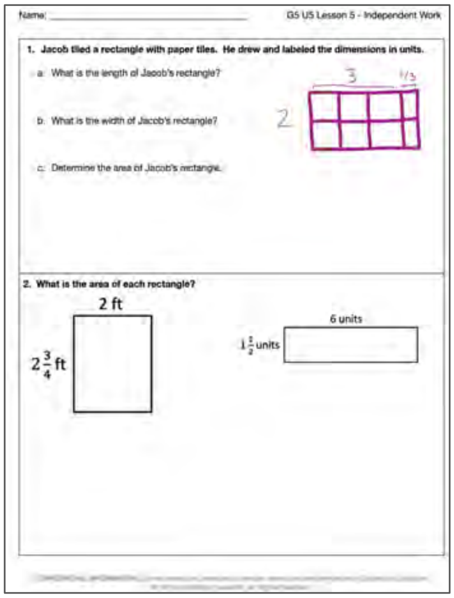
On your Own:

Now it's time to find the area of rectangles with whole-by-mixed and whole-by-fractional number side lengths on your own.



Name: ______________________ G5 U5 Lesson 5 - Independent Work

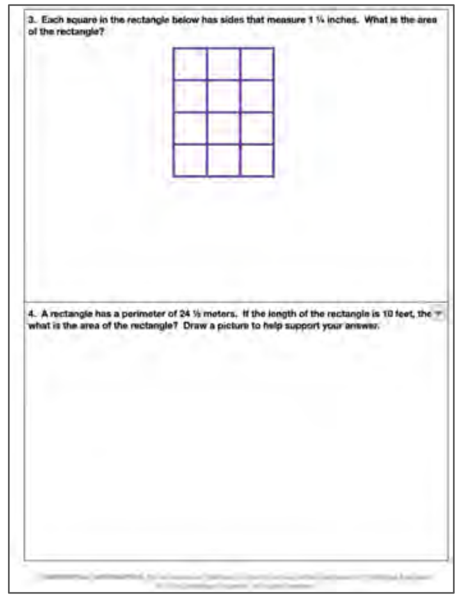
1. Jacob tiled a rectangle with paper tiles. He drew and labeled the dimensions in units.

a. What is the length of Jacob's rectangle?

b. What is the width of Jacob's rectangle?

c. Determine the area of Jacob's rectangle.

2. What is the area of each rectangle?



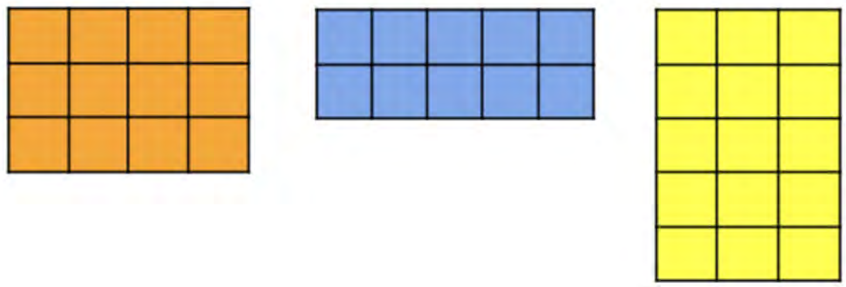
3. Each square in the rectangle below has sides that measure 1 ¼ inches. What is the area of the rectangle?

4. A rectangle has a perimeter of 24 ½ meters. If the length of the rectangle is 10 feet, the what is the area of the rectangle? Draw a picture to help support your answer.

Name: ____ G5 U5 Lesson 5 - Let's Try It

1. Brianna built rectangles by using square tiles made of paper. Each square tile has an area of 1 square inch.

a. Label the length and width of each rectangle.



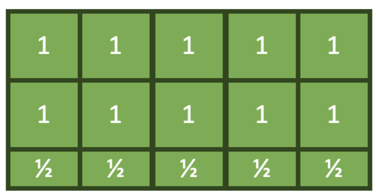
b. What is the area of each rectangle? Include the unit with each answer.

AREA: ____________________

AREA: ____________________

AREA: ____________________

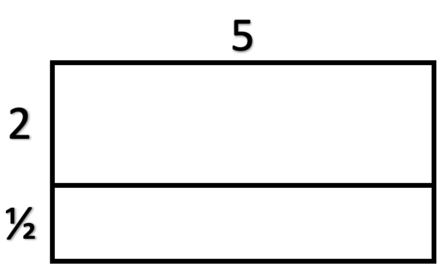
c. Brianna cut some of her paper tiles in half and made the rectangle below. She labeled the whole tiles and the half tiles. Label the length and width of the rectangle.



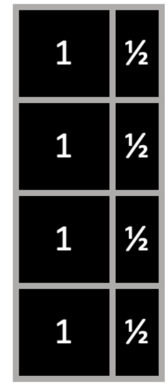
d. Brianna's rectangle has ______ whole tiles and ______ half-tiles.

e. What is the area of Brianna's rectangle?

f. Use the area model to show how Brianna can use multiplication to find the area.



2. The rectangle shown here is built of whole tiles and half tiles.

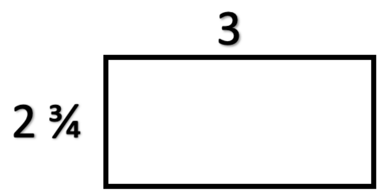


a. Label the length and width of the rectangle.

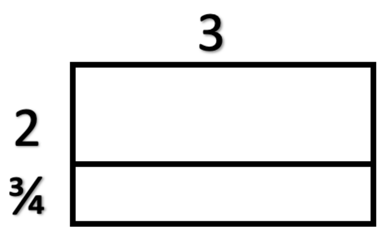
b. Count the tiles to find the area.

c. Draw an area model to show how you can use multiplication to find the area.

3. The rectangle on the right does not show tiles, but we can still find the area by using multiplication.

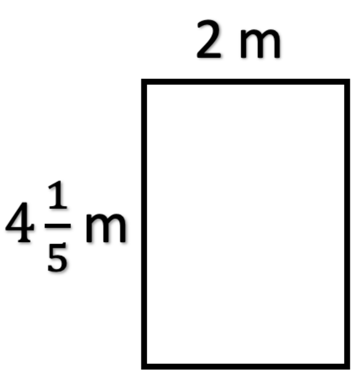


a. Complete the area model to find the partial products.



b. What is the area of the rectangle?

4. Vernon is making a campaign banner to run for class president. Use an area model to find the area of Vernon's campaign banner.



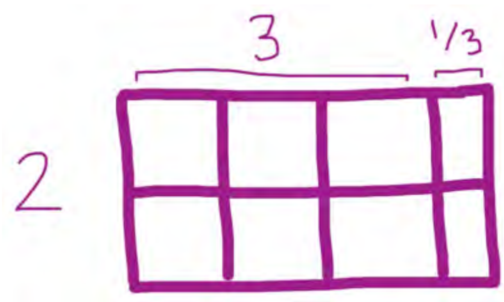
Name: ____ G5 U5 Lesson 5 - Independent Work

1. Jacob tiled a rectangle with paper tiles. He drew and labeled the dimensions in units.

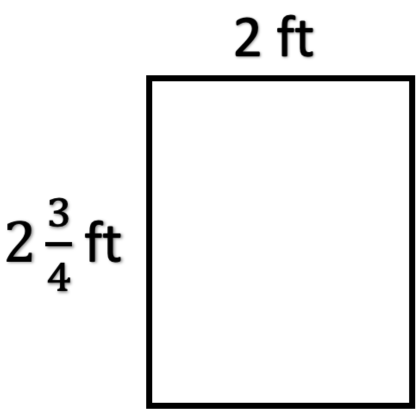
a. What is the length of Jacob's rectangle?

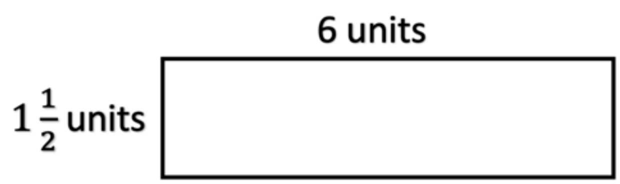
b. What is the width of Jacob's rectangle?

c. Determine the area of Jacob's rectangle.

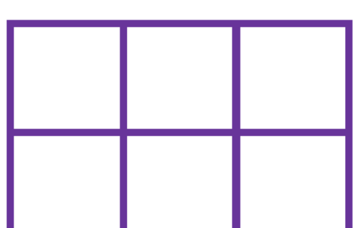


2. What is the area of each rectangle?





3. Each square in the rectangle below has sides that measure 1 ¼ inches. What is the area of the rectangle?

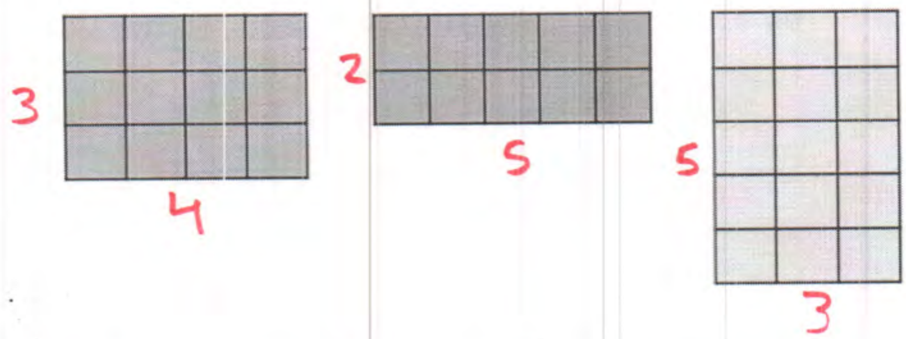


4. A rectangle has a perimeter of 24 ½ meters. If the length of the rectangle is 10 feet, then what is the area of the rectangle? Draw a picture to help support your answer.

Name: KEY

1. Brianna built rectangles by using square tiles made of paper. Each square tile has an area of 1 square inch.

a. Label the length and width of each rectangle.



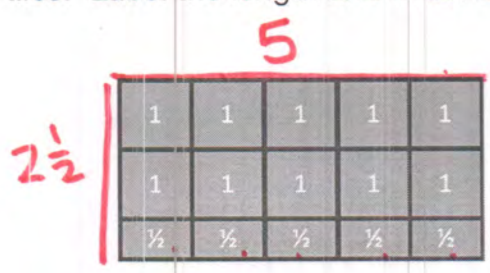
b. What is the area of each rectangle? Include the unit with each answer.

AREA: $12\ in^2$

AREA: $10\ in^2$

AREA: $15\ in^2$

c. Brianna cut some of her paper tiles in half and made the rectangle below. She labeled the whole tiles and the half tiles. Label the length and width of the rectangle.

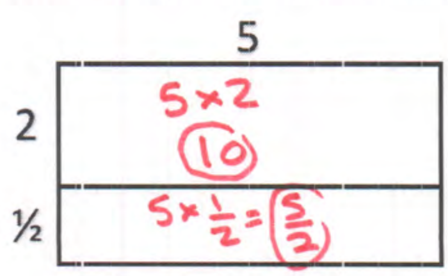


d. Brianna's rectangle has 10 whole tiles and 5 half-tiles.

e. What is the area of Brianna's rectangle?

$$10+\frac{5}{2} \longrightarrow 10+2\frac{1}{2} = 12\frac{1}{2}\ u^2$$

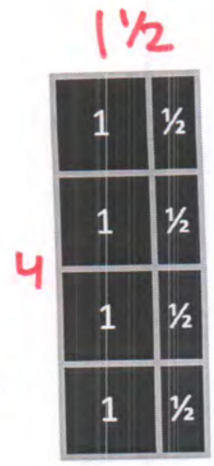
f. Use the area model to show how Brianna can use multiplication to find the area.



$10+\frac{5}{2}$

$10+2\frac{1}{2}$

$12\frac{1}{2}\ u^2$

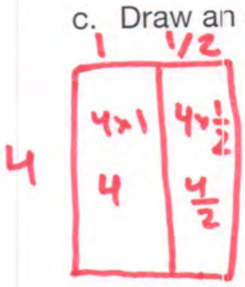
2. The rectangle shown here is built of whole tiles and half tiles.

a. Label the length and width of the rectangle. ✓

b. Count the tiles to find the area.

4 wholes + 4 halves

$4 + 2 = 6\ u^2$

c. Draw an area model to show how you can use multiplication to find the area.

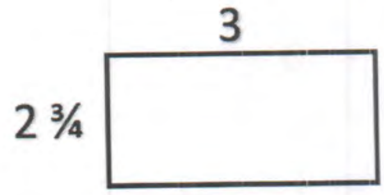


$(4 \times 1) + (4 \times \frac{1}{2})$

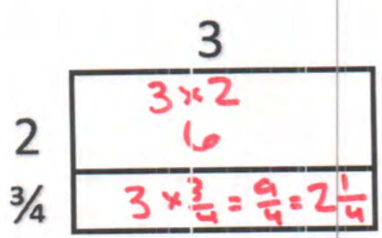
$4 + 2$

$6\ u^2$

3. The rectangle on the right does not show tiles, but we can still find the area by using multiplication.



a. Complete the area model to find the partial products.

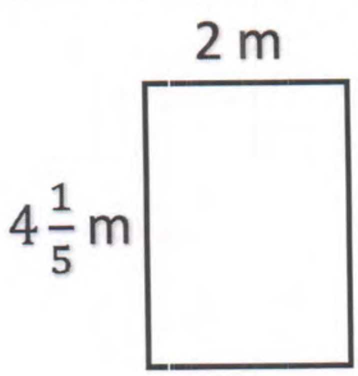


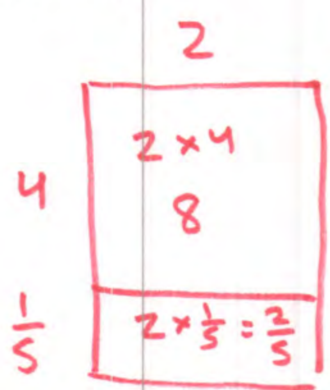
$6 + 2\frac{1}{4}$

b. What is the area of the rectangle?

$8\frac{1}{4}\ u^2$

4. Vernon is making a campaign banner to run for class president. Use an area model to find the area of Vernon's campaign banner.



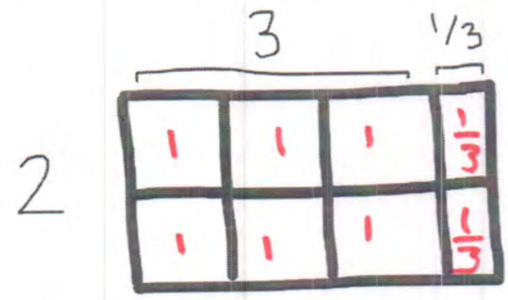


$8 + \frac{2}{5}$

$8\frac{2}{5}\ m^2$

Name: KEY

1. Jacob tiled a rectangle with paper tiles. He drew and labeled the dimensions in units.



a. What is the length of Jacob's rectangle?

$3\frac{1}{3}$

b. What is the width of Jacob's rectangle?

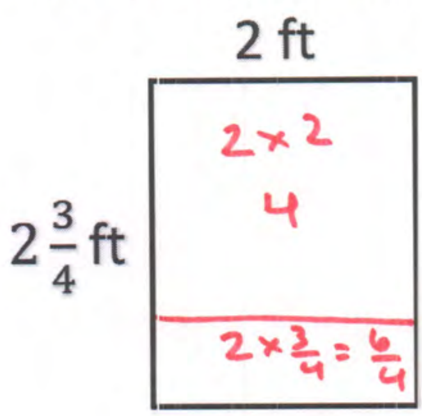
2

c. Determine the area of Jacob's rectangle.

$6 + \frac{2}{3}$

$6\frac{2}{3}\ u^2$

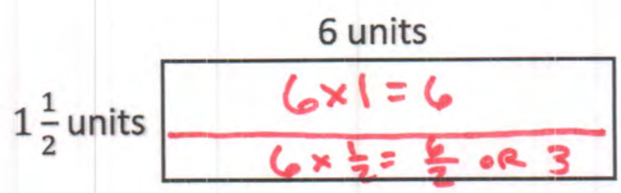
2. What is the area of each rectangle?



$4 + \frac{6}{4}$

$4 + 1\frac{2}{4}$

$5\frac{2}{4}$ or $5\frac{1}{2}\ ft^2$

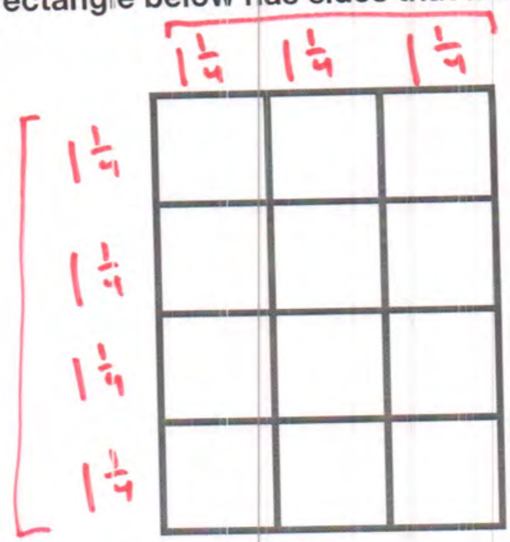


$6 + 3$

$9\ u^2$

$3\frac{3}{4}$

3. Each square in the rectangle below has sides that measure 1 ¼ inches. What is the area of the rectangle?



	3	3/4
5	5×3 15	$5 \times \frac{3}{4}$ $\frac{15}{4}$ or $3\frac{3}{4}$

$15 + 3\frac{3}{4}$

$18\frac{3}{4}$ in^2

4. A rectangle has a perimeter of 24 ½ meters. If the length of the rectangle is 10 feet, then what is the area of the rectangle? Draw a picture to help support your answer.

10

$2\frac{1}{4}$ $2\frac{1}{4}$

10

$10 + 10 + ? + ? = 24\frac{1}{2}$

$20 + ? + ? = 24\frac{1}{2}$

$? + ? = 4\frac{1}{2}$

2 2 $\frac{1}{4}$ $\frac{1}{4}$

	10
2	10×2 20
$\frac{1}{4}$	$10 \times \frac{1}{4} = \frac{10}{4}$

$20 + \frac{10}{4}$

$20 + 2\frac{2}{4}$

$22\frac{2}{4}$ or $22\frac{1}{2}$ ft^2

G5 U5 Lesson 6

Find the area of rectangles with mixed-by-mixed and fraction-by-fraction side lengths by tiling, record by drawing, and relate to fraction multiplication.

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G5 U5 Lesson 6 - Students will find the area of rectangles with mixed-by-mixed and fraction-by-fraction side lengths by tiling, record by drawing, and relate to fraction multiplication

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): Last time we met, we worked on calculating the area of a rectangle when one of the sides was a fraction or a mixed number. Today, we'll keep thinking about the area of rectangles, but we'll see examples where both dimensions are fractions or mixed numbers. You'll see that we'll use a lot of the same thinking!

Let's Talk (Slide 3): Let's begin by looking at these two rectangles. What is the same about them? What is different about them?
Possible Student Answers, Key Points:

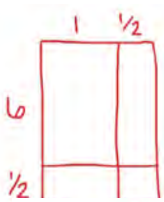
- They have the same dimensions. They're each 6 ½ units long and 1 ½ units wide.
- They look a little different in size. The second rectangle looks like an area model; it's partitioned into sections and the dimensions are decomposed.

These figures both show rectangles that measure 6 ½ units long and 1 ½ units wide. The second figure is made like an area model. Which figure do you think makes it easier to find the area of the rectangle? Possible Student Answers, Key Points:

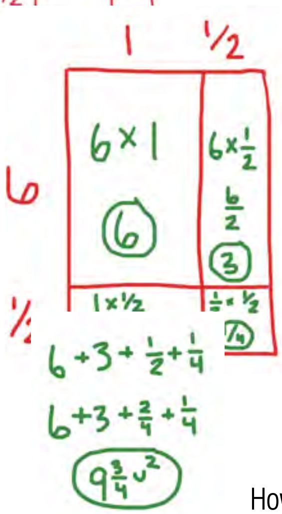
- Maybe the first one is easier, because it involves fewer values.
- Maybe the second one is easier, because it's broken into parts that I can solve in my head.

Today, we'll use area models to help us find the area of rectangles with fraction and mixed number side lengths.

Let's Think (Slide 4): Our first problem wants us to find the area of the rectangle we were just looking at.



Rather than have to think about multiplying a 6 ½ by 1 ½ all at once, let's draw an area model so we can think of this rectangle as smaller, simpler rectangles. We know that when we draw an area model, it doesn't have to be the exact dimensions of the actual rectangle. *(draw an area model with 1 and ½ labeled along the top and 6 and ½ labeled along the left)* We'll work to find the area of each rectangle, then we can combine those areas to find the final answer.



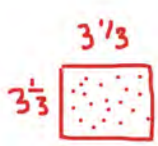
Help me find each partial product. *(write each expression and product in the corresponding portion of the area model as you narrate)* What is 6 x 1? (6) The area of this section is 6 units squared. What is 6 x ½? (6/2 or 3) 6 times ½ is 6/2. I know 6/2 is the same as 3 wholes. The area of this section is 3 square units. What is 1 x ½? (½) The area of this section is ½ square unit. Lastly, what is ½ times ½? (¼) The area of this final section is ¼ square unit. Because we used an area model, each partial product was pretty easy to do in our heads. Nice work.

Now let's combine each area to find the area of the entire rectangle. *(write 6 + 3 + ½ + ¼)* The two fractional addends don't have like units, so I'll think of ½ as 2/4 to make it simpler to combine. 6 plus 3 plus 2/4 plus ¼ results in an area of 9 ¾ square units. The area of the full rectangle is 9 ¾ square units.

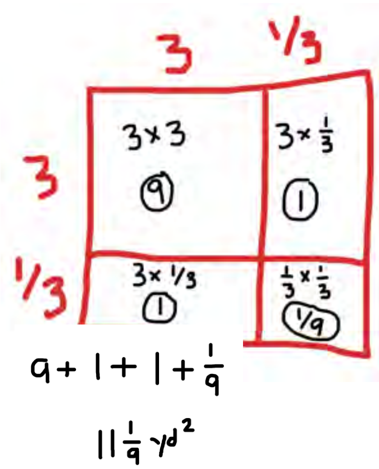
How did using an area model help us find the area of the rectangle? Possible Student Answers, Key Points:

- Decomposing the length and width, meant that we could think about more bite-size problems that we can do in our heads.
- We broke up the dimensions into whole numbers and fractions. This made it easy to find the partial products we could combine to find the area of the entire figure

Let's Think (Slide 5): *(read problem)* Right away, you probably notice that this problem doesn't include a picture. What should we do? (sketch our own picture)



(sketch a simple drawing as you narrate) I know squares have equal sides, so I'm picturing a square sandbox that measures 3 ⅓ on each side. The problem wants us to find the area, so I'm picturing the area inside the sandbox as what we're trying to determine. An area model will help us break this problem into more manageable pieces.



(sketch an area model and label each side as 3 and 1/3 as shown) We'll find the area of each part, then add them together to find the total area. How would you find the area of each part? *(write expression and product in each box as student explains)* Possible Student Answers, Key Points:

- 3 times 3 is 9. 3 times 1/3 is 3/3, which is the same as 1 whole. 3 times 1/3 is 3/3 or 1 whole again. 1/3 times 1/3 is 1/9.

|

The area of one section is 9 square units, another is 1 square unit, another is 1 square unit, and the smallest part has an area of 1/9 square unit. *(write 9 + 1 + 1 + 1/9)* If we add the areas together, we can see that the square has an area of 11 1/9 square yards.

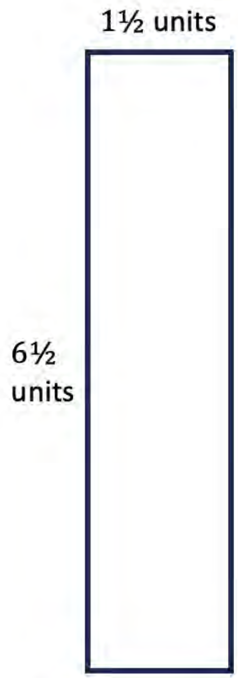
Let's Try it (Slides 6 - 7): Now it's time to practice finding the area of rectangles with fractional side lengths. With each example, we'll use an area model to help us break the problem into easier pieces. By decomposing the mixed number side lengths, we create several simpler area problems that we can combine to get our final answer. Let's try a few more, and I'll be ready to support as needed.

WARM WELCOME

Today we will find the area of rectangles with mixed-by-mixed and fraction-by-fraction side lengths by tiling, record by drawing, and relate to fraction multiplication.

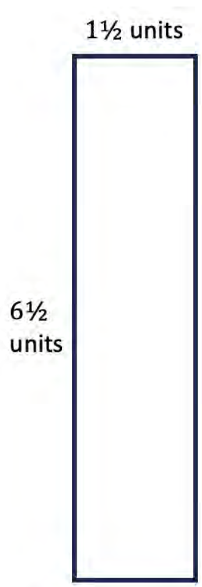
Let's Talk:

What's the same?
What's different?



Let's Think:

What is the area of the rectangle?

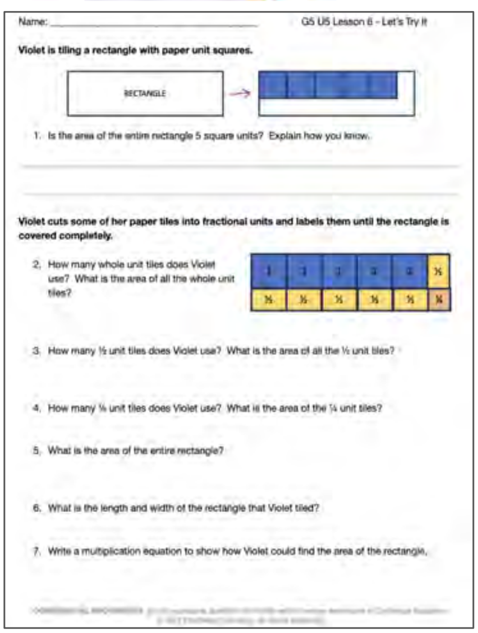


Let's Think:

A square sandbox has side lengths that measure 3 ⅓ yards. What is the area of the square sandbox?

Let's Try It:

Let's explore finding the area of rectangles with mixed-by-mixed and fraction-by-fraction side lengths together.

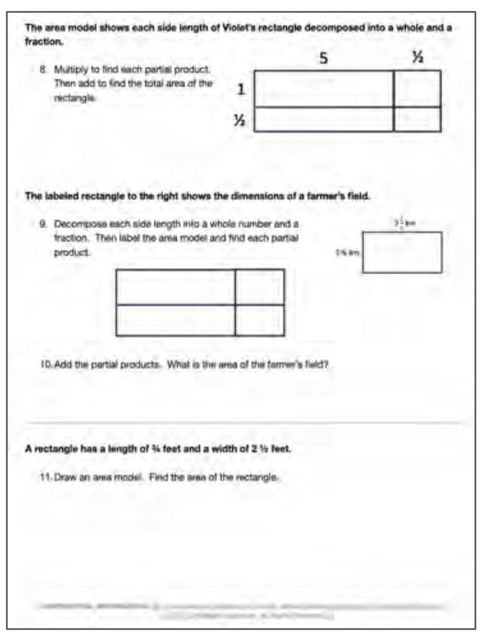

Name: ______________________ G5 U5 Lesson 6 - Let's Try It

Violet is tiling a rectangle with paper unit squares.

1. Is the area of the entire rectangle 5 square units? Explain how you know.

Violet cuts some of her paper tiles into fractional units and labels them until the rectangle is covered completely.

2. How many whole unit tiles does Violet use? What is the area of all the whole unit tiles?
3. How many ½ unit tiles does Violet use? What is the area of all the ½ unit tiles?
4. How many ¼ unit tiles does Violet use? What is the area of the ¼ unit tiles?
5. What is the area of the entire rectangle?
6. What is the length and width of the rectangle that Violet tiled?
7. Write a multiplication equation to show how Violet could find the area of the rectangle.


The area model shows each side length of Violet's rectangle decomposed into a whole and a fraction.

8. Multiply to find each partial product. Then add to find the total area of the rectangle.

The labeled rectangle to the right shows the dimensions of a farmer's field.

9. Decompose each side length into a whole number and a fraction. Then label the area model and find each partial product.

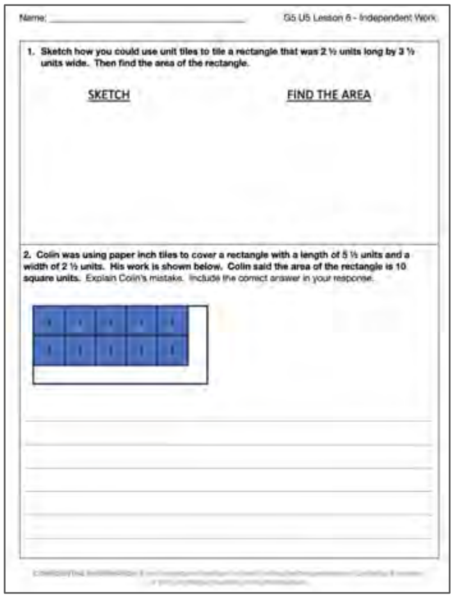
10. Add the partial products. What is the area of the farmer's field?

A rectangle has a length of ¾ feet and a width of 2 ½ feet.

11. Draw an area model. Find the area of the rectangle.

On your Own:

Now it's time to find the area of rectangles with mixed-by-mixed and fraction-by-fraction side lengths on your own.

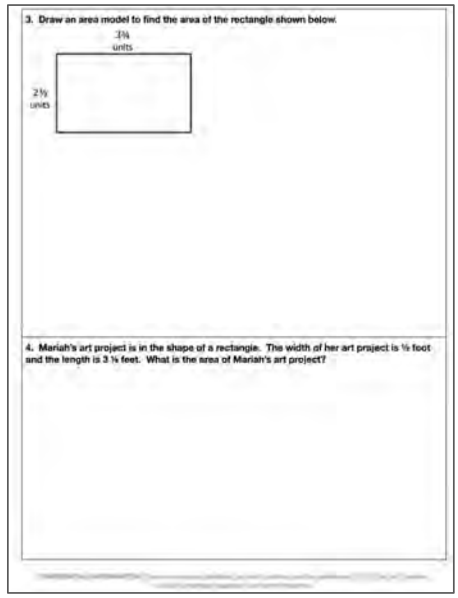


Name: ______________________ G5 U5 Lesson 6 - Independent Work

1. Sketch how you could use unit tiles to tile a rectangle that was $2\frac{1}{2}$ units long by $3\frac{1}{2}$ units wide. Then find the area of the rectangle.

SKETCH FIND THE AREA

2. Colin was using paper inch tiles to cover a rectangle with a length of $5\frac{1}{2}$ units and a width of $2\frac{1}{2}$ units. His work is shown below. Colin said the area of the rectangle is 10 square units. Explain Colin's mistake. Include the correct answer in your response.

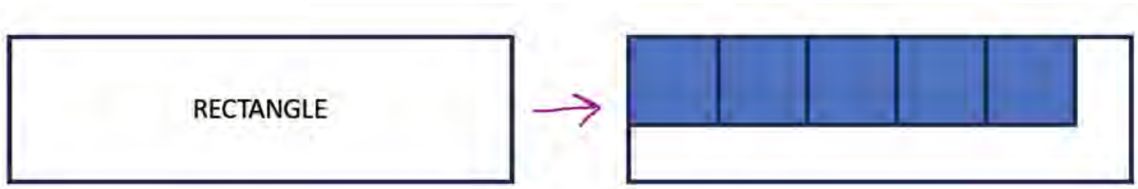


3. Draw an area model to find the area of the rectangle shown below.

4. Mariah's art project is in the shape of a rectangle. The width of her art project is $\frac{1}{2}$ foot and the length is $3\frac{1}{4}$ feet. What is the area of Mariah's art project?

Name: ____ G5 U5 Lesson 6 - Let's Try It

Violet is tiling a rectangle with paper unit squares.



1. Is the area of the entire rectangle 5 square units? Explain how you know.

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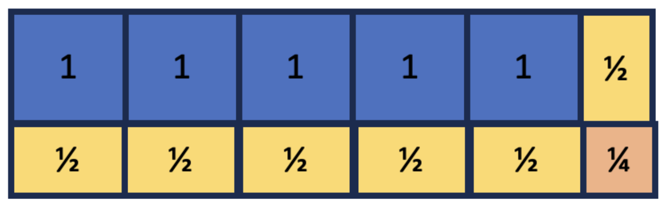
____

Violet cuts some of her paper tiles into fractional units and labels them until the rectangle is covered completely.



2. How many whole unit tiles does Violet use? What is the area of all the whole unit tiles?

3. How many ½ unit tiles does Violet use? What is the area of all the ½ unit tiles?

4. How many ¼ unit tiles does Violet use? What is the area of the ¼ unit tiles?

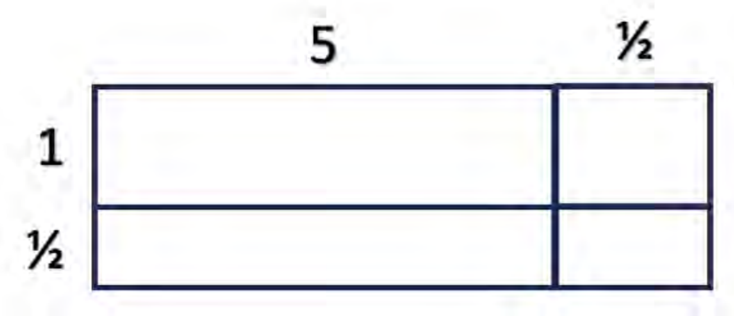
5. What is the area of the entire rectangle?

6. What is the length and width of the rectangle that Violet tiled?

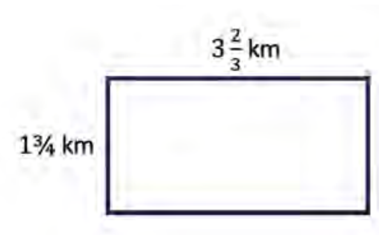
7. Write a multiplication equation to show how Violet could find the area of the rectangle.

The area model shows each side length of Violet's rectangle decomposed into a whole and a fraction.

8. Multiply to find each partial product. Then add to find the total area of the rectangle.



The labeled rectangle to the right shows the dimensions of a farmer's field.



9. Decompose each side length into a whole number and a fraction. Then label the area model and find each partial product.

10. Add the partial

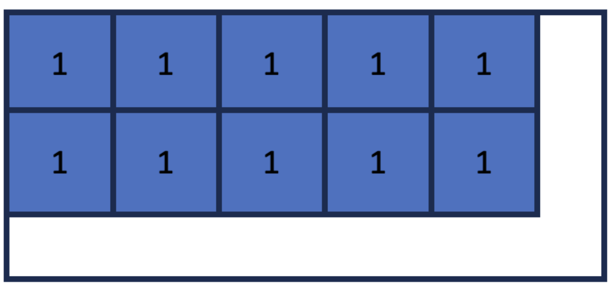
A rectangle has a length of ¾ feet and a width of 2 ½ feet.

11. Draw an area model. Find the area of the rectangle.

1. Sketch how you could use unit tiles to tile a rectangle that was 2 ½ units long by 3 ½ units wide. Then find the area of the rectangle.

SKETCH **FIND THE AREA**

2. Colin was using paper inch tiles to cover a rectangle with a length of 5 ½ units and a width of 2 ½ units. His work is shown below. Colin said the area of the rectangle is 10 square units. Explain Colin's mistake. Include the correct answer in your response.



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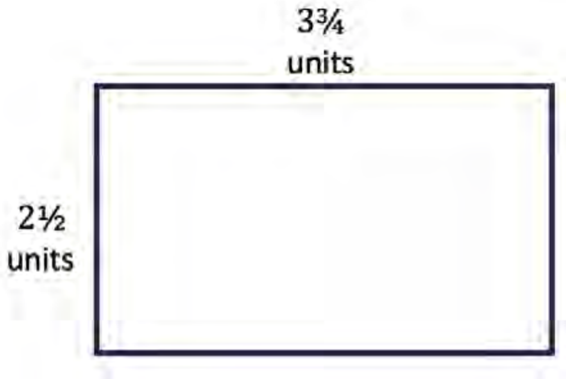
3. Draw an area model to find the area of the rectangle shown below.

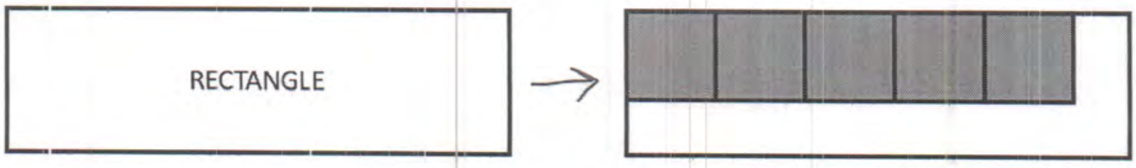


4. Mariah's art project is in the shape of a rectangle. The width of her art project is ½ foot and the length is 3 ⅛ feet. What is the area of Mariah's art project?

Name: KEY

G5 U5 Lesson 6 - Let's Try It

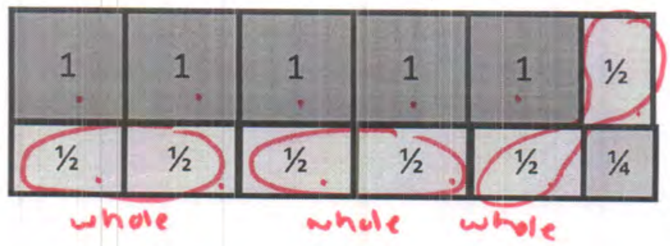
Violet is tiling a rectangle with paper unit squares.



1. Is the area of the entire rectangle 5 square units? Explain how you know.

No, the area is not 5 square units. She didn't tile the entire space

Violet cuts some of her paper tiles into fractional units and labels them until the rectangle is covered completely.



2. How many whole unit tiles does Violet use? What is the area of all the whole unit tiles?

5 whole tiles $= 5u^2$

3. How many ½ unit tiles does Violet use? What is the area of all the ½ unit tiles?

6 half tiles $= 3u^2$

4. How many ¼ unit tiles does Violet use? What is the area of the ¼ unit tiles?

1 quarter tile $= \frac{1}{4}u^2$

5. What is the area of the entire rectangle?

$5 + 3 + \frac{1}{4} = 8\frac{1}{4}u^2$

6. What is the length and width of the rectangle that Violet tiled?

length $= 5\frac{1}{2}$ width $= 1\frac{1}{2}$

7. Write a multiplication equation to show how Violet could find the area of the rectangle.

$5\frac{1}{2} \times 1\frac{1}{2} = ?$

The area model shows each side length of Violet's rectangle decomposed into a whole and a fraction.

8. Multiply to find each partial product. Then add to find the total area of the rectangle.

	5	½
1	$5 \times 1 = 5$	$\frac{1}{2} \times 1 = \frac{1}{2}$
½	$5 \times \frac{1}{2} = \frac{5}{2}$ OR $2\frac{1}{2}$	$\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$

$5 + \underbrace{\frac{1}{2} + 2\frac{1}{2}} + \frac{1}{4}$

$5 + 3 + \frac{1}{4}$

$8\frac{1}{4}\ u^2$

The labeled rectangle to the right shows the dimensions of a farmer's field.

	$3\frac{2}{3}$ km
1¾ km	

9. Decompose each side length into a whole number and a fraction. Then label the area model and find each partial product.

	3	2/3
1	$3 \times 1 = 3$	$\frac{2}{3} \times 1 = \frac{2}{3}$
$\frac{3}{4}$	$3 \times \frac{3}{4} = \frac{9}{4} = 2\frac{1}{4}$	$\frac{3}{4} \times \frac{2}{3} = \frac{6}{12}$

10. Add the partial products. What is the area of the farmer's field?

$3 + \frac{2}{3} + 2\frac{1}{4} + \frac{6}{12}$

$3 + \frac{8}{12} + 2\frac{3}{12} + \frac{6}{12} = 5\frac{17}{12} = 6\frac{5}{12}\ km^2$

A rectangle has a length of ¾ feet and a width of 2 ½ feet.

11. Draw an area model. Find the area of the rectangle.

	2	1/2
$\frac{3}{4}$	$2 \times \frac{3}{4}$	$\frac{3}{4} \times \frac{1}{2}$

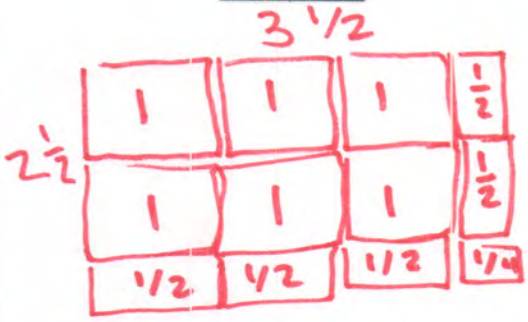
$\frac{6}{4} + \frac{3}{8}$

$\frac{12}{8} + \frac{3}{8} = \frac{15}{8} = 1\frac{7}{8}\ ft^2$

Name: KEY

1. Sketch how you could use unit tiles to tile a rectangle that was 2 ½ units long by 3 ½ units wide. Then find the area of the rectangle.

SKETCH



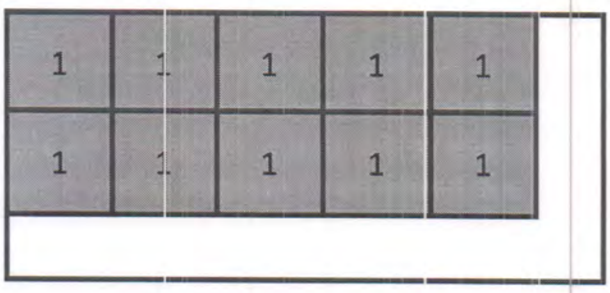
FIND THE AREA

	3	1/2
2	2×3 6	$2 \times \frac{1}{2} =$ 1
$\frac{1}{2}$	$3 \times \frac{1}{2} = \frac{3}{2}$	$\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$

$6 + 1 + 1\frac{1}{2} + \frac{1}{4}$

$6 + 1 + 1\frac{2}{4} + \frac{1}{4} = 8\frac{3}{4}\,u^2$

2. Colin was using paper inch tiles to cover a rectangle with a length of 5 ½ units and a width of 2 ½ units. His work is shown below. Colin said the area of the rectangle is 10 square units. Explain Colin's mistake. Include the correct answer in your response.

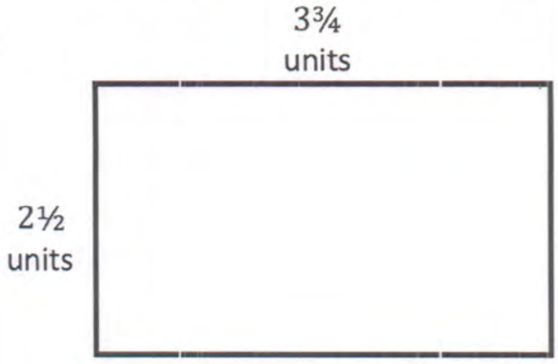


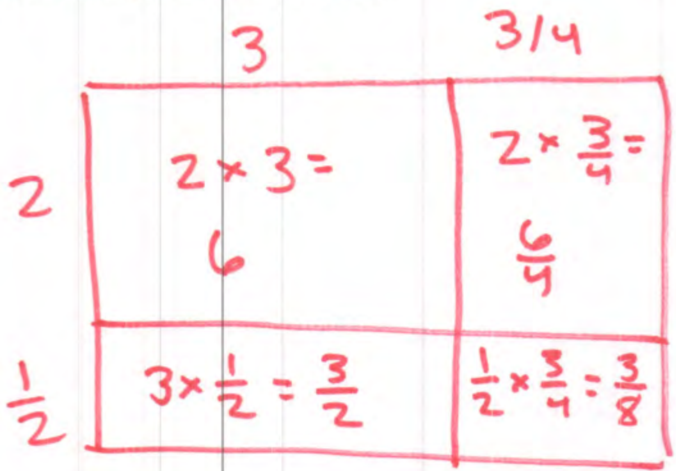
	5	1/2
2	5×2 10	$2 \times \frac{1}{2}$ 1
$\frac{1}{2}$	$5 \times \frac{1}{2} = \frac{5}{2}$	$\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$

$10 + 1 + 2\frac{2}{4} + \frac{1}{4} = 13\frac{3}{4}\,u^2$

Colin's wrong, because he didn't tile the whole figure. I made an area model and found partial products of 10, 1, $2\frac{1}{2}$, and $\frac{1}{4}$. I added those together for a total area of $13\frac{3}{4}\,u^2$.

3. **Draw an area model to find the area of the rectangle shown below.**



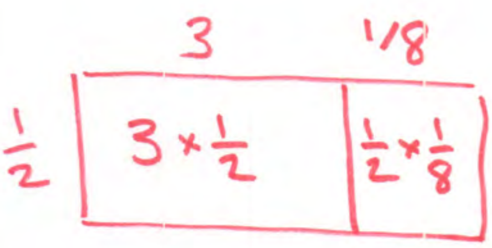


$6 + \underbrace{1\frac{2}{4} + 1\frac{1}{2}}_{3} + \frac{3}{8}$

$6 + 3 + \frac{3}{8}$

$9\frac{3}{8}u^2$

4. **Mariah's art project is in the shape of a rectangle. The width of her art project is ½ foot and the length is 3 ⅛ feet. What is the area of Mariah's art project?**



$3 \times \frac{1}{2} + \frac{1}{2} \times \frac{1}{8}$

$\frac{3}{2} + \frac{1}{16}$

$1\frac{1}{2} + \frac{1}{16}$

$1\frac{8}{16} + \frac{1}{16}$

$1\frac{9}{16}\ ft^2$

G5 U5 Lesson 7

Multiply mixed number factors, and relate to the distributive property and the area model.

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G5 U5 Lesson 7 - Students will multiply mixed number factors, and relate to the distributive property and area model

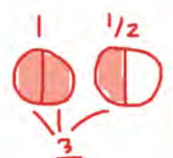
Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): We've been getting better at finding the area of rectangles with fractional side lengths. So far we've explored how we can find the area of rectangles by counting unit squares and by using an area model to decompose a rectangle into more manageable pieces. Today, we'll use what we've done previously and introduce a new strategy that doesn't require us to decompose at all. Before I show you what I mean, let's refresh on an important skill that will help us today.

Let's Talk (Slide 3): Look at the mixed numbers and fractions shown here. What do you notice? What do you wonder? Possible Student Answers, Key Points:

- I notice each equation shows a mixed number and a fraction greater than 1. I notice the mixed numbers are equivalent to the fractions greater than 1. I notice the last equation is missing a number.
- I wonder if these are all true statements. I wonder what these have to do with finding area. I wonder what the missing number is.

Each of these is an example of a mixed number and its equivalent fraction greater than 1. Sometimes we call these fractions greater than 1 "improper fractions."



Let's think about 1 ½, for example. *(draw two circles partitioned into halves and shade/label 1 ½)* If I'm picturing 1 ½ pizzas, I can think of that as 1 pizza and an extra half of a pizza like this. If I think about that amount as just halves, I can see it's equivalent to *(point and count)* 1 half, 2 halves, 3 halves. 1 ½ is equivalent to 3/2. 3/2 is the fraction greater than 1, or improper fraction, that is equivalent to the mixed number 1 ½.

$$3\tfrac{2}{5} = \frac{17}{5}$$
$$\frac{15}{5} + \frac{2}{5}$$

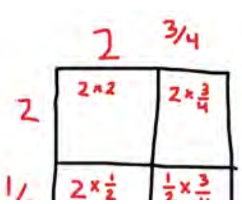
We don't have to draw a picture to know these are equivalent. We can think about it numerically. Let's look at 3 ⅖ I can think of 3 wholes as being the same as 15/5. So, I can decompose 3 ⅖ into 15/5 and ⅖ 15/5 plus ⅖ is equal to 17/5. The mixed number 3 ⅖ is equivalent to the improper fraction 17/5.*(if necessary, talk through a similar representation for 4 1/10)*

Let's look at the last example with the missing number. How can you use what we just looked at to find the missing value? Possible Student Answers, Key Points:

- I know 2 wholes would be the same as 14/7. I can decompose 2 5/7 into 14/7 + 5/7. So, I know 2 5/7 is equivalent to 19/7. The missing number is 19.

This skill is going to come in handy for our lesson. We know we can multiply the length and width of a rectangle to determine its area. Rather than decompose and multiply in parts, today we'll see how if we write mixed number dimensions as improper fractions, we can multiply quickly without an area model. Let's try this out.

Let's Think (Slide 4): This problem wants us to find the area of the rectangle using two different strategies.



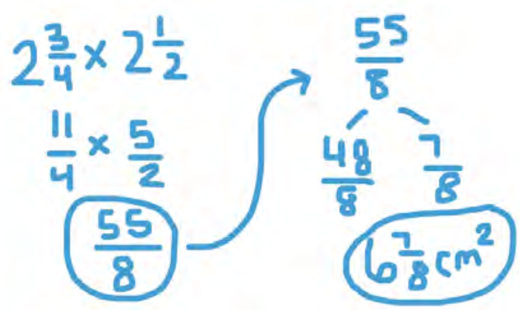
We'll start by using an area model, since that's what we're used to. *(draw a 2 x 2 area model and label one side with 2 and ¾ and the other side with 2 and ½)* I know I can multiply to find the area of each smaller piece, and then add my partial products together to find the entire area. *(write each multiplication expression inside the corresponding box)*

$$(2\times2)+\left(2\times\tfrac{3}{4}\right)+\left(2\times\tfrac{1}{2}\right)+\left(\tfrac{1}{2}\times\tfrac{3}{4}\right)$$
$$4 + 1\tfrac{2}{4} + 1 + \tfrac{3}{8}$$
$$4 + 1\tfrac{4}{8} + 1 + \tfrac{3}{8}$$
$$6\tfrac{7}{8}\ cm^2$$

Let's write the partial products as one expression outside of the area model. *(write expression and evaluate as you narrate)* We know 2 x 2 is what? (4) We know 2 x ¾ is what? (6/4) I can write that as 1 and 2/4, since 4/4 is a whole. What is 2 x ½? (2/2 or 1 whole) We'll write that as 1, since it's simpler to think about. Lastly, what is ½ x ¾? (⅜

Before adding, I notice the fractions have different units. Let's rewrite 1 2/4 as 1 4/8 so that we can easily add it to the other fraction with units of eighths. If I add up each area, I can see that the rectangle's total area is 6 ⅜square centimeters.

Great! We solved for the area of this rectangle using an area model. Now let's try another strategy using those improper fractions from the beginning of the lesson.



To find the area of this rectangle, we need to multiply 2 ¾ x 2 ½. *(write 2 ¾ x 2 ½)* If we rewrite both of these mixed numbers as improper fractions, or fractions greater than 1, we can simply multiply across the fractions to arrive at the area of the rectangle. I know 2 ¾ is 2 wholes and ¾, so I can think of that as 8/4 and ¾. 2 ¾ is equivalent to 11/4. What is 2 ½ as an improper fraction? Possible Student Answers, Key Points:

- 2 ½ is equivalent to 5/2.
- 2 wholes is 4/2. 4/2 plus the ½, means the improper fraction equivalent to 2 ½ is 5/2.

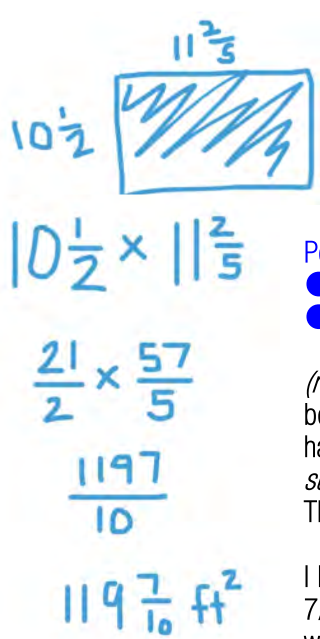
(write 11/4 x 5/2 underneath original expression) Now I can just multiply across the improper fractions. That's pretty efficient. 11/4 times 5/2 is 55/8. *(write 55/8)* I could leave my answer like that, but it might make more sense to rewrite it as a mixed number. 55/8 is between 6 wholes and 7 wholes, because 6 wholes would be 48/8 and 7 wholes would be 56/8. I can decompose 55/8 into 48/8 and ⅞ *(show using a number bond)*, so the mixed number equivalent to 55/8 is 6 ⅞. Our answer is 6 ⅞ square units, just like the answer we got with an area model.

We found the area using an area model first. Then, we found the area by multiplying our side lengths as improper fractions. Which strategy do you find most efficient, and why? Possible Student Answers, Key Points:

- I like the area model, because the numbers are easy to calculate in my head.
- I like the improper fraction strategy, because it feels like less steps.

Both strategies are useful, and you might run into certain problems that are easier to use with one strategy over the other. We'll keep trying the strategies out so we get more confident with them.

Let's Think (Slide 5): *(read problem)* This problem wants us to pick a strategy to find the area of the playground.



They don't include a picture, so it can be helpful to quickly sketch our own. *(sketch a rectangle labeled with the dimensions from the story problem)* We can use an area model or the strategy we just learned. Since it says we can choose, let's try the one we just learned. We'll change the mixed number dimensions into improper fractions and multiply them.

(write 10 ½ x 11 ⅖) Let's first think about these two mixed numbers as improper fractions, or fractions greater than 1. What would the dimensions be as improper fractions, and how do you know? Possible Student Answers, Key Points:

- I know 10 wholes would be 20/2, so 20/2 plus ½ is 21/2.
- I know 11 wholes would be 55/5, so 55/5 plus ⅖ is 57/5.

(rewrite the expression as 21/2 x 57/5) Hm, these numbers feel like they're getting kind of big. I'm beginning to wonder if this strategy was the right one to choose. Let's keep going, because I know we can handle it. Take a moment, feel free to use pencil and paper, and find the product of 21 x 57. *(wait and support as needed)* 21 times 57 means our numerator is 1197. 2 times 5 means our denominator is 10. The area is 1197/10 square feet.

I know 10 tenths is one whole. So, 119 wholes would be 1190 tenths. I can think of 1197/10 as 119 7/10 square feet. That problem didn't have as friendly of numbers as the previous problem. Do you think we picked the best strategy for this problem? Possible Student Answers, Key Points:

- I think we did. The multiplication was a little tricky, and rewriting the answer as a mixed number took time, but I can do it. I like not having to draw an area model.
- I think we should have done an area model. It would have broken the math into pieces that are easier to think about.

Either strategy will work on our problems today, and it's always nice to have options when tackling math problems. Consider the numbers in the problem before choosing a strategy. The easier you can make your process, the less likely you are to make small mistakes.

Let's Try it (Slides 6 - 7): As you work through the next few problems, we'll get a chance to try out area models and today's new strategy where we convert the mixed number measurements into improper fractions. Using both strategies can be a great way to check your work. If we're given a choice of strategy, we'll want to think carefully and predict what either strategy would mean with the numbers at hand. Let's go for it!

WARM WELCOME

Today we will multiply mixed number factors, and relate to the distributive property and area model.

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Let's Talk:

What do you notice?
What do you wonder?

$$1\frac{1}{2} = \frac{3}{2}$$

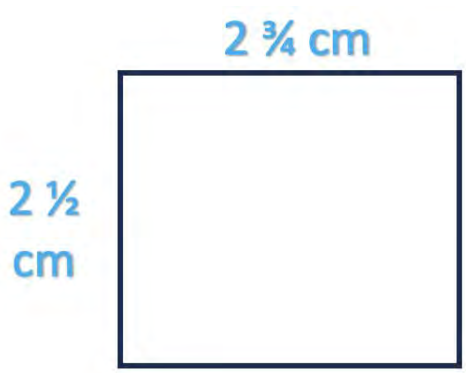
$$4\frac{1}{10} = \frac{41}{10}$$

$$3\frac{2}{5} = \frac{17}{5}$$

$$2\frac{5}{7} = \frac{\boxed{}}{7}$$

Let's Think:

Find the area of the rectangle using two different strategies.

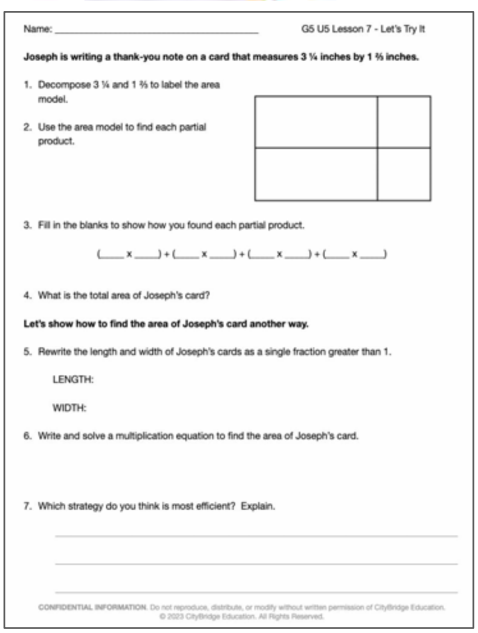


Let's Think:

A rectangular playground is 10 ½ feet long and 11 ⅖ feet wide. Choose a strategy to find the area of the playground.

Let's Try It:

Let's explore multiplying mixed number factors together.



Name: ______________________ G5 U5 Lesson 7 - Let's Try It

Joseph is writing a thank-you note on a card that measures 3 ¼ inches by 1 ⅖ inches.

1. Decompose 3 ¼ and 1 ⅖ to label the area model.
2. Use the area model to find each partial product.
3. Fill in the blanks to show how you found each partial product.

   (____ x ____) + (____ x ____) + (____ x ____) + (____ x ____)

4. What is the total area of Joseph's card?

Let's show how to find the area of Joseph's card another way.

5. Rewrite the length and width of Joseph's cards as a single fraction greater than 1.

   LENGTH:

   WIDTH:

6. Write and solve a multiplication equation to find the area of Joseph's card.
7. Which strategy do you think is most efficient? Explain.

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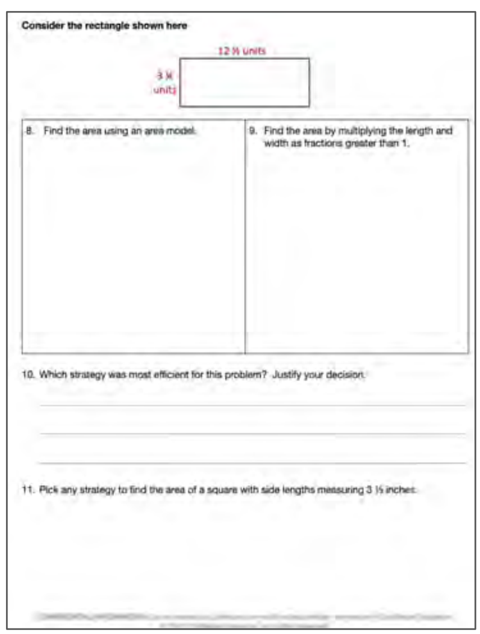


Consider the rectangle shown here

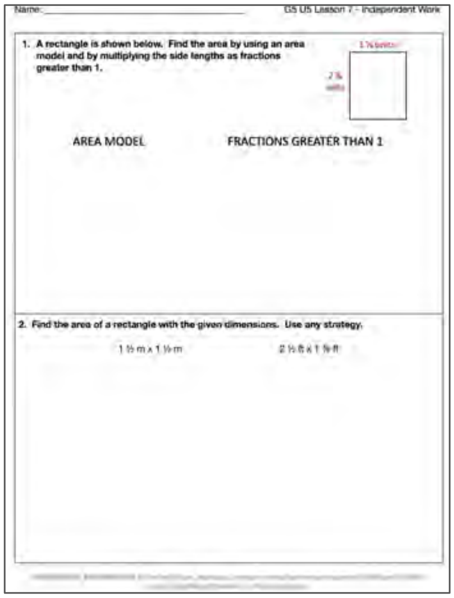
12 ½ units

3 ½ units

8. Find the area using an area model.
9. Find the area by multiplying the length and width as fractions greater than 1.
10. Which strategy was most efficient for this problem? Justify your decision.
11. Pick any strategy to find the area of a square with side lengths measuring 3 ½ inches.

On your Own:

Now it's time to multiply mixed number factors on your own.



Name: ______________________ G5 U5 Lesson 7 - Independent Work

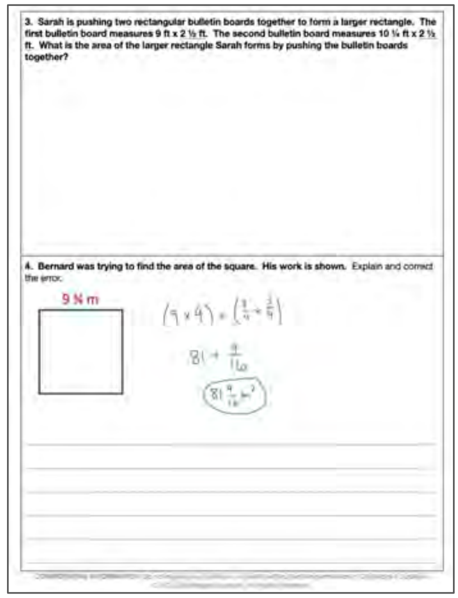
1. A rectangle is shown below. Find the area by using an area model and by multiplying the side lengths as fractions greater than 1.

AREA MODEL

FRACTIONS GREATER THAN 1

2. Find the area of a rectangle with the given dimensions. Use any strategy.

[illegible]



3. Sarah is pushing two rectangular bulletin boards together to form a larger rectangle. The first bulletin board measures 9 ft x 2 ½ ft. The second bulletin board measures 10 ¼ ft x 2 ½ ft. What is the area of the larger rectangle Sarah forms by pushing the bulletin boards together?

4. Bernard was trying to find the area of the square. His work is shown. Explain and correct the error.

9 ¾ m

$(9 \times 9) + (\frac{3}{4} \times \frac{3}{4})$

$81 + \frac{9}{16}$

$81\frac{9}{16}\ m^2$

Name: ____

Joseph is writing a thank-you note on a card that measures 3 ¼ inches by 1 ⅔ inches.

1. Decompose 3 ¼ and 1 ⅔ to label the area model.

2. Use the area model to find each partial product.

3. Fill in the blanks to show how you found each partial product.

(______ x ______) + (______ x ______) + (______ x ______) + (______ x ______)

4. What is the total area of Joseph's card?

Let's show how to find the area of Joseph's card another way.

5. Rewrite the length and width of Joseph's cards as a single fraction greater than 1.

   LENGTH:

   WIDTH:

6. Write and solve a multiplication equation to find the area of Joseph's card.

7. Which strategy do you think is most efficient? Explain.

____

____

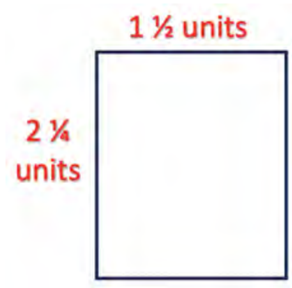
____

Consider the rectangle shown here

8. Find the area using an area model.	9. Find the area by multiplying the length and width as fractions greater than 1.

10. Which strategy was most efficient for this problem? Justify your decision.

11. Pick any strategy to find the area of a square with side lengths measuring $3 \frac{2}{3}$ inches.



1. A rectangle is shown below. Find the area by using an area model and by multiplying the side lengths as fractions greater than 1.

AREA MODEL **FRACTIONS GREATER THAN 1**

2. Find the area of a rectangle with the given dimensions. Use any strategy.

1 ½ m x 1 ½ m

2 ½ ft x 1 ⅞ ft

3. Sarah is pushing two rectangular bulletin boards together to form a larger rectangle. The first bulletin board measures 9 ft x 2 ½ ft. The second bulletin board measures 10 ¼ ft x 2 ½ ft. What is the area of the larger rectangle Sarah forms by pushing the bulletin boards together?

4. Bernard was trying to find the area of the square. His work is shown. Explain and correct the error.

$$(9 \times 9) + \left(\frac{3}{4} \times \frac{3}{4}\right)$$

$$81 + \frac{9}{16}$$

$$81\frac{9}{16}\ m^2$$

Name: KEY

Joseph is writing a thank-you note on a card that measures 3 ¼ inches by 1 ⅔ inches.

1. Decompose 3 ¼ and 1 ⅔ to label the area model.

2. Use the area model to find each partial product.

	3	$\frac{1}{4}$
1	$3 \times 1 = 3$	$1 \times \frac{1}{4} = \frac{1}{4}$
$\frac{2}{3}$	$3 \times \frac{2}{3} = \frac{6}{3} = 2$	$\frac{2}{3} \times \frac{1}{4} = \frac{2}{12}$

3. Fill in the blanks to show how you found each partial product.

$$(3 \times 1) + (\tfrac{1}{4} \times 1) + (3 \times \tfrac{2}{3}) + (\tfrac{1}{4} \times \tfrac{2}{3})$$

$$3 + \tfrac{1}{4} \rightarrow \tfrac{3}{12} + 2 + \tfrac{2}{12}$$

4. What is the total area of Joseph's card?

$5\frac{5}{12}$ in^2

Let's show how to find the area of Joseph's card another way.

5. Rewrite the length and width of Joseph's cards as a single fraction greater than 1.

LENGTH: $3\frac{1}{4} = \frac{13}{4}$

WIDTH: $1\frac{2}{3} = \frac{5}{3}$

6. Write and solve a multiplication equation to find the area of Joseph's card.

$$\frac{13}{4} \times \frac{5}{3} = \frac{65}{12} = 5\frac{5}{12} \text{ in}^2$$

7. Which strategy do you think is most efficient? Explain.

They are both efficient, but in different ways. The area model makes the math easier, but involves lots of steps. The second way has less steps but trickier numbers.

Consider the rectangle shown here

12 ½ units

3 ¼ units

$$\begin{array}{r} 25 \\ \times\ 13 \\ \hline 75 \\ 250 \\ \hline 325 \end{array}$$

8. Find the area using an area model.

	12	$\frac{1}{2}$
3	36	$\frac{3}{2} = 1\frac{1}{2}$
$\frac{1}{4}$	$\frac{12}{4} = 3$	$\frac{1}{8}$

$36 + 1\frac{1}{2} + 3 + \frac{1}{8}$

$36 + 1\frac{4}{8} + 3 + \frac{1}{8}$

$40\frac{5}{8}\,u^2$

9. Find the area by multiplying the length and width as fractions greater than 1.

$12\frac{1}{2} = \frac{25}{2}$ $\quad 3\frac{1}{4} = \frac{13}{4}$

$\frac{25}{2} \times \frac{13}{4} = \frac{325}{8} = \frac{320}{8} + \frac{5}{8}$

$40\frac{5}{8}\,u^2$

10. Which strategy was most efficient for this problem? Justify your decision.

I liked the area model, because this problem had improper fractions that ~~were~~ were hard to multiply and simplify.

11. Pick any strategy to find the area of a square with side lengths measuring 3 ⅓ inches.

$3\frac{1}{3}$

$3\frac{1}{3}$

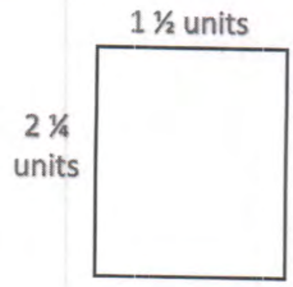
$\frac{10}{3} \times \frac{10}{3} = \frac{100}{9} = 11\frac{1}{9}\,in^2$

$\frac{99}{9}$ $\quad \frac{1}{9}$

11 $\quad \frac{1}{9}$

Name: KEY

1. A rectangle is shown below. Find the area by using an area model and by multiplying the side lengths as fractions greater than 1.



AREA MODEL

	2	$\frac{1}{4}$
1	2×1	$\frac{1}{4} \times 1$
$\frac{1}{2}$	$2 \times \frac{1}{2}$	$\frac{1}{2} \times \frac{1}{4}$

$2 + \frac{1}{4} + 1 + \frac{1}{8}$

$2 + \frac{2}{8} + 1 + \frac{1}{8} = 3\frac{3}{8}u^2$

FRACTIONS GREATER THAN 1

$2\frac{1}{4} = \frac{9}{4}$ $\quad 1\frac{1}{2} = \frac{3}{2}$

$\frac{9}{4} \times \frac{3}{2} = \frac{27}{8} = 3\frac{3}{8}u^2$

$\frac{24}{8}$ $\frac{3}{8}$

2. Find the area of a rectangle with the given dimensions. Use any strategy.

1 ½ m x 1 ½ m

$\frac{3}{2} \times \frac{3}{2}$

$\frac{9}{4}$

$\frac{8}{4}$ $\frac{1}{4}$

$2\frac{1}{4}m^2$

2 ½ ft x 1 ⅞ ft

	2	$\frac{1}{2}$
1	2	$\frac{1}{2}$
$\frac{7}{8}$	$\frac{14}{8} = 1\frac{6}{8}$	$\frac{7}{16}$

$2 + \frac{1}{2} + 1\frac{6}{8} + \frac{7}{16}$

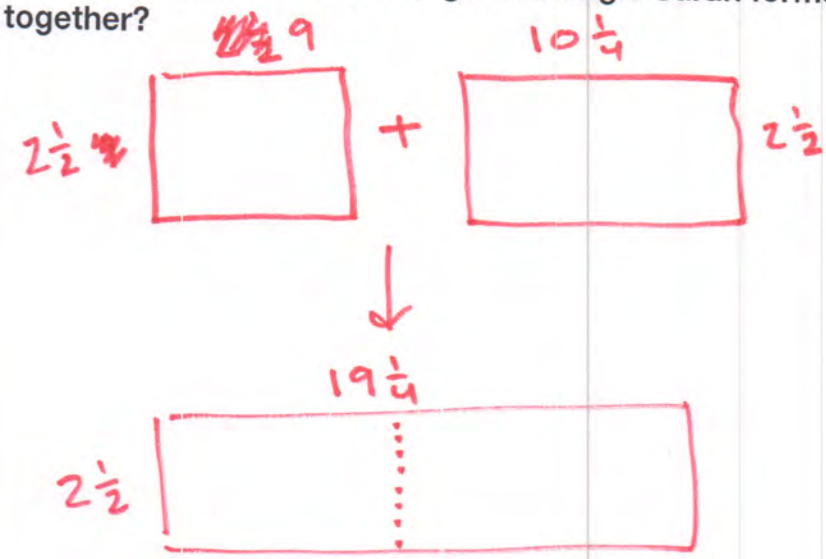
$2 + \frac{8}{16} + 1\frac{12}{16} + \frac{7}{16}$

$3\frac{27}{16}$

$\frac{16}{16}$ $\frac{11}{16}$

$4\frac{11}{16}ft^2$

3. Sarah is pushing two rectangular bulletin boards together to form a larger rectangle. The first bulletin board measures 9 ft x 2 ½ ft. The second bulletin board measures 10 ¼ ft x 2 ½ ft. What is the area of the larger rectangle Sarah forms by pushing the bulletin boards together?



$(2\times19)+(2\times\frac{1}{4})+(19\times\frac{1}{2})+(\frac{1}{2}\times\frac{1}{4})$

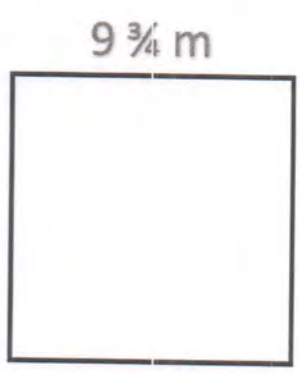
$38+\underbrace{\frac{1}{2}+\frac{19}{2}}+\frac{1}{8}$

$38+\frac{20}{2}+\frac{1}{8}$

$38+10+\frac{1}{8}$

$48\frac{1}{8}\ ft^2$

4. Bernard was trying to find the area of the square. His work is shown. Explain and correct the error.



$(9\times9)+(\frac{3}{4}\times\frac{3}{4})+(9\times\frac{3}{4})+(9\times\frac{3}{4})$

$81+\frac{9}{16}+\frac{27}{4}+\frac{27}{4}$

$\underbrace{6\frac{3}{4}+6\frac{3}{4}}$

$81\frac{9}{16}\ m^2 + 13\frac{1}{2}$

$13\frac{8}{16} = 94\frac{17}{16}$ OR $95\frac{1}{16}\ m^2$

He didn't multiply $9\frac{3}{4}\times9\frac{3}{4}$. He only multiplied parts of his factors together. He needed to also multiply $9\times\frac{3}{4}$ and $9\times\frac{3}{4}$ to find the total area. The total area of the square is $95\frac{1}{16}\ m^2$.

G5 U5 Lesson 8

Solve real-world problems involving area of figures with fractional side lengths using visual models and/or equations.

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G5 U5 Lesson 8 - Students will solve real-world problems involving area of figures with fractional side lengths using visual models and/or equations

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): Today is our last lesson in this unit. We spent the first half of the unit digging deep into volume concepts. More recently, we've been tackling problems that involve area with fractional side lengths. Today we'll use everything we've learned about area to solve real-world problems. What have you learned so far about calculating the area of rectangles with fractional dimensions that you predict might come in handy today? Possible Student Answers, Key Points:

- I know area is the amount of space a two-dimensional figure takes up, and we measure area in square units.
- We've found the area of rectangles with fractional side by using an area model. We also learned how you can multiply the side lengths as improper fractions to quickly find the area.

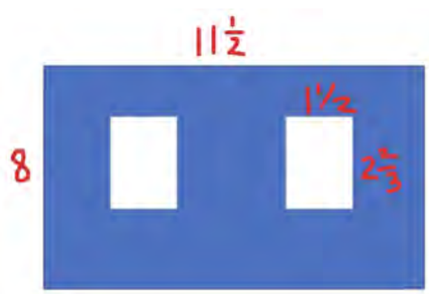
You've learned a lot. Let's put all that to use!

Let's Talk (Slide 3): *(read the information)* Based on the information provided, what math questions could we ask about this wall with the two windows? Possible Student Answers, Key Points:

- What is the area of a window? Both windows?
- What is the area of the wall?
- What is the perimeter of one of the windows or the wall?
- How much paint or wallpaper do we need to cover the wall?

Since the information involves the measurements of rectangular figures, there is a lot we could ask! This is the perfect context for a problem about area. Let's solve one.

Let's Think (Slide 4): Here is one math question that we could ask and answer based on the information about the windows and the wall. *(read the problem)*



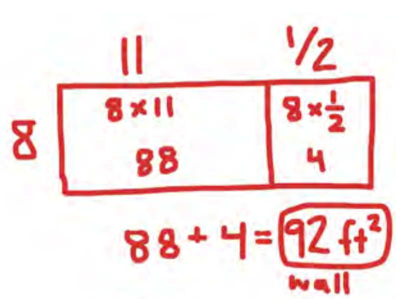
What information do we know from the problem, and what information are we trying to find out? *(label the image with dimensions as the student shares)* Possible Student Answers, Key Points:

- We know the wall measures 11 ½ feet long and 8 feet tall.
- We know there are two identical windows. They each measure 1 ½ feet long and 2 ⅔ feet tall.
- We are trying to figure out how much paint we need for the wall. We are trying to find the area of the wall, not including the two windows.

This problem is asking us to find the area of the wall, since they want to know how much paint would cover the entire wall. We obviously don't want to paint the windows, so it will be important that we don't include the windows when we calculate the area of the wall. If I'm planning out my solution pathway, I can think of the painted area like the wall minus the two windows will equal the area that I paint. *(write equation with words/pictures as shown)* Let's do some math!

We'll start by finding the area of the entire wall. Since we know the length is 11 ½ and the width is 8, we can multiply them together. I can use an area model or rewrite 11 ½ as an improper fraction. Which strategy would you choose, and why? Possible Student Answers, Key Points:

- I'd choose an area model since 11 ½ seems like it will give me big numbers in the improper fraction.
- I'd choose writing 11 ½ as an improper fraction, so I don't have to draw an entire area model.



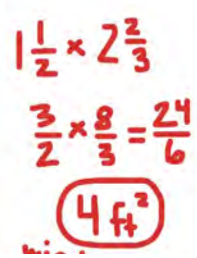
I'm going to use an area model to multiply 8 x 11 ½, because when I thought about changing 11 ½ into an improper fraction, the numbers didn't seem entirely friendly. *(draw a 2 x 1 area model, labeling the side lengths as 8 and 11 and ½)* I know 8 x 11 is 88. I know 8 x ½ is 8/2, which is just 4. *(fill in area model with the expressions and products)* 88 + 4, means the area of the entire wall is 92 square feet. *(write answer)*

Is 92 square feet the answer to our problem? How do you know? Possible Student Answers, Key Points:

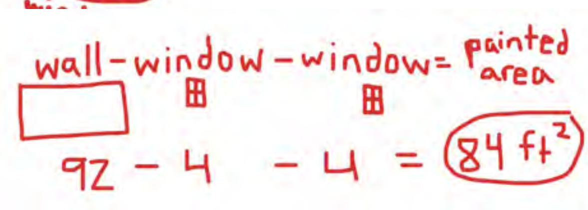
- It's not. That's just the area of the wall. We haven't taken out the windows.
- We're not done yet. If we said 92 square feet was how much paint we needed, we'd be painting over the windows.

Let's keep going. Now we have to consider the windows. Let's find the area of one window. If the dimensions are 1 ½ and 2 ⅔ feet, which strategy would you want to use to multiply these values? Possible Student Answers, Key Points:

- I might use an area model, because that's what we used on the last part of the problem.
- I might change them into improper fractions since the numbers in each mixed number are pretty accessible.



Since the numbers in each mixed number are small and pretty "friendly", how about we try converting them to improper fractions. An area model would definitely work too, if that's what you had wanted to do on your own. *(write 1 ½ x 2 ⅔ then write improper fractions underneath as student shares out)* What is 1 ½ as a fraction greater than 1? (3/2) What is 2 ⅔ as a fraction greater than 1? (8/3) When we multiply 3/2 by 8/3, we end up with 24/6. So, I know the area of each window is 4 square feet. The windows are the same size.



We have all the information we need to determine the amount of paint we'll use. The entire wall is 92 square feet. If we subtract out the windows, we can think of our problem as being 92 - 4 - 4, or 92 - 8 square feet. What is the area of the wall that we will need to paint? (84 square feet) We will need 84 square feet of paint to cover the wall. Nice work!

We just solved a real-world story problem involving area with fractional side lengths.

Let's Try it (Slides 5 - 6): Now we'll work to solve some other, similar story problems. Once we read each problem, we'll pause to think about what we know and what we're trying to find out. From there, we can develop a plan to solve. Since some of the problems today will include multiple steps, it will be crucial for us to think about the story and plan before jumping straight into the math. You've worked so hard the past several lessons, so I know we have the skills we need to succeed when solving today's story problems.

WARM WELCOME

Today we will solve real-world problems involving area of figures with fractional side lengths using visual models and/or equations.

Let's Talk:

A rectangular wall measures $11 \frac{1}{2}$ feet by 8 feet. There are two windows in the wall that each measure $1 \frac{1}{2}$ feet by $2 \frac{2}{3}$ feet.

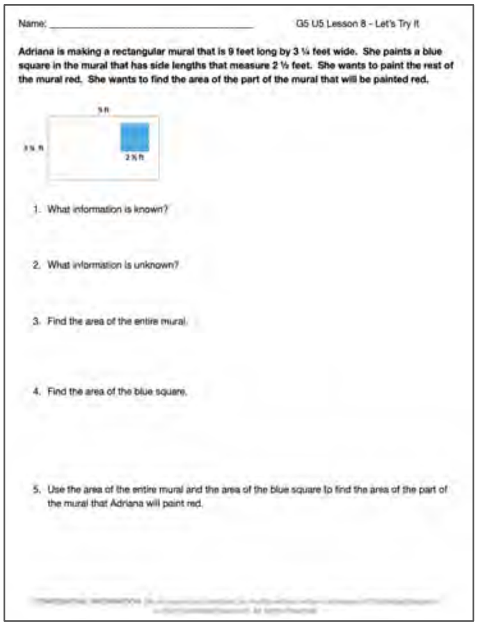
What math questions could we create with the given information?

Let's Think:

A rectangular wall measures $11 \frac{1}{2}$ feet by 8 feet. There are two windows in the wall that each measure $1 \frac{1}{2}$ feet by $2 \frac{2}{3}$ feet. How many square feet of paint are needed to cover the wall?

Let's Try It:

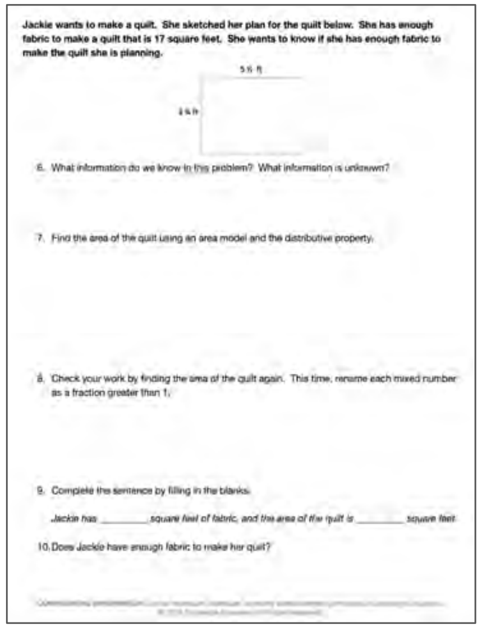
Let's explore solving real-world problems involving area of figures with fractional side lengths together.



Name: ______________________ G5 U5 Lesson 8 - Let's Try It

Adriana is making a rectangular mural that is 9 feet long by $3\frac{1}{4}$ feet wide. She paints a blue square in the mural that has side lengths that measure $2\frac{1}{2}$ feet. She wants to paint the rest of the mural red. She wants to find the area of the part of the mural that will be painted red.

1. What information is known?
2. What information is unknown?
3. Find the area of the entire mural.
4. Find the area of the blue square.
5. Use the area of the entire mural and the area of the blue square to find the area of the part of the mural that Adriana will paint red.



Jackie wants to make a quilt. She sketched her plan for the quilt below. She has enough fabric to make a quilt that is 17 square feet. She wants to know if she has enough fabric to make the quilt she is planning.

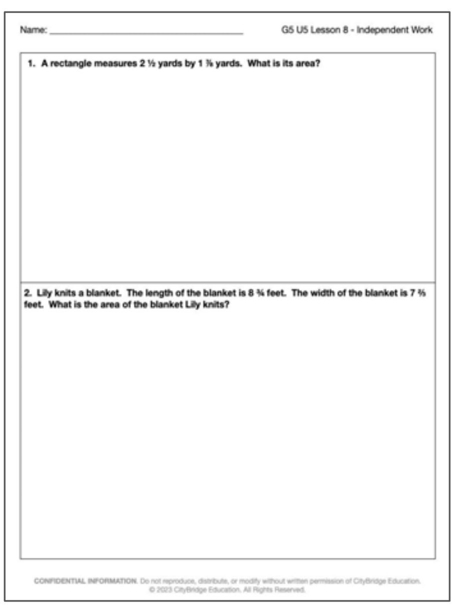
6. What information do we know in this problem? What information is unknown?
7. Find the area of the quilt using an area model and the distributive property.
8. Check your work by finding the area of the quilt again. This time, rename each mixed number as a fraction greater than 1.
9. Complete the sentence by filling in the blanks.

   Jackie has ________ square feet of fabric, and the area of the quilt is ________ square feet.

10. Does Jackie have enough fabric to make her quilt?

On your Own:

Now it's time to solve real-world problems involving area of figures with fractional side lengths on your own.



Name: ______________________ G5 U5 Lesson 8 - Independent Work

1. **A rectangle measures $2\frac{1}{2}$ yards by $1\frac{7}{8}$ yards. What is its area?**
2. **Lily knits a blanket. The length of the blanket is $8\frac{3}{4}$ feet. The width of the blanket is $7\frac{2}{3}$ feet. What is the area of the blanket Lily knits?**

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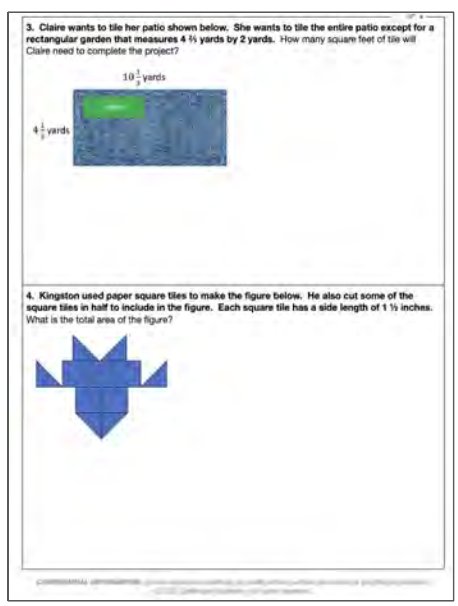
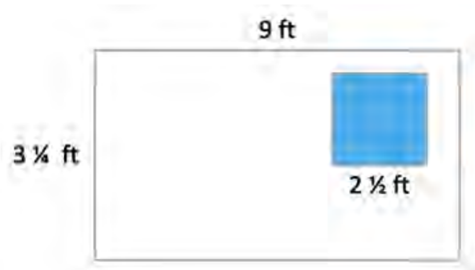


3. **Claire wants to tile her patio shown below. She wants to tile the entire patio except for a rectangular garden that measures $4\frac{2}{3}$ yards by 2 yards.** How many square feet of tile will Claire need to complete the project?

4. **Kingston used paper square tiles to make the figure below. He also cut some of the square tiles in half to include in the figure. Each square tile has a side length of $1\frac{1}{2}$ inches.** What is the total area of the figure?

Name: ____ G5 U5 Lesson 8 - Let’s Try It

Adriana is making a rectangular mural that is 9 feet long by 3 ¼ feet wide. She paints a blue square in the mural that has side lengths that measure 2 ½ feet. She wants to paint the rest of the mural red. She wants to find the area of the part of the mural that will be painted red.



1. What information is known?

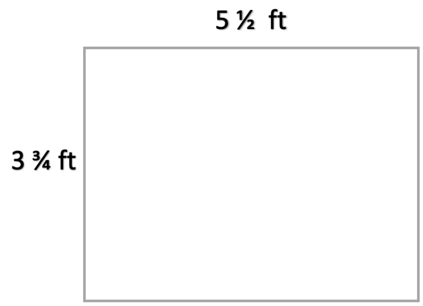
2. What information is unknown?

3. Find the area of the entire mural.

4. Find the area of the blue square.

5. Use the area of the entire mural and the area of the blue square to find the area of the part of the mural that Adriana will paint red.

Jackie wants to make a quilt. She sketched her plan for the quilt below. She has enough fabric to make a quilt that is 17 square feet. She wants to know if she has enough fabric to make the quilt she is planning.



6. What information do we know in this problem? What information is unknown?

7. Find the area of the quilt using an area model and the distributive property.

8. Check your work by finding the area of the quilt again. This time, rename each mixed number as a fraction greater than 1.

9. Complete the sentence by filling in the blanks.

   Jackie has ___________ square feet of fabric, and the area of the quilt is ___________ square feet.

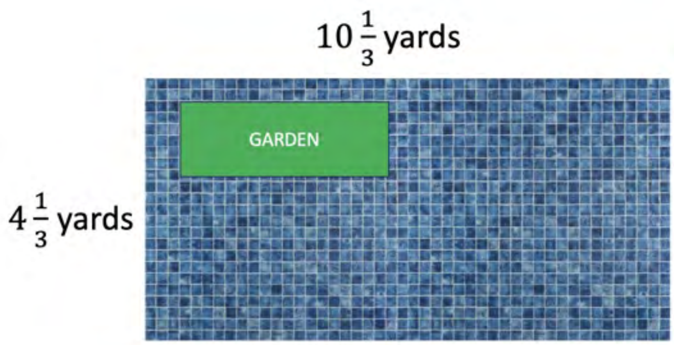
10. Does Jackie have enough fabric to make her quilt?

Name: ____ G5 U5 Lesson 8 - Independent Work

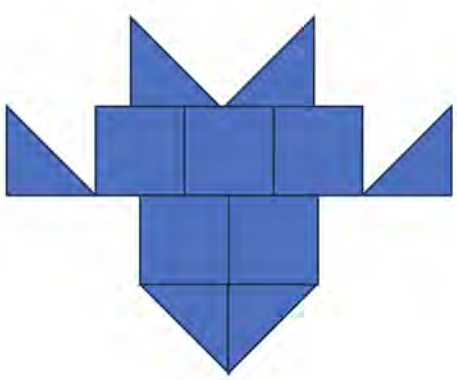
1. A rectangle measures 2 ½ yards by 1 ⅞ yards. What is its area?

2. Lily knits a blanket. The length of the blanket is 8 ¾ feet. The width of the blanket is 7 ⅞ feet. What is the area of the blanket Lily knits?

3. Claire wants to tile her patio shown below. She wants to tile the entire patio except for a rectangular garden that measures 4 ⅖ yards by 2 yards. How many square feet of tile will Claire need to complete the project?

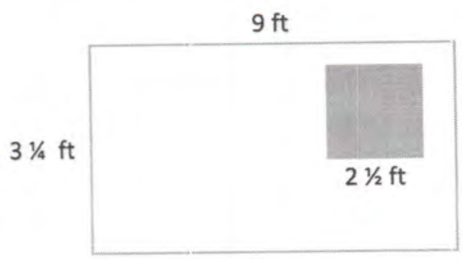


4. Kingston used paper square tiles to make the figure below. He also cut some of the square tiles in half to include in the figure. Each square tile has a side length of 1 ½ inches. What is the total area of the figure?



Name: KEY

Adriana is making a rectangular mural that is 9 feet long by 3 ¼ feet wide. She paints a blue square in the mural that has side lengths that measure 2 ½ feet. She wants to paint the rest of the mural red. She wants to find the area of the part of the mural that will be painted red.



1. What information is known?
   - I know the length and width of the mural.
   - I know the blue part is a square that is $2\frac{1}{2}$ by $2\frac{1}{2}$ ft.

2. What information is unknown?
   - I don't know the area of the blue square.
   - I don't know the area of the mural.

3. Find the area of the entire mural.

	3	1/4
9	9×3	$9\times\frac{1}{4}$

$27 + \frac{9}{4}$

$27 + 2\frac{1}{4} = 29\frac{1}{4}\ ft^2$

4. Find the area of the blue square.

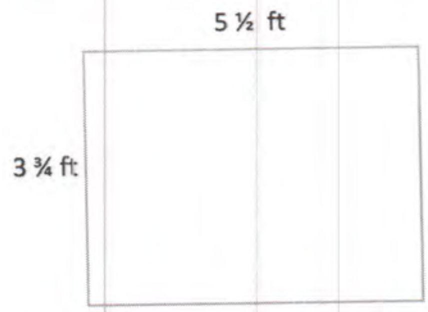
$2\frac{1}{2} \times 2\frac{1}{2}$

$\frac{5}{2} \times \frac{5}{2} = \frac{25}{4} = 6\frac{1}{4}\ ft^2$

5. Use the area of the entire mural and the area of the blue square to find the area of the part of the mural that Adriana will paint red.

$29\frac{1}{4} - 6\frac{1}{4} = 23\ ft^2$

Jackie wants to make a quilt. She sketched her plan for the quilt below. She has enough fabric to make a quilt that is 17 square feet. She wants to know if she has enough fabric to make the quilt she is planning.



6. What information do we know in this problem? What information is unknown?

- She has 17 square feet.
- I know the length & width of the quilt.

- I don't know the area of the quilt.
- I don't know if she has enough fabric.

7. Find the area of the quilt using an area model and the distributive property.

	5	1/2
3	3×5	$3\times\frac{1}{2}$
3/4	$5\times\frac{3}{4}$	$\frac{1}{2}\times\frac{3}{4}$

$$(3\times5)+(3\times\tfrac{1}{2})+(5\times\tfrac{3}{4})+(\tfrac{1}{2}\times\tfrac{3}{4})$$
$$15+\tfrac{3}{2}+\tfrac{15}{4}+\tfrac{3}{8}$$
$$15+1\tfrac{1}{2}+3\tfrac{3}{4}+\tfrac{3}{8}$$
$$15+1\tfrac{4}{8}+3\tfrac{6}{8}+\tfrac{3}{8}$$
$$19\tfrac{13}{8}=20\tfrac{5}{8}\ ft^2$$

8. Check your work by finding the area of the quilt again. This time, rename each mixed number as a fraction greater than 1.

$3\frac{3}{4}=\frac{15}{4}$

$5\frac{1}{2}=\frac{11}{2}$

$$\frac{15}{4}\times\frac{11}{2}=\frac{165}{8}=20\frac{5}{8}\ ft^2$$

$$\begin{array}{r} 15 \\ \times\ 11 \\ \hline 15 \\ 150 \\ \hline 165 \end{array}$$

9. Complete the sentence by filling in the blanks.

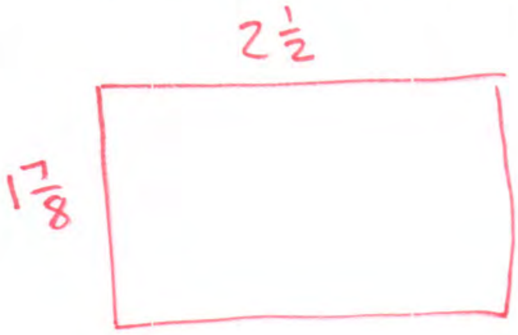
Jackie has 17 *square feet of fabric, and the area of the quilt is* $20\frac{5}{8}$ *square feet.*

10. Does Jackie have enough fabric to make her quilt?

She does not have enough.

Name: KEY

1. **A rectangle measures 2 ½ yards by 1 ⅞ yards. What is its area?**



$2\frac{1}{2} \times 1\frac{7}{8} = ?$

$\frac{5}{2} \times \frac{15}{8} = \frac{75}{16}$

$\frac{64}{16}$ $\frac{11}{16}$

$4\frac{11}{16}$ yd^2

2. **Lily knits a blanket. The length of the blanket is 8 ¾ feet. The width of the blanket is 7 ⅔ feet. What is the area of the blanket Lily knits?**

	8	3/4
7	8×7	$7 \times \frac{3}{4}$
$\frac{2}{3}$	$8 \times \frac{2}{3}$	$\frac{2}{3} \times \frac{3}{4}$

$(7 \times 8) + (7 \times \frac{3}{4}) + (8 \times \frac{2}{3}) + (\frac{2}{3} \times \frac{3}{4})$

$56 + \frac{21}{4} + \frac{16}{3} + \frac{6}{12}$

$56 + 5\frac{1}{4} + 5\frac{1}{3} + \frac{6}{12}$

$56 + 5\frac{3}{12} + 5\frac{4}{12} + \frac{6}{12}$

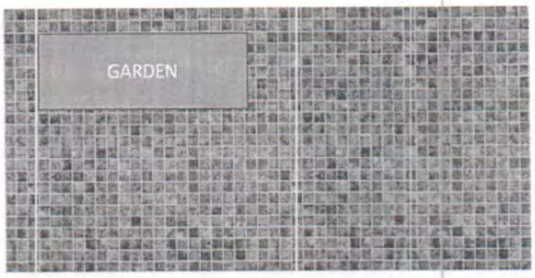
$66\frac{13}{12}$

$67\frac{1}{12}$ ft^2

3. Claire wants to tile her patio shown below. She wants to tile the entire patio except for a rectangular garden that measures 4 ⅖ yards by 2 yards. How many square feet of tile will Claire need to complete the project?

$10\frac{1}{3}$ yards

$4\frac{1}{3}$ yards



PATIO

$(4\times10)+(4\times\frac{1}{3})+(10\times\frac{1}{3})+(\frac{1}{3}\times\frac{1}{3})$

$40 + \frac{4}{3} + \frac{10}{3} + \frac{1}{9}$

$40 + \frac{14}{3} + \frac{1}{9}$

$40 + 4\frac{2}{3} + \frac{1}{9} \rightarrow 40 + 4\frac{6}{9} + \frac{1}{9} = 44\frac{7}{9}\ yd^2$

GARDEN

$(4\times2)+(\frac{2}{5}\times2)$

$8 + \frac{4}{5}$

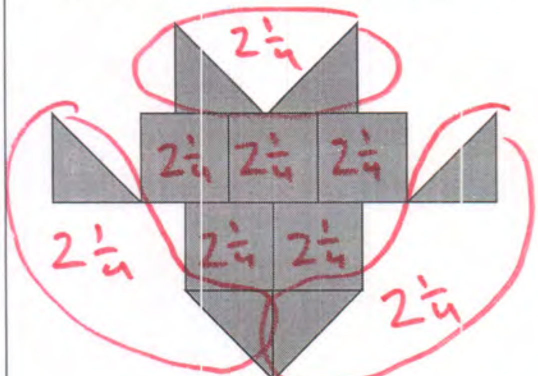
$8\frac{4}{5}\ yd^2$

$44\frac{7}{9} - 8\frac{4}{5} = ?$

$44\frac{35}{45} - 8\frac{36}{45} = ?$

$43\frac{80}{45} - 8\frac{36}{45} = 35\frac{44}{45}\ yd^2$

4. Kingston used paper square tiles to make the figure below. He also cut some of the square tiles in half to include in the figure. Each square tile has a side length of 1 ½ inches. What is the total area of the figure?



$\square = \frac{3}{2}\times\frac{3}{2} = \frac{9}{4} = 2\frac{1}{4}$

$8 \times 2\frac{1}{4}$

squares

$(8\times2)+(8\times\frac{1}{4})$

$16 + 2$

$18\ in^2$

CITYTUTOR DC

G5 Unit 6:

The Coordinate Plane

G5 U6 Lesson 1

Find and write coordinate pairs

CITYTUTOR DC

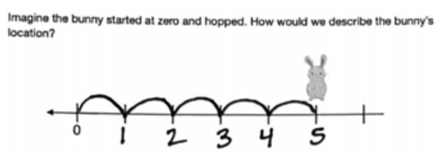
G1 U1 Lesson 1 - Today we will find and write coordinate pairs.

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): Today we are going to learn something that is used in tons of jobs like being a pilot or an architect or anyone who needs to specify a location. We are going to take number lines and see how putting two together helps us specify a location in any area. And the locations are going to be marked using something called "coordinate pairs."

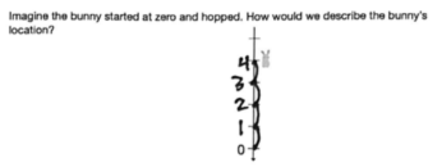
Let's Review (Slide 3): Let's start with just one number line on its own. Imagine the bunny started at zero and hopped. How would we describe the bunny's location? Possible Student Answers, Key Points:

- The bunny made 5 hops.
- If we put numbers, the bunny would be at the 5.



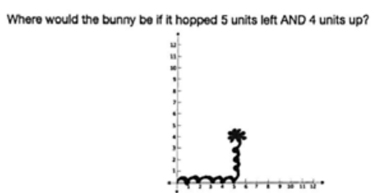
One of the things that's tricky about number lines is that we pay a lot of attention to these tick marks along the line. But really, the line itself shows the distance from zero and the tick marks are just showing stopping points along the way. So, it is helpful to show the bunnies jumps and then we can put numbers at the tick marks to show where each jump stops. But we are always counting the spaces not the tick marks. I will draw it. The bunny is 5 spaces from zero or 5 units from zero.

Let's Review (Slide 4): Let's look at a number line going this way. It's the same idea. We don't want to count the tick marks. We count the space between the tick marks and then the tick marks just mark where each space or jump ends.



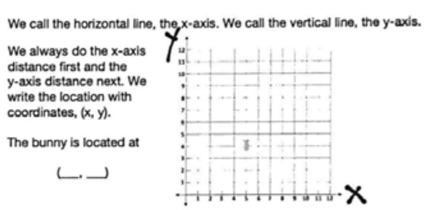
Let's count the spaces together. Watch me mark them. Notice that the numbers go right next to the tick marks. If I put the number in the space then it is between the tick marks and we can't tell what it's referring to. So we put the numbers next to the tick mark. The bunny jumped 4 spaces up or 4 units up.

Let's Talk (Slide 5): Now here's the cool part. If we put those two numbers line together then we can measure distances from left to right and distances up and down, which means we can find any location in the area between.

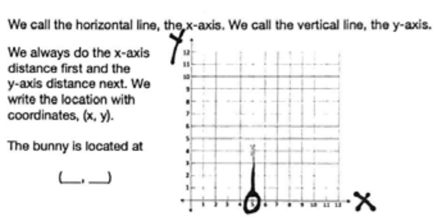


Imagine if the bunny jumped 5 units left AND 4 units up. It would be somewhere around here. But it would be much easier if we had some lines to guide us, right? That is what we are going to see on the next slide.

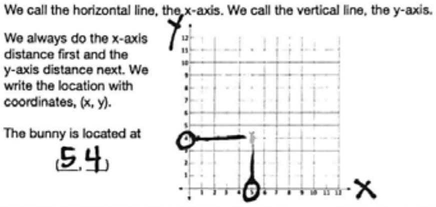
Let's Talk (Slide 6): Now we have lines! Hooray! This is called the coordinate plane.



We call the horizontal line, the x-axis. We call the vertical line, the y-axis. *Write x beside the x-axis and y beside the y-axis.*

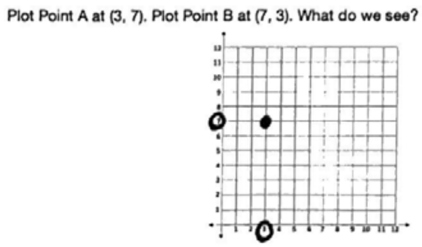


We don't want to have to always say left and right or up and down. So mathematicians made an agreement and we have to stick to that agreement too. The agreement is that we always do left and right first. Then we will do up and down. That means we always do the x-axis distance first and the y-axis distance next. One trick I use to remember this is to think of a baby. The baby learns to call first so x-axis first. Then it learns to walk so y-axis is second. *Use your fingers to crawl along the x-axis and then move your hand up and down as you explain.* Let's practice finding locations using the x-axis then the y-axis. First, we look at the x-axis. The bunny is above the 5 on the x-axis because it jumped 5 hops right.

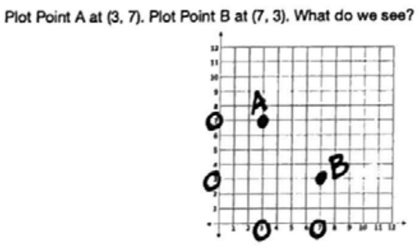


The bunny is next to the 4 on the y-axis because it jumped 4 hops up. Now we can write where the bunny is located with just two numbers called coordinates. We write (5, 4). The 5 stands for the place on the x-axis and the 4 stands for the place on the y-axis.

Let's Think (Slides 7): Let's practice finding locations using the x-axis then the y-axis.



This says, "plot Point A at (3, 7)." I am going to start with the 3 on the x-axis. That's the line going side to side like a baby crawling. Here is the 3. Now we look for the 7 on the y-axis. That's the line going up and down like when the baby learns to stand. Here is the 7. My location is where these come together. *Drag your fingers up from the 3 and sideways from the 7 at the same time. Stop where they meet and draw the point.* Here! I am going to label it A.



Now we need to plot Point B at (7, 3). It's the same numbers but in a different order. Do you think that this point will be at the same point as (3, 7)? No! The go with different axes! We need to find 7 on the x-axis. Here. Now we find the 3 on the y-axis. Here. This is where the numbers meet up and so this is where Point B is.

Let's Try it (Slides 8): Let's work on graphing more coordinates together. I will help you practice before you do it on your own.

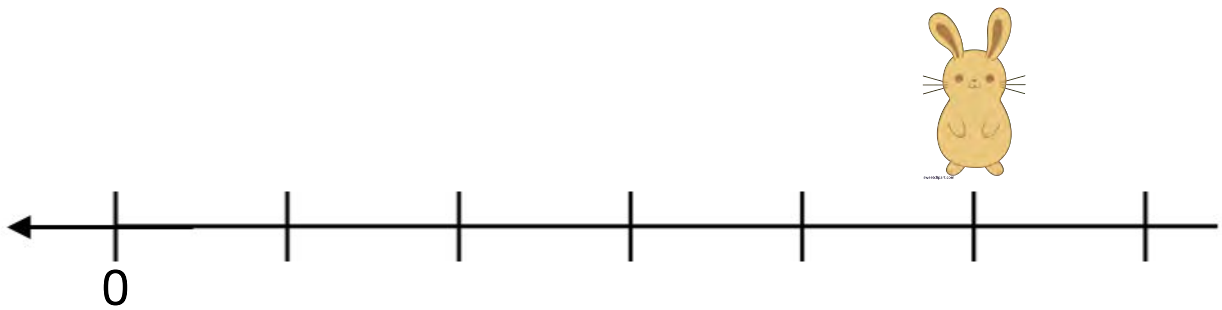
WARM WELCOME

Today we will find and write coordinate pairs.

Let's Review:

Today we are going to use numbers lines to describe location.

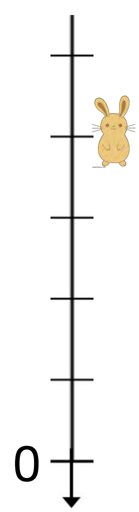
Imagine the bunny started at zero and hopped. How would we describe the bunny's location?



Let's Review:

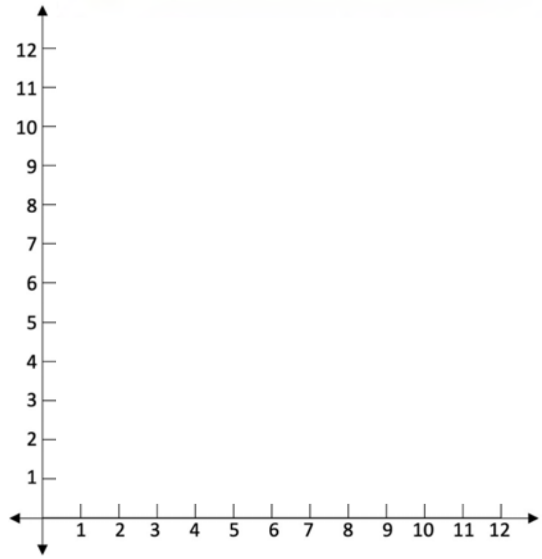
Today we are going to use numbers lines to describe location.

Imagine the bunny started at zero and hopped. How would we describe the bunny's location?



Let's Talk: Let's put both lines together so we can map more locations.

Where would the bunny be if it hopped 5 units left AND 4 units up?



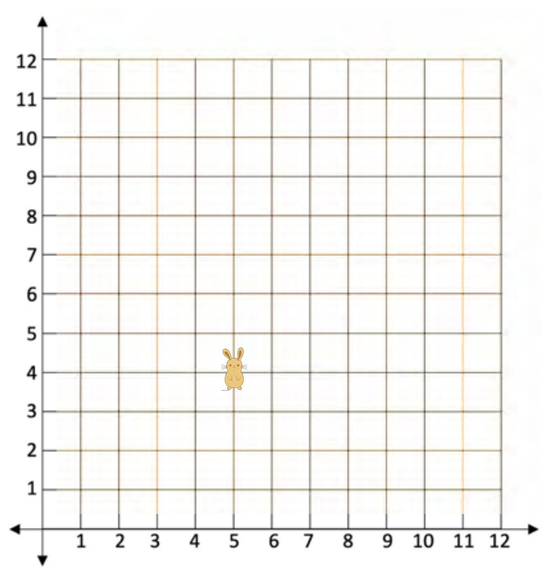
Let's Talk: When we put a horizontal and vertical line together, we create the coordinate plane.

We call the horizontal line, the x-axis. We call the vertical line, the y-axis.

We always do the x-axis distance first and the y-axis distance next. We write the location with coordinates, (x, y).

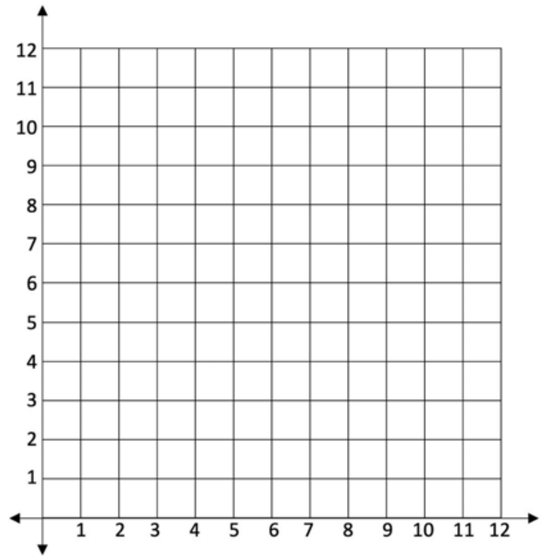
The bunny is located at

(___, ___)

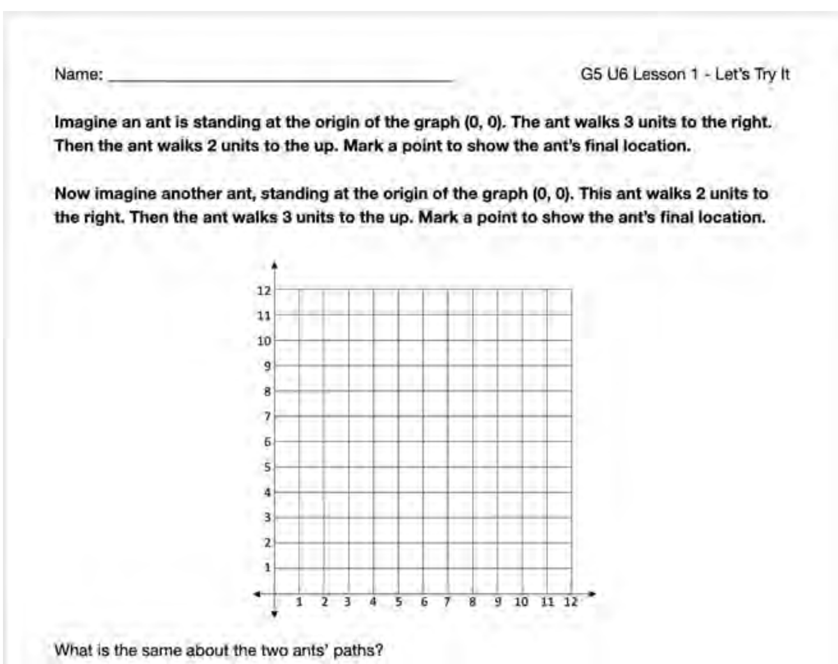


Let's Think: Let's practice finding locations using the x-axis then the y-axis.

Plot Point A at (3, 7). Plot Point B at (7, 3). What do we see?



Let's Try It: Let's practice plotting points together.



Name: ______________________ G5 U6 Lesson 1 - Let's Try It

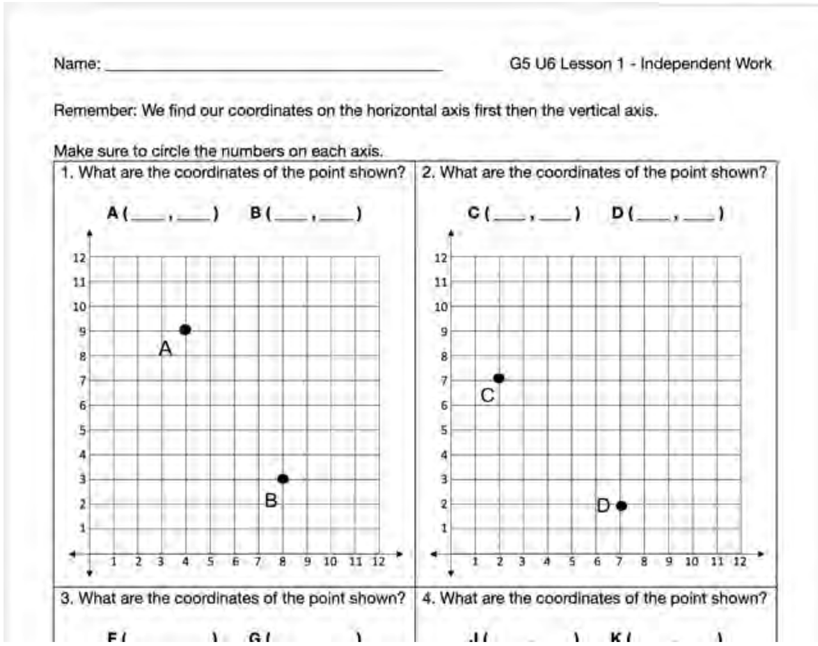
Imagine an ant is standing at the origin of the graph (0, 0). The ant walks 3 units to the right. Then the ant walks 2 units to the up. Mark a point to show the ant's final location.

Now imagine another ant, standing at the origin of the graph (0, 0). This ant walks 2 units to the right. Then the ant walks 3 units to the up. Mark a point to show the ant's final location.

What is the same about the two ants' paths?

On your Own:

Now it's time for you to plot points and write their coordinates.


Name: ______________________ G5 U6 Lesson 1 - Independent Work

Remember: We find our coordinates on the horizontal axis first then the vertical axis.

Make sure to circle the numbers on each axis.

1. What are the coordinates of the point shown?

A (___ , ___) B (___ , ___)

2. What are the coordinates of the point shown?

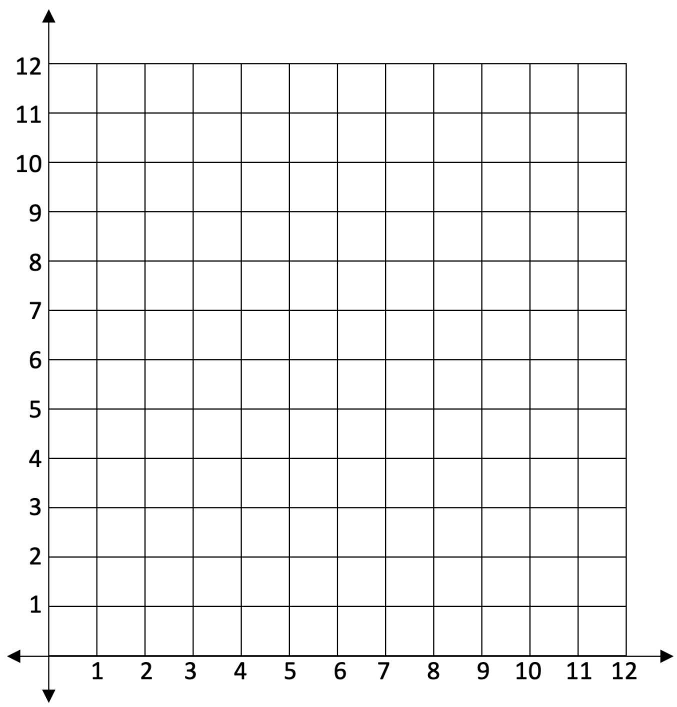
C (___ , ___) D (___ , ___)

3. What are the coordinates of the point shown?

4. What are the coordinates of the point shown?

Imagine an ant is standing at the origin of the graph (0, 0). The ant walks 3 units to the right. Then the ant walks 2 units to the up. Mark a point to show the ant's final location.

Now imagine another ant, standing at the origin of the graph (0, 0). This ant walks 2 units to the right. Then the ant walks 3 units to the up. Mark a point to show the ant's final location.



What is the same about the two ants' paths?

____

____

What are the coordinates of the first ant's location? (____, ____)

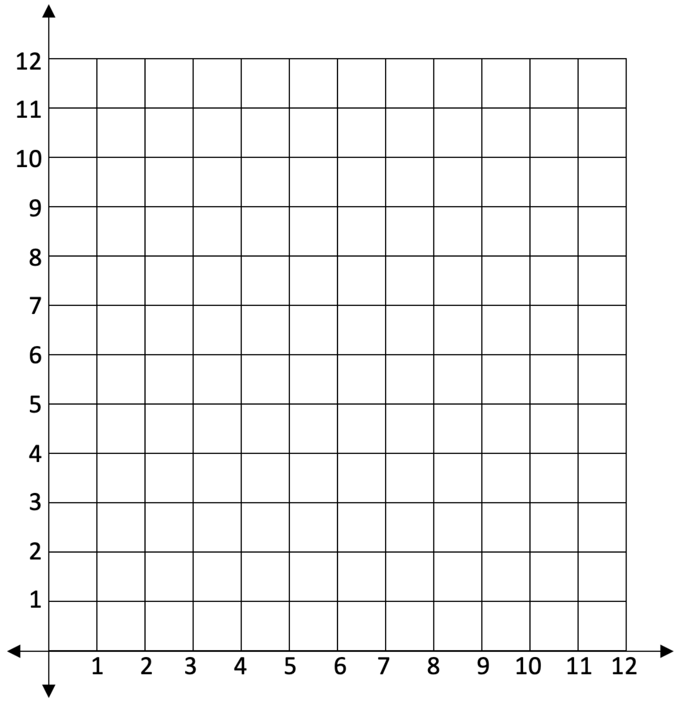
What are the coordinates of the second ant's location? (____, ____)

Why aren't the ants at the same location as each other?

____

____

Plot point A at (3, 5). Plot point B at (5, 3).

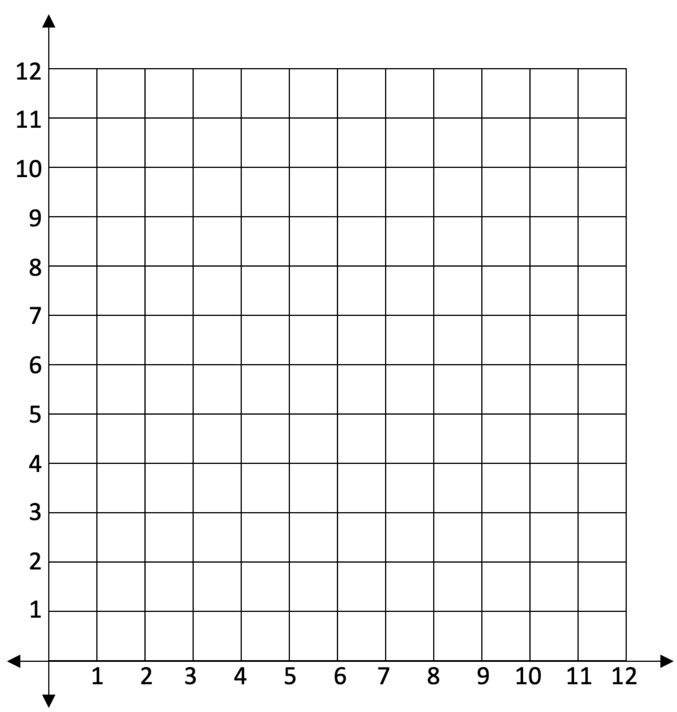


The coordinates have the same numbers. Why aren't they at the same location as each other?

____

____

Plot point A at (0, 2). Plot point B at (2, 0).



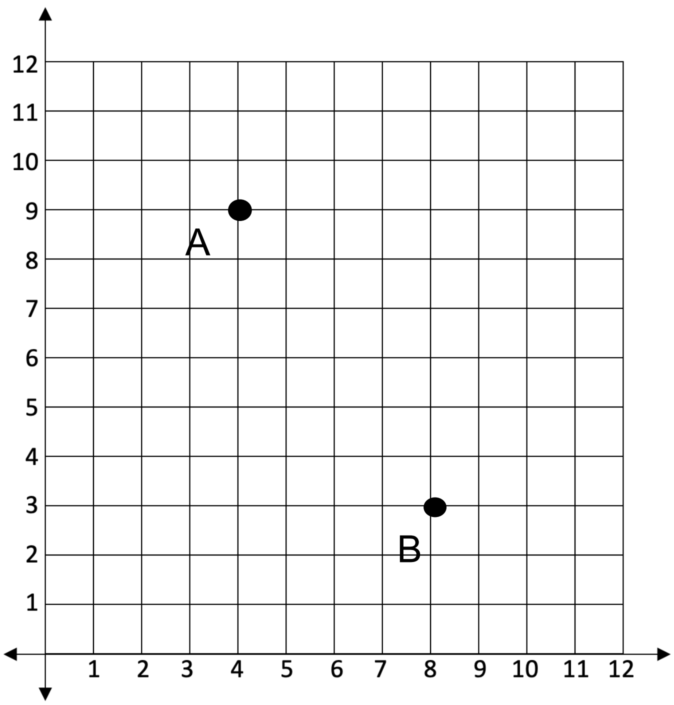
Name: ____ G5 U6 Lesson 1 - Independent Work

Remember: We find our coordinates on the horizontal axis first then the vertical axis.

Make sure to circle the numbers on each axis.

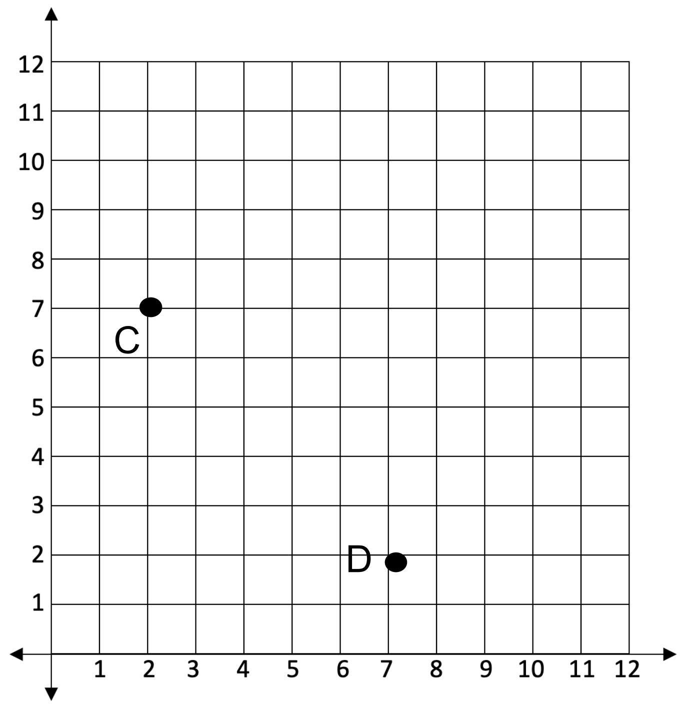
1. What are the coordinates of the point shown?

A (_____ , _____) B (_____ , _____)



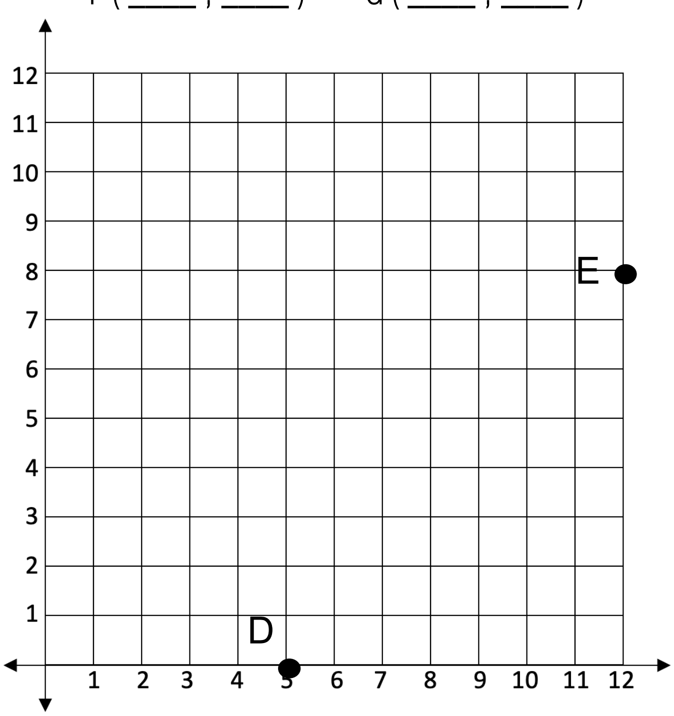
2. What are the coordinates of the point shown?

C (_____ , _____) D (_____ , _____)



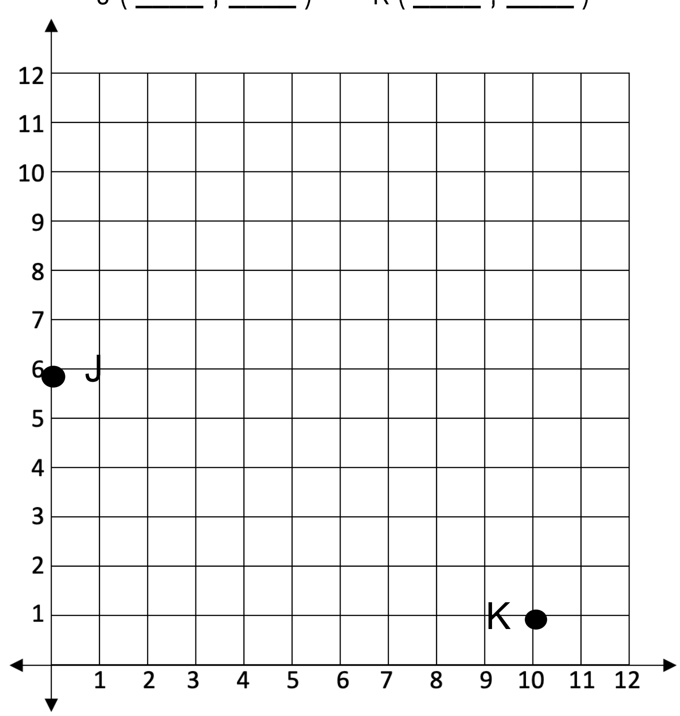
3. What are the coordinates of the point shown?

F (_____ , _____) G (_____ , _____)



4. What are the coordinates of the point shown?

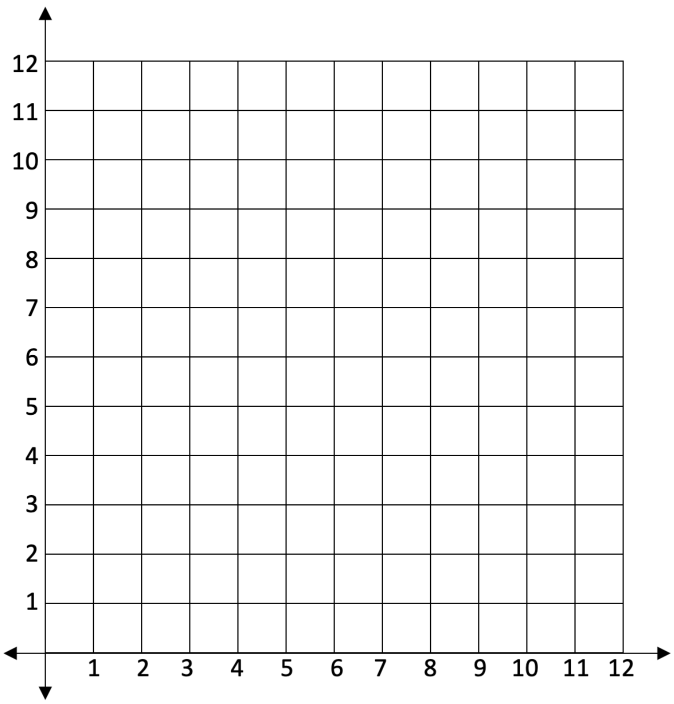
J (_____ , _____) K (_____ , _____)



Make sure to circle the coordinates on each axis.

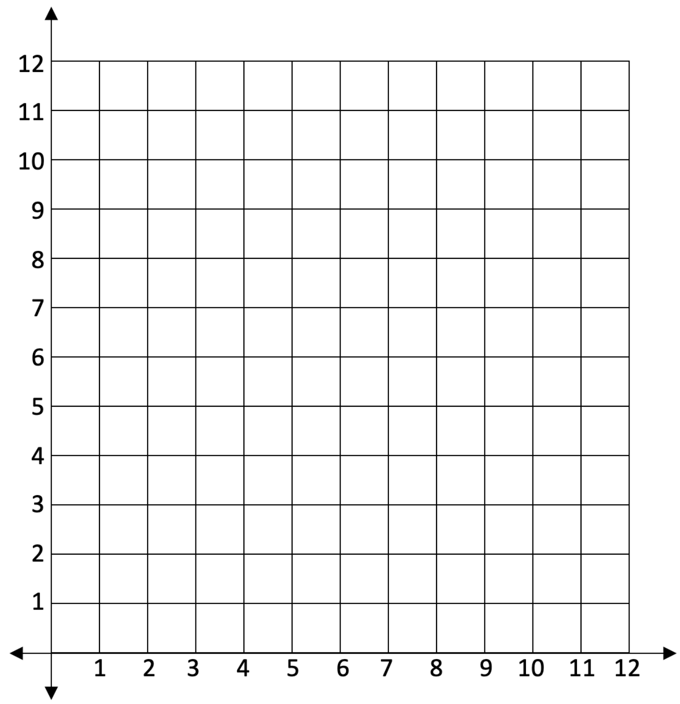
1. Plot each point and label it with a letter.

A (8, 7)   B (1, 5)



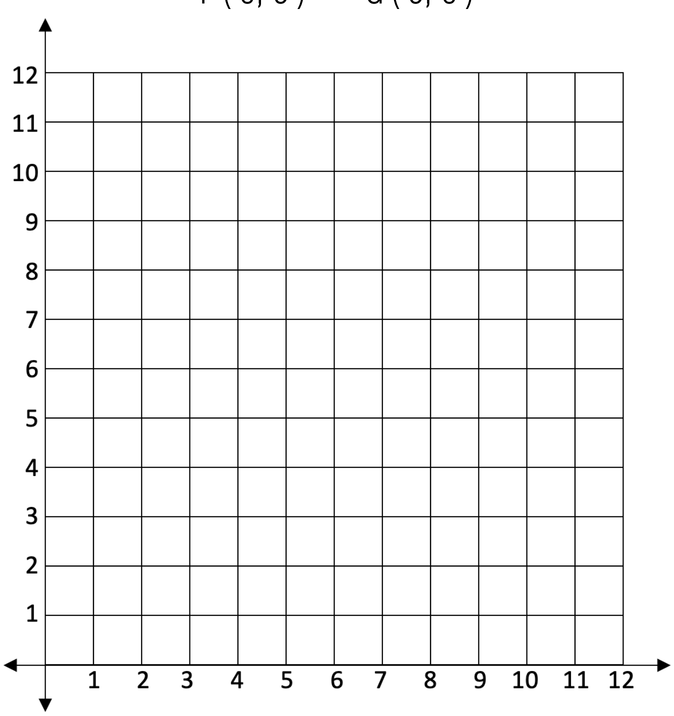
2. Plot each point and label it with a letter.

C (6, 3)   D (3, 6)



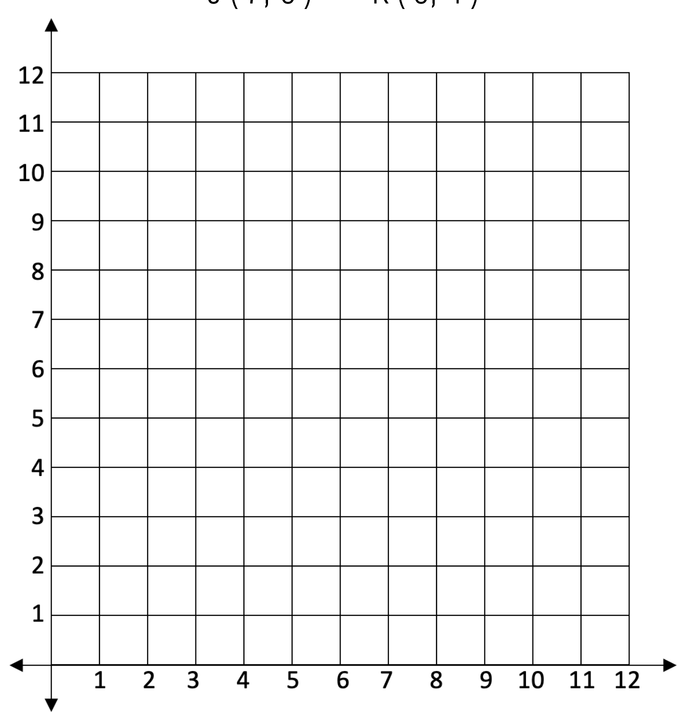
3. Plot each point and label it with a letter.

F (0, 9)   G (9, 0)



4. Plot each point and label it with a letter.

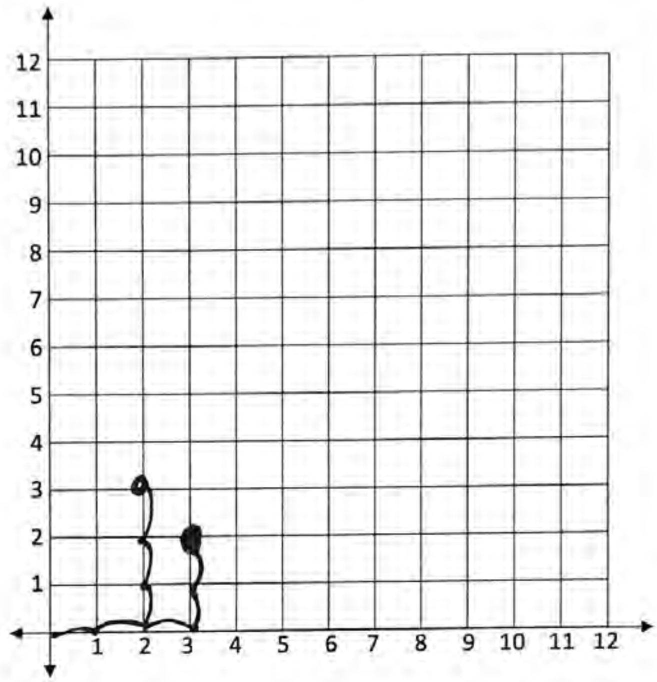
J (7, 0)   K (0, 4)



Name: ANSWER KEY

Imagine an ant is standing at the origin of the graph (0, 0). The ant walks 3 units to the right. Then the ant walks 2 units to the up. Mark a point to show the ant's final location.

Now imagine another ant, standing at the origin of the graph (0, 0). This ant walks 2 units to the right. Then the ant walks 3 units to the up. Mark a point to show the ant's final location.



What is the same about the two ants' paths?

Both ants had the same numbers: 2 and 3.
They both walked left and up.

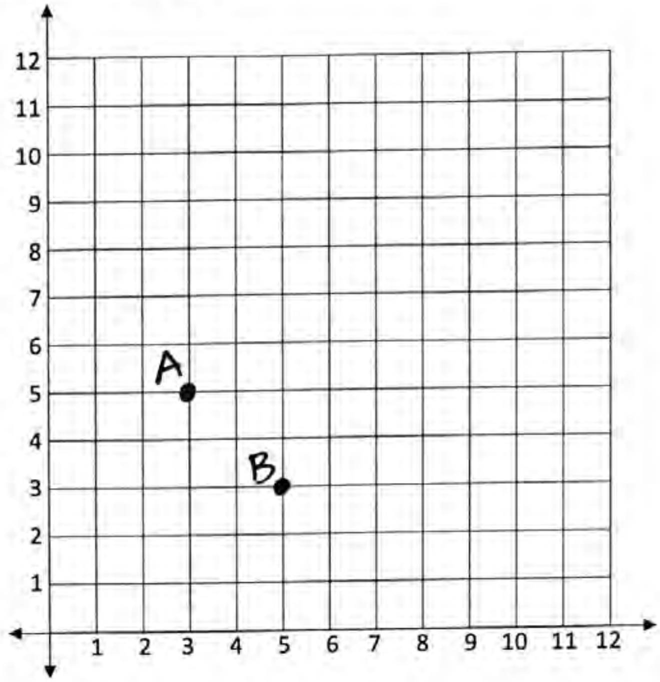
What are the coordinates of the first ant's location? (3, 2)

What are the coordinates of the second ant's location? (2, 3)

Why aren't the ants at the same location as each other?

The 2 and 3 units weren't in the same directions.
They were switched.

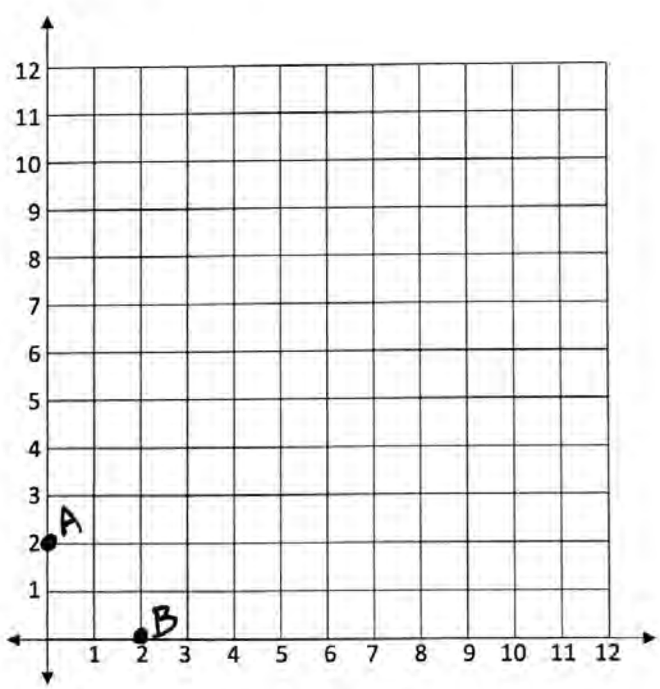
Plot point A at (3, 5). Plot point B at (5, 3).



The coordinates have the same numbers. Why aren't they at the same location as each other?

The order of the numbers is switched so the direction of the numbers is switched.

Plot point A at (0, 2). Plot point B at (2, 0).



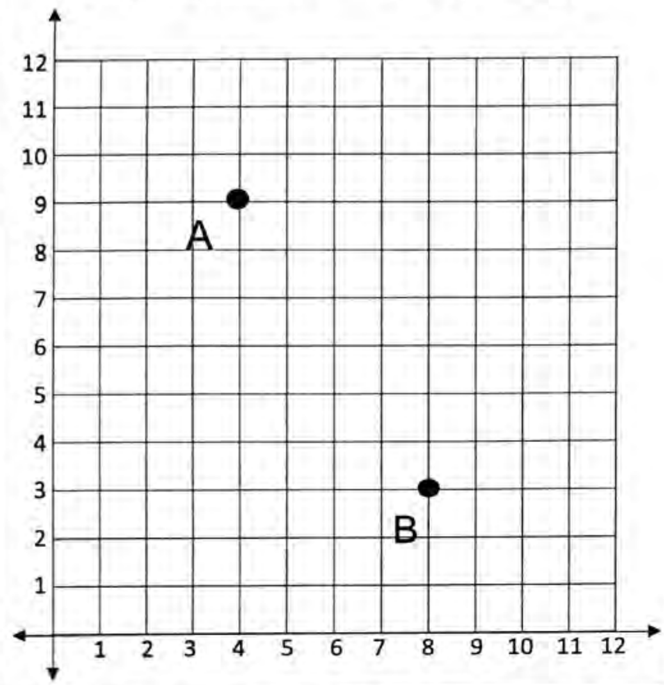
Name: ANSWER KEY

Remember: We find our coordinates on the horizontal axis first then the vertical axis.

Make sure to circle the numbers on each axis.

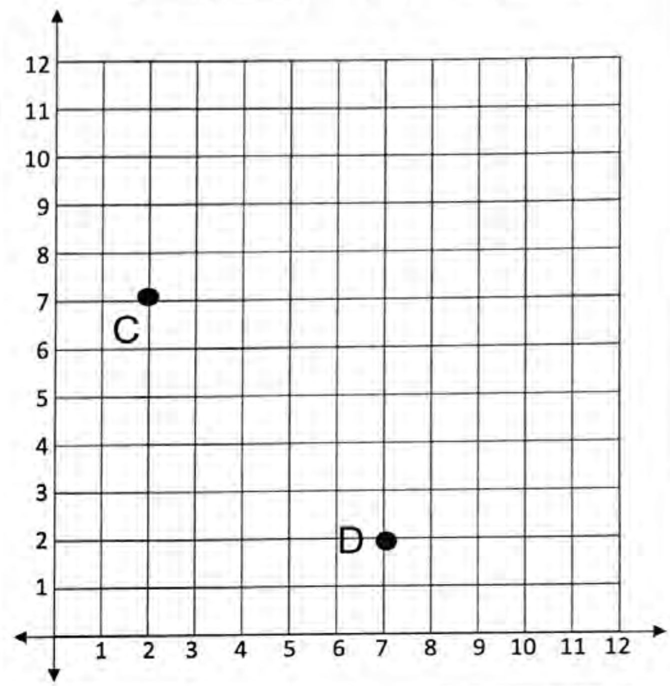
1. What are the coordinates of the point shown?

A(4 , 9) B(8 , 3)



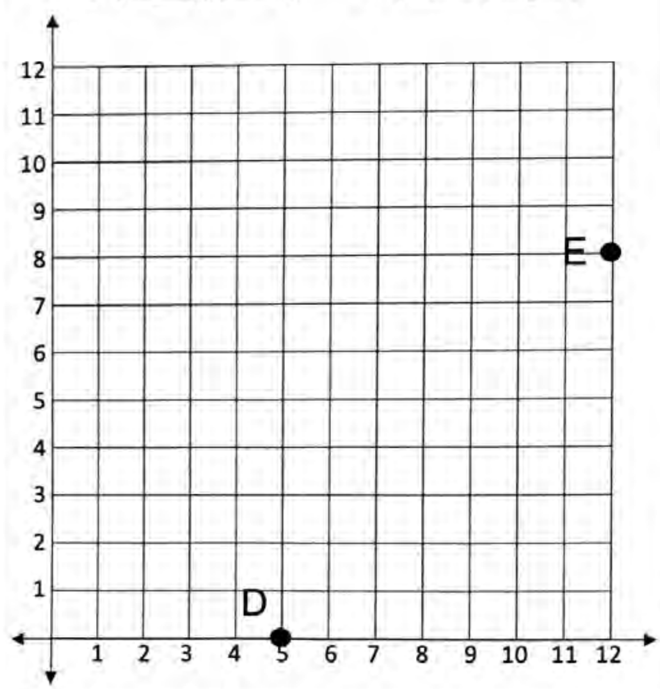
2. What are the coordinates of the point shown?

C(2 , 7) D(7 , 2)



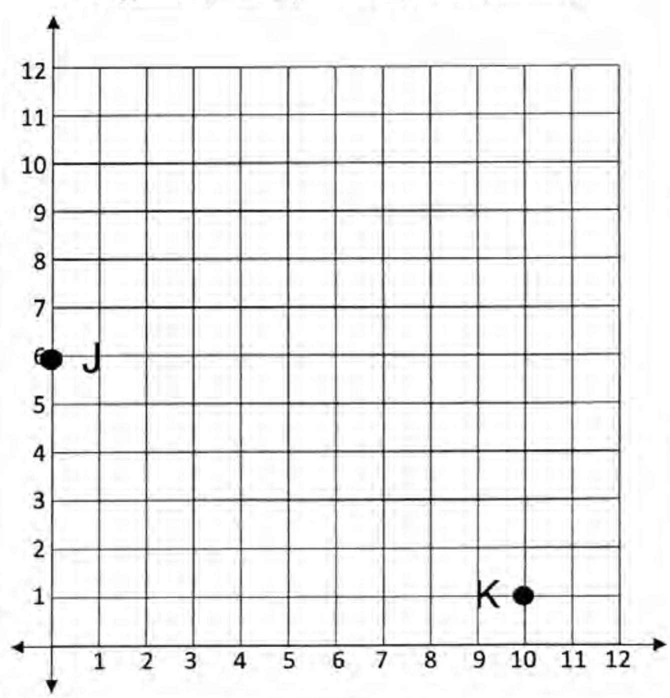
3. What are the coordinates of the point shown?

F(5 , 0) G(12 , 8)



4. What are the coordinates of the point shown?

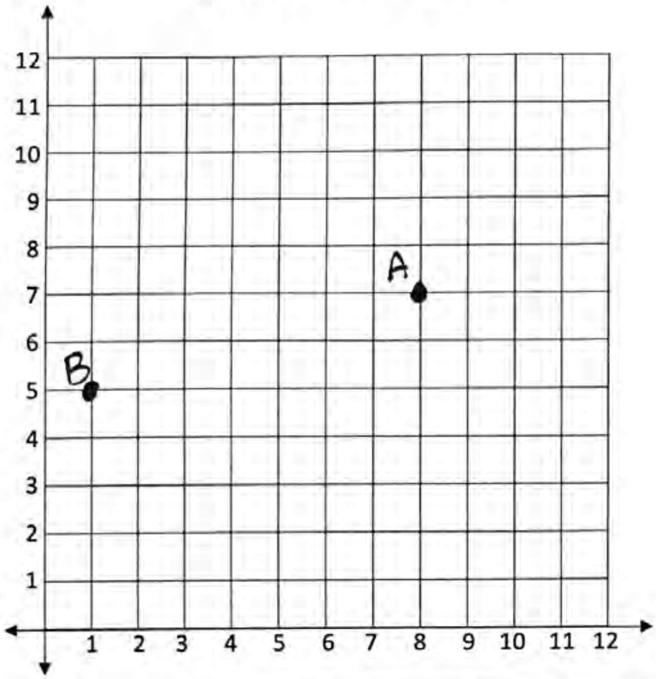
J(0 , 6) K(10 , 1)



Make sure to circle the coordinates on each axis.

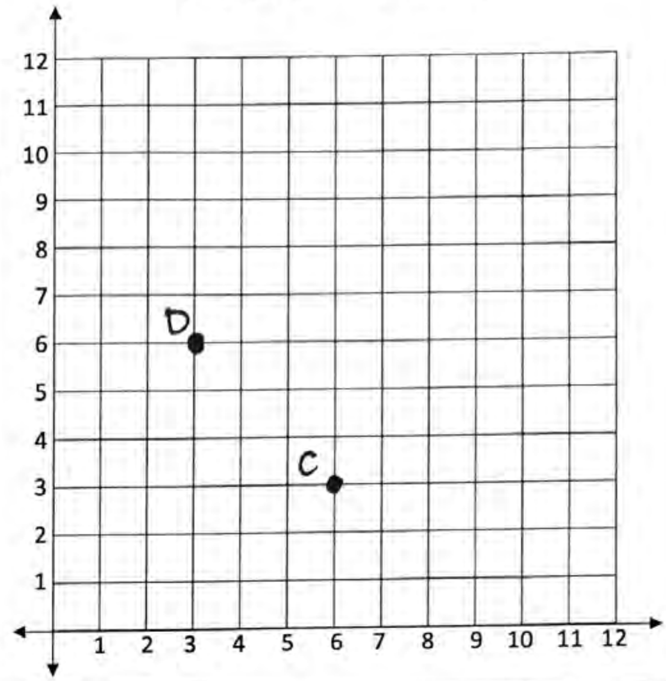
1. Plot each point and label it with a letter.

A (8, 7) B (1, 5)



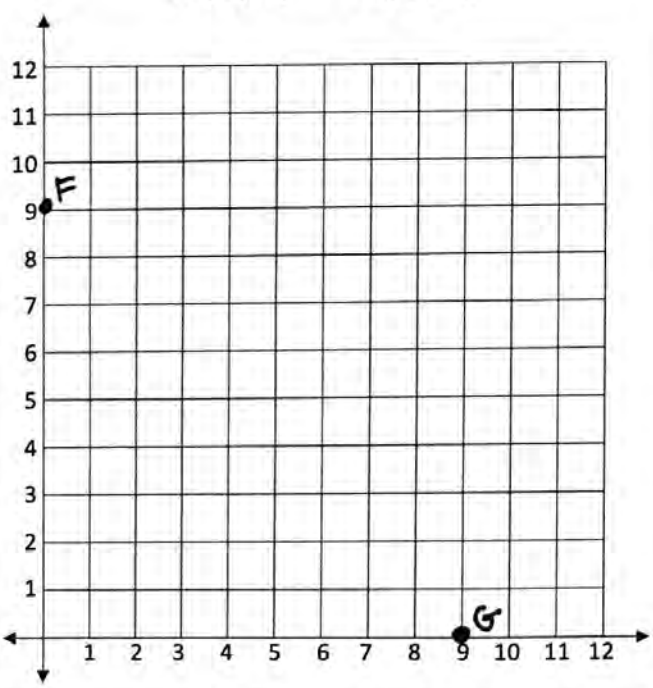
2. Plot each point and label it with a letter.

C (6, 3) D (3, 6)



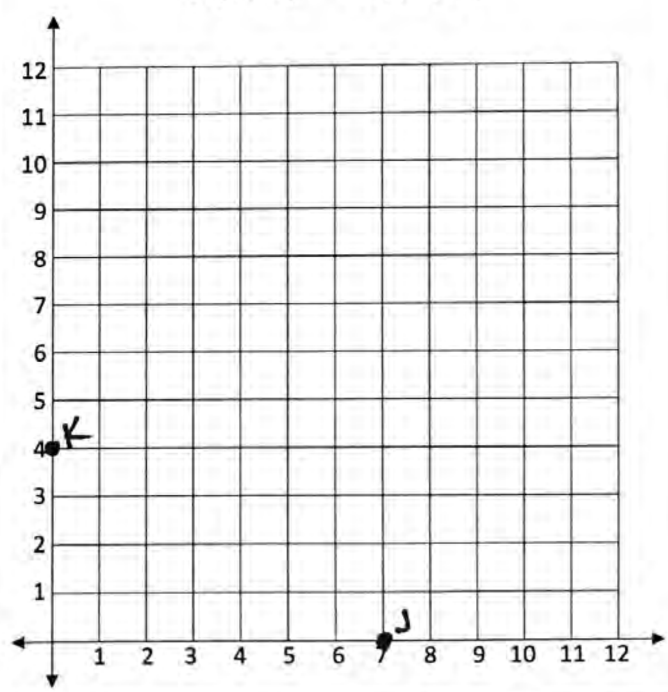
3. Plot each point and label it with a letter.

F (0, 9) G (9, 0)



4. Plot each point and label it with a letter.

J (7, 0) K (0, 4)



G5 U6 Lesson 2

Find patterns for points on a line

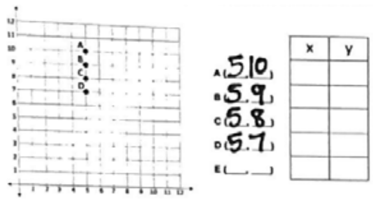
G1 U1 Lesson 2 - Today we will find patterns for points on a line.

Warm Welcome (Slide 1): Tutor choice

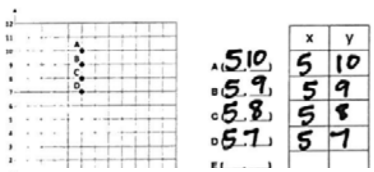
Frame the Learning/Connect to Prior Learning (Slide 2): Today we will keep graphing coordinate pairs and we are going to make lines.

Let's Review (Slide 3): How do we find locations on the coordinate plane? Possible Student Answers, Key Points:

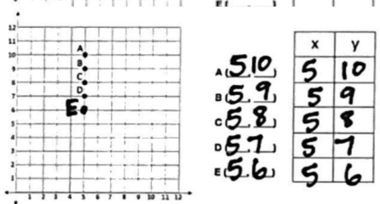
- The baby crawls before it learns to stand.
- We go left to right then up and down.
- We do the x-axis first and then the y-axis.



Let's start with Point A. I look at the x-axis and see it is above the 5. I look at the y-axis and see it is beside the 10. The point is (5, 10). What are the coordinates of Point B? *Seek student input on the rest of the answers. Point to the point and drag your finger to its location on the x-axis. Then point to the point and drag your finger to its location on the y-axis.* What are the coordinates of Point C? What are the coordinates of Point D?



Just like we keep the x-axis number and the y-axis number together with parentheses, we can keep the numbers together on a table. This is really useful when we have a set of points.

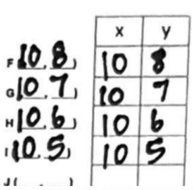


Now we can really start to see a pattern and I bet you can guess where Point E would be. *Seek student input.* It goes here! And I see that is above the 5 on the x-axis and beside the 6 on the y-axis. I will put that on my table too. What pattern do we notice with these coordinates? Possible Student Answers, Key Points:

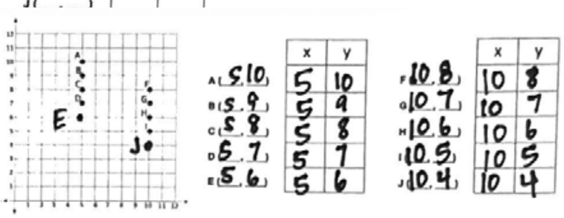
- The left hand column is always 5.
- The x-coordinate is always 5.

You don't need to know this yet but we can show this with an equation. The x-axis is always 5 so we can write x = 5.

Let's Talk (Slide 4): Let's see if we see a similar pattern with another line.



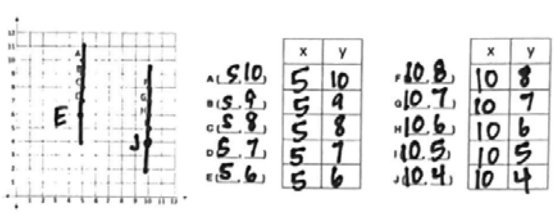
What are the coordinates of Point F? *Seek student input on the rest of the answers. Point to the point and drag your finger to its location on the x-axis. Then point to the point and drag your finger to its location on the y-axis.* What are the coordinates of Point G? What are the coordinates of Point H? What are the coordinates of Point I? We can put all of these points on our table and they mean the same thing.



Now we can really start to see a pattern and I bet you can guess where Point J would be. *Seek student input.* It goes here! And I see that is above the 10 on the x-axis and beside the 4 on the y-axis. I will put that on my table too. What pattern do we notice with these coordinates? Possible Student Answers, Key Points:

- The left hand column is always 10.
- The x-coordinate is always 10.

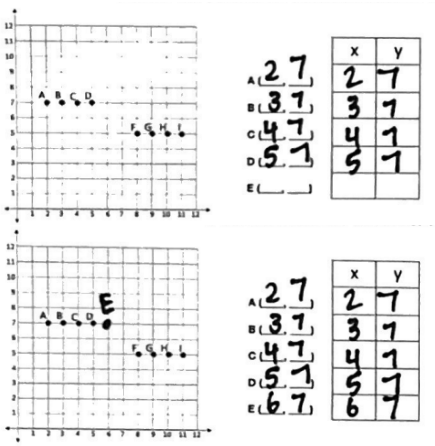
You don't need to know this yet but we can show this with an equation. The x-axis is always 10 so we can write x = 10.



Both of these lines were vertical lines. That means they go up and down. And we noticed something special about the coordinates for both of these lines. What do you think we will see on the table of any vertical line? Possible Student Answers, Key Points:

- The left hand column is always the same number.
- The x-coordinate is always the same number.
- One number stays the same for all the coordinates.

Let's Think (Slide 5): Let's see if we can find a pattern with horizontal lines as well. Horizontal lines are lines that go side to side.

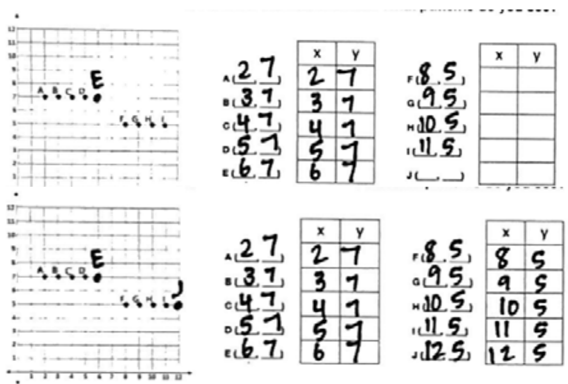


What are the coordinates of Point A? *Seek student input on the rest of the answers. Point to the point and drag your finger to its location on the x-axis. Then point to the point and drag your finger to its location on the y-axis.* What are the coordinates of Point B? What are the coordinates of Point C? What are the coordinates of Point D? We can put all of these coordinates on the table.

Now we can really start to see a pattern and I bet you can guess where Point E would be. *Seek student input.* It goes here! It is (6, 7). I will put that on my table too. What pattern do we notice with these coordinates? Possible Student Answers, Key Points:

- The right hand column is always 7.
- The y-coordinate is always 7.

You don't need to know this yet but we can show this with an equation. The y-axis is always 7 so we can write y = 7.



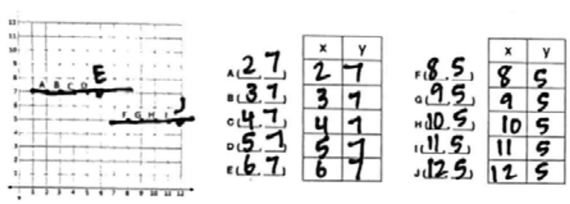
What are the coordinates of Point F? *Seek student input on the rest of the answers. Point to the point and drag your finger to its location on the x-axis. Then point to the point and drag your finger to its location on the y-axis.* What are the coordinates of Point G? What are the coordinates of Point H? What are the coordinates of Point I? We can put all of these coordinates on the table.

Now we can really start to see a pattern and I bet you can guess where Point J would be. *Seek student input.* It goes here! It is (12, 5). I will put that on my table too. What pattern do we notice with these coordinates? Possible Student Answers, Key Points:

- The right hand column is always 5.
- The y-coordinate is always 5.

You don't need to know this yet but we can show this with an equation. The y-axis is always 5 so we can write y = 5.

What do we notice about the coordinates for both of these lines? Possible Student Answers, Key Points:



- The right hand column is always the same number.
- The y-coordinate is always the same number.
- One number stays the same for all the coordinates.

Any time we have a horizontal or vertical line, we will have the same number for one of the coordinates. For vertical lines, x will always be the same. For vertical lines, y will always be the same.

Let's Try it (Slides 6): Let's work on graphing lines together. We will see these same patterns. I will help you practice before you do it on your own.

WARM WELCOME

Today we will find patterns for points on a line.

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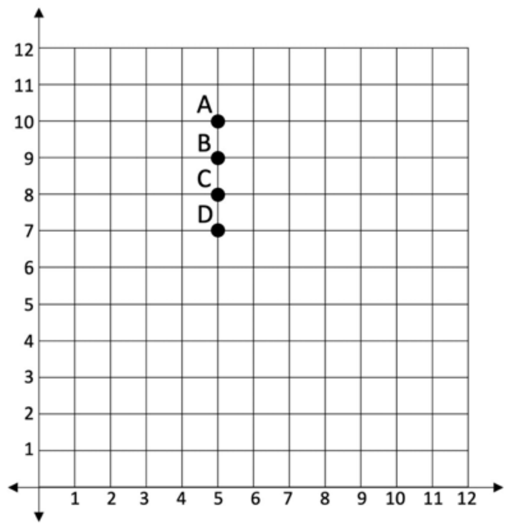
Let's Review: How do we find locations on the coordinate plane?

Write the coordinates for the points below. Where do we think Point E would go?



A (____, ____)

B (____, ____)

C (____, ____)

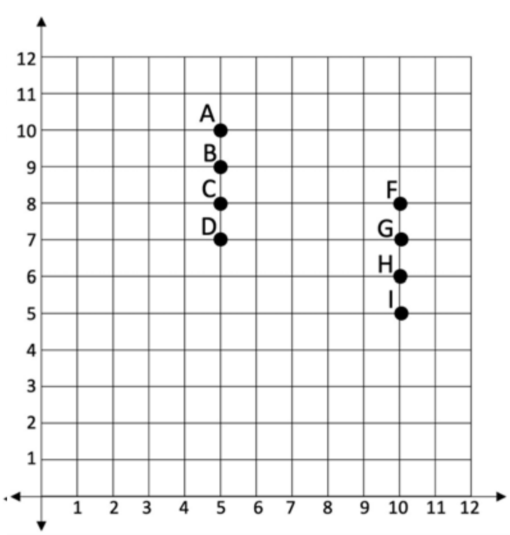
D (____, ____)

E (____, ____)

x	y

Let's Talk: Let's map out another line and see if we can notice a pattern.

What do you notice about each set of coordinates?



A (____, ____)

B (____, ____)

C (____, ____)

D (____, ____)

E (____, ____)

x	y

F (____, ____)

G (____, ____)

H (____, ____)

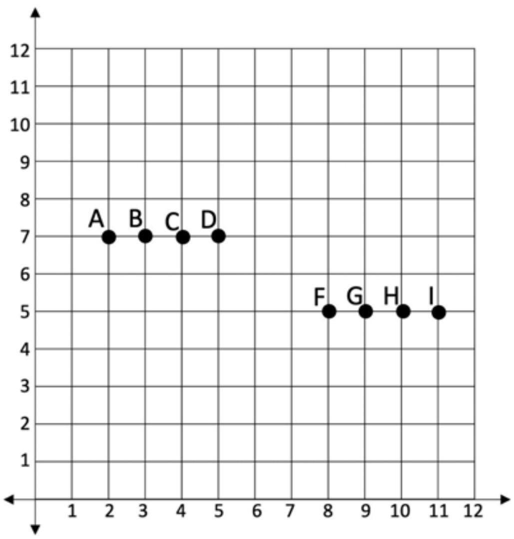
I (____, ____)

J (____, ____)

x	y

Let's Think: There are patterns for horizontal lines as well.

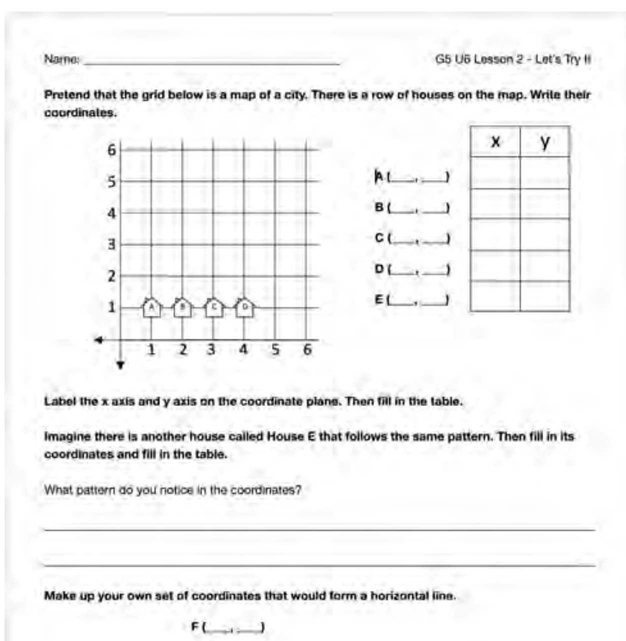
Write the coordinates for the points and find the next one. What patterns do you see?



	x	y
A (____, ____)		
B (____, ____)		
C (____, ____)		
D (____, ____)		
E (____, ____)		

	x	y
F (____, ____)		
G (____, ____)		
H (____, ____)		
I (____, ____)		
J (____, ____)		

Let's Try It: Let's practice plotting coordinates that make lines.



Name: ____________________ G5 U6 Lesson 2 - Let's Try It

Pretend that the grid below is a map of a city. There is a row of houses on the map. Write their coordinates.

	x	y
A (___, ___)		
B (___, ___)		
C (___, ___)		
D (___, ___)		
E (___, ___)		

Label the x axis and y axis on the coordinate plane. Then fill in the table.

Imagine there is another house called House E that follows the same pattern. Then fill in its coordinates and fill in the table.

What pattern do you notice in the coordinates?

____

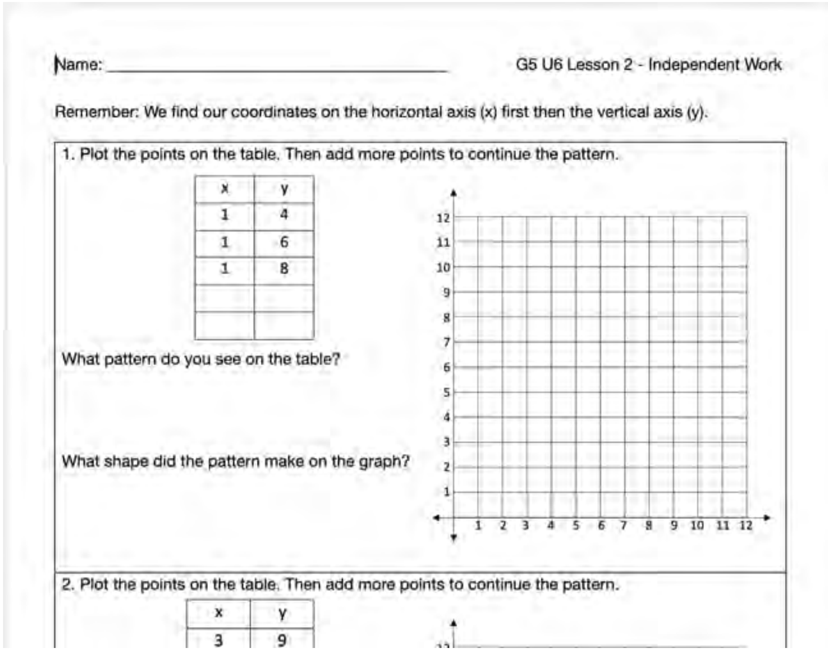
____

Make up your own set of coordinates that would form a horizontal line.

F (___, ___)

On your Own:

Now it's time for you to plot coordinates that make lines.



Name: ______________________________ G5 U6 Lesson 2 - Independent Work

Remember: We find our coordinates on the horizontal axis (x) first then the vertical axis (y).

1. Plot the points on the table. Then add more points to continue the pattern.

x	y
1	4
1	6
1	8

What pattern do you see on the table?

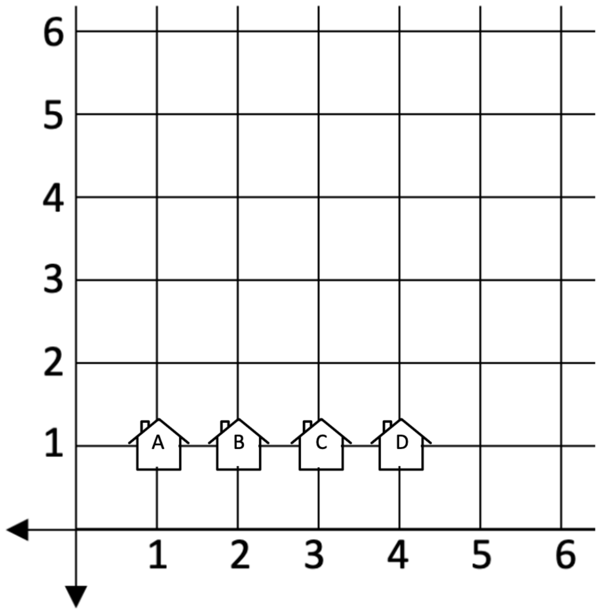
What shape did the pattern make on the graph?

2. Plot the points on the table. Then add more points to continue the pattern.

x	y
3	9

Name: ______________________________________

Pretend that the grid below is a map of a city. There is a row of houses on the map. Write their coordinates.



A (_____, _____)

B (_____, _____)

C (_____, _____)

D (_____, _____)

E (_____, _____)

x	y

Label the x axis and y axis on the coordinate plane. Then fill in the table.

Imagine there is another house called House E that follows the same pattern. Then fill in its coordinates and fill in the table.

What pattern do you notice in the coordinates?

____

____

Make up your own set of coordinates that would form a horizontal line.

F (_____, _____)

G (_____, _____)

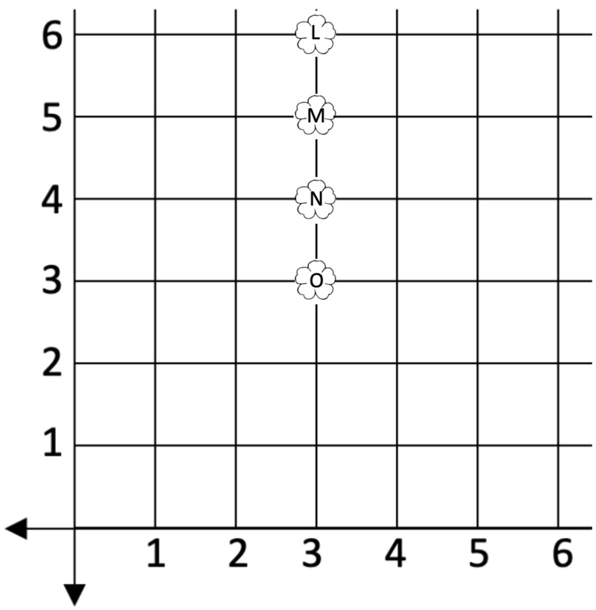
H (_____, _____)

I (_____, _____)

J (_____, _____)

Pretend that the grid below is a map of a garden. There is a row of flowers on the map. Write their coordinates.

x	y



L (_____, _____)

M (_____, _____)

N (_____, _____)

O (_____, _____)

P (_____, _____)

Label the x axis and y axis on the coordinate plane.
Then fill in the table.

Imagine there is another flower called Flower P that follows the same pattern. Then fill in its coordinates and fill in the table.

What pattern do you notice in the coordinates?

____

____

Make up your own set of coordinates that would form a vertical line.

Q (_____, _____)

R (_____, _____)

S (_____, _____)

T (_____, _____)

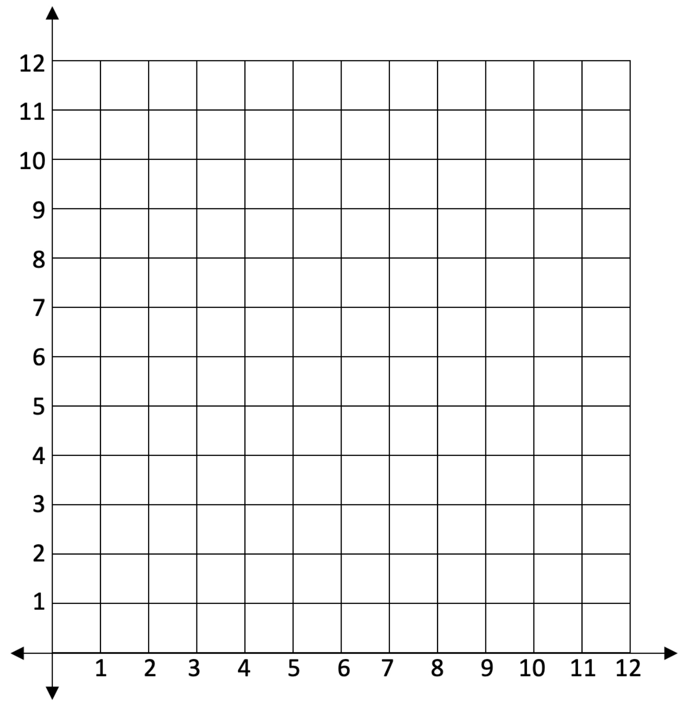
U (_____, _____)

Name: ____

Remember: We find our coordinates on the horizontal axis (x) first then the vertical axis (y).

1. Plot the points on the table. Then add more points to continue the pattern.

x	y
1	4
1	6
1	8

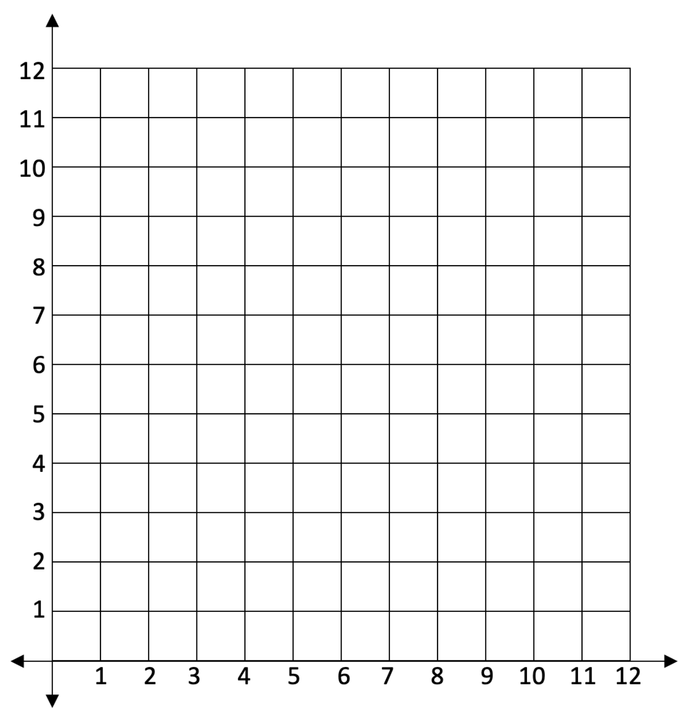


What pattern do you se

What shape did the pattern make on the graph?

2. Plot the points on the table. Then add more points to continue the pattern.

x	y
3	9
4	9
5	9



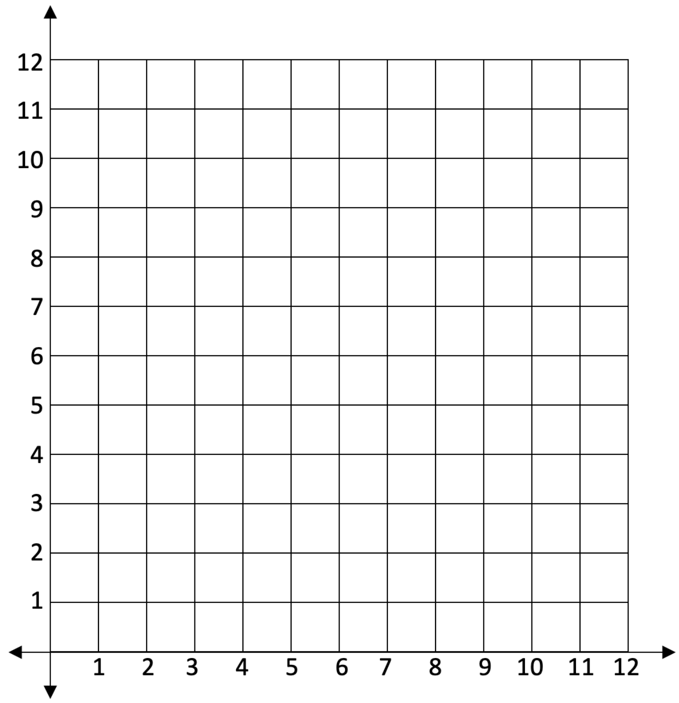
What pattern do you s

What shape did the pattern make on the graph?

Remember: We find our coordinates on the horizontal axis first then the vertical axis.

3. Plot the points on the table. Then add more points to continue the pattern.

x	y
4	1
4	3
4	5

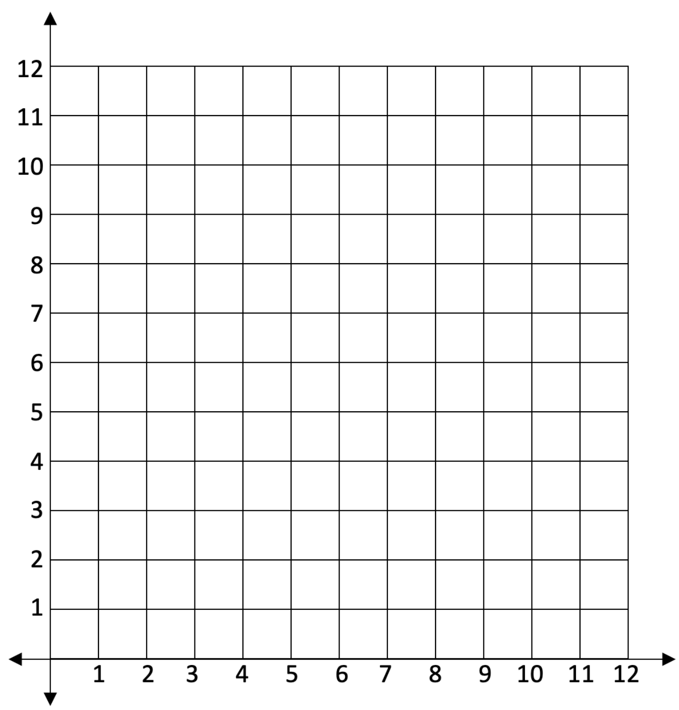


What pattern do you s

What shape did the pattern make on the graph?

4. Plot the points on the table. Then add more points to continue the pattern.

x	y
4	6
5	6
6	6

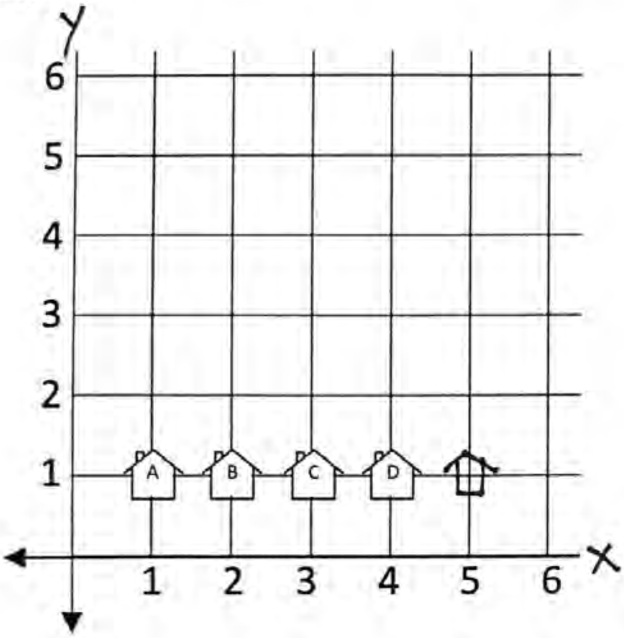


What pattern do you s

What shape did the pattern make on the graph?

Name: ANSWER KEY

Pretend that the grid below is a map of a city. There is a row of houses on the map. Write their coordinates.



A (1 , 1)

B (2 , 1)

C (3 , 1)

D (4 , 1)

E (5 , 1)

x	y
1	1
2	1
3	1
4	1
5	1

Label the x axis and y axis on the coordinate plane. Then fill in the table.

Imagine there is another house called House E that follows the same pattern. Then fill in its coordinates and fill in the table.

What pattern do you notice in the coordinates?

The x is going up by 1.
The y is staying 1. We can write y=1.

Make up your own set of coordinates that would form a horizontal line.

F (1 , 4) ← There are lots of different correct answers. The y just needs to stay the same number for y.

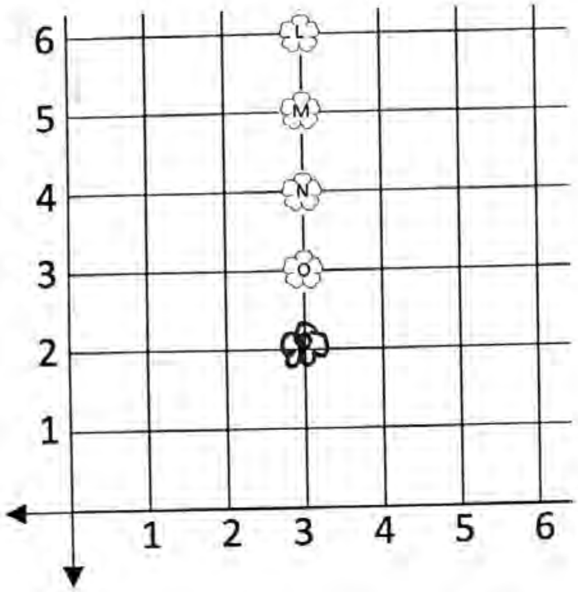
G (2 , 4)

H (3 , 4)

I (4 , 4)

J (5 , 4)

Pretend that the grid below is a map of a garden. There is a row of flowers on the map. Write their coordinates.



L(3 , 6)

M(3 , 5)

N(3 , 4)

O(3 , 3)

P(3 , 2)

x	y
3	6
3	5
3	4
3	3
3	2

Label the x axis and y axis on the coordinate plane. Then fill in the table.

Imagine there is another flower called Flower P that follows the same pattern. Then fill in its coordinates and fill in the table.

What pattern do you notice in the coordinates?

The x stays at 3. We can write x = 3.

The y is going down by 1.

Make up your own set of coordinates that would form a vertical line.

Q(1 , 5) ← There are lots of different correct answers The x just needs to stay the same number.

R(1 , 4)

S(1 , 3)

T(1 , 2)

U(1 , 1)

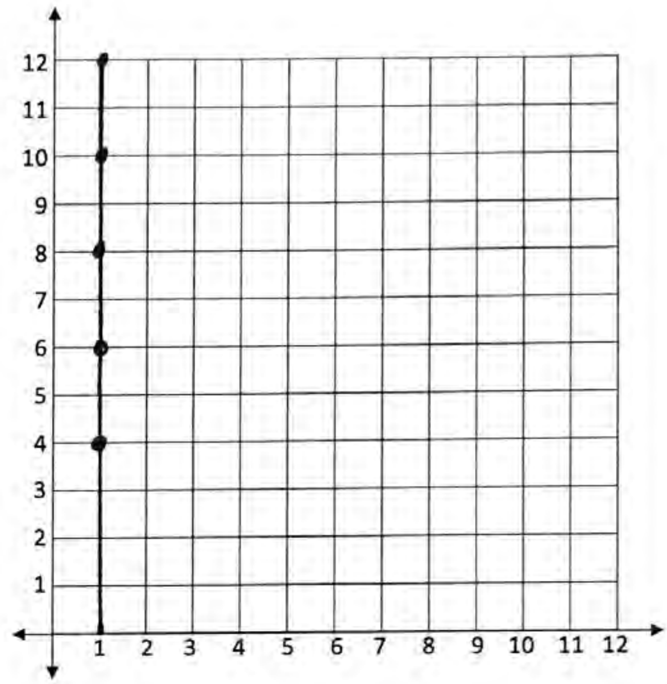
Name: ANSWER KEY

G5 U6 Lesson 2 - Independent Work

Remember: We find our coordinates on the horizontal axis (x) first then the vertical axis (y).

1. Plot the points on the table. Then add more points to continue the pattern.

x	y
1	4
1	6
1	8
1	10
1	12



What pattern do you see on the table?

The x is staying 1.

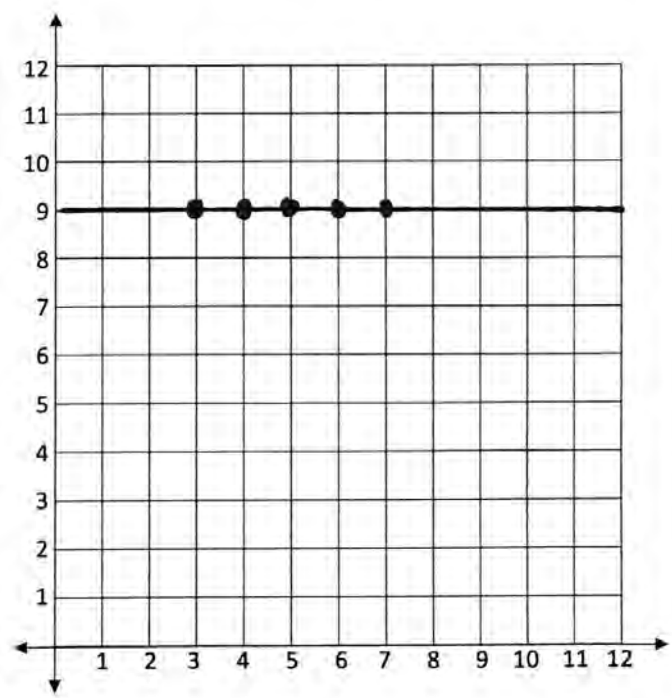
The y is going up by 2.

What shape did the pattern make on the graph?

a straight vertical line.

2. Plot the points on the table. Then add more points to continue the pattern.

x	y
3	9
4	9
5	9
6	9
7	9



What pattern do you see on the table?

The x is going up by 1.

The y is staying 9.

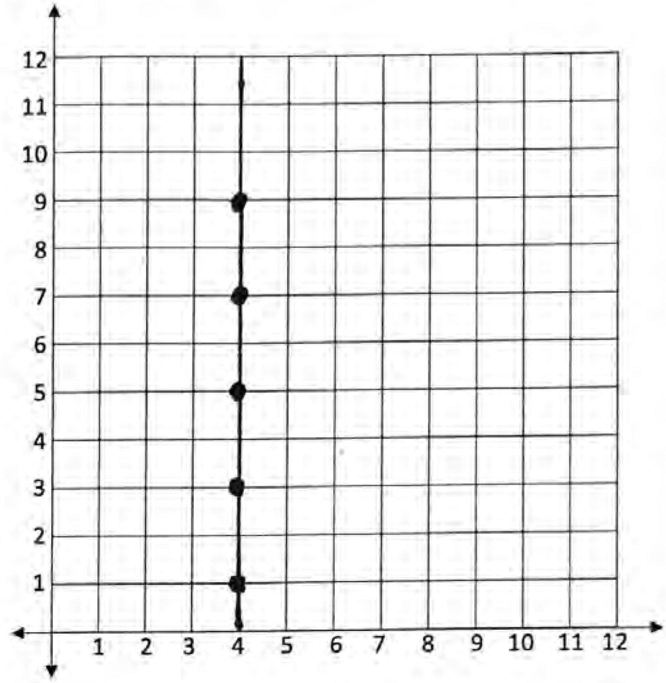
What shape did the pattern make on the graph?

a straight horizontal line

Remember: We find our coordinates on the horizontal axis first then the vertical axis.

3. Plot the points on the table. Then add more points to continue the pattern.

x	y
4	1
4	3
4	5
4	7
4	9



What pattern do you see on the table?

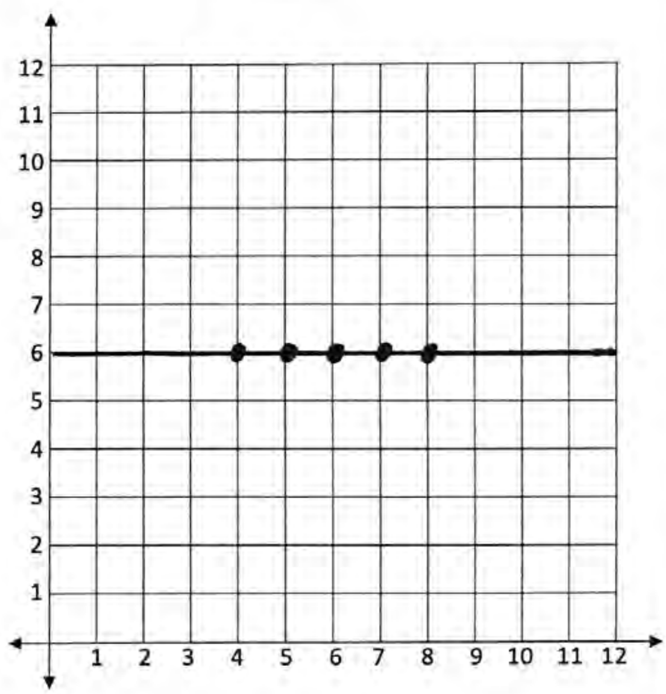
The x is staying 4.
The y is going up by 2.

What shape did the pattern make on the graph?

a straight vertical line

4. Plot the points on the table. Then add more points to continue the pattern.

x	y
4	6
5	6
6	6
7	6
8	6



What pattern do you see on the table?

The x is going up by 1.
The y is staying 6.

What shape did the pattern make on the graph?

a straight horizontal line

G5 U6 Lesson 3

Plot and generate points that follow a rule

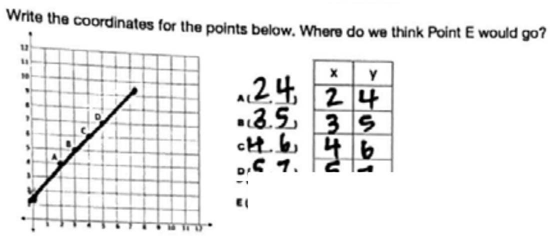
CITYTUTOR DC

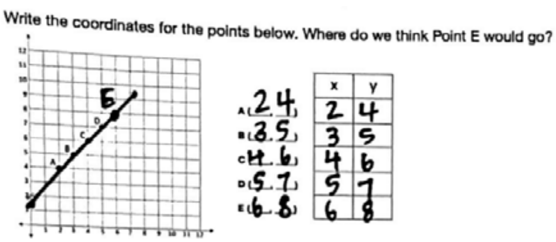
G1 U1 Lesson 3 - Today we will plot and generate points that follow a rule.

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): Today we are going to learn how to describe rules that coordinate pairs sometimes follow. We're going to use equations to show the rules and we will see that equations, tables and graphs can all be used to show the same set of coordinate pairs.

Let's Review (Slide 3): Let's start with review.





We can see that these points make a diagonal line.

Now, I want you to tell me the coordinates for the points we can see. *Collect correct answers from the students and record the coordinates.* Remember that we can write this in a table as well.

Based on this pattern, what do you think the coordinates of Point E would be? And how do you know? Possible Student Answers, Key Points:

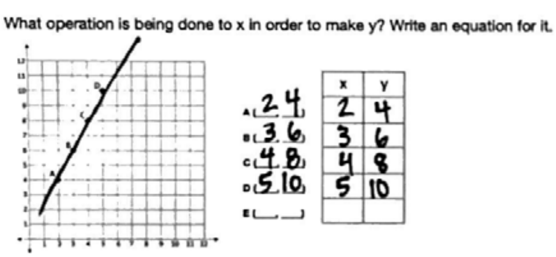
- It's (6, 8) because that's 1 more in the x column and 1 more in the y column.
- It's (6, 8) because that's the next counting number for each side.
- It's (6, 8) because that's the next point that's up and over.
- It's (6, 8) because I can imagine where the dot is.

This is important. We kind of notice a pattern but it's not the same as the patterns we saw in the last lesson.

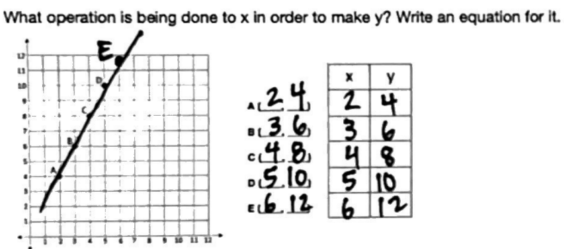
Let's Talk (Slide 4): When points make a straight line, we can write a rule for x and y using an equation. We will need to look for more patterns. You might have noticed that the x column is going up by 1 like "2, 3, 4, 5, 6." The y column is going up by 1 too. It is good to notice those patterns. But in order to write the rule or the equation, we have to notice the pattern going across the table. We need to know what is happening to x in order to make y.

The same operation - plus, minus, multiply or divide - is happening to x. In other words, x plus something or x times something or x minus something or x divided by something makes y. We can see that it has to be plus or times because the numbers are going up. I know that 2 x 2 makes 4. But if I try 3 x 2 in the next row, I get 6 not 5. Let's try addition. I know that 2 + 2 = 4. Let's try it for the next row. 3 + 2 = 5. Then 4 + 2 = 6, 5 + 2 = 7, 6 + 2 = 8. The rule is "add 2." We can write it as x + 2 = y because every x coordinate plus 2 makes the corresponding y coordinate. This equation and this table and this line are all ways to represent the same set of coordinates.

Let's Talk (Slide 5): Let's try a rule with a different operation! We can do it because we have another diagonal line.



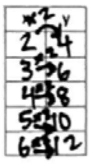
We start by finding the coordinates of the points. What are they? *Collect correct answers from the students and record the coordinates.* Remember that we can write this in a table as well.



Based on this pattern, what do you think the coordinates of Point E would be? And how do you know? Possible Student Answers, Key Points:

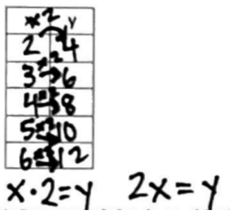
- It's (6, 12) because that's 1 more in the x column and 2 more in the y column.
- It's (6, 12) because you can count by ones for x and count by twos for y.
- It's (6, 12) because that's the next point that's up 2 and over 1.
- It's (6, 12) because I can imagine where the dot is.
- It's (6, 12) because it is always x times 2.

This is great. We can see so many patterns and one of those patterns will be our rule. What patterns do we see? Possible Student Answers, Key Points:



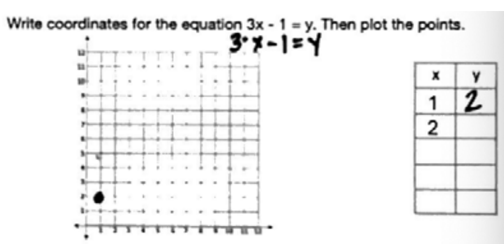
- The x column is always plus 1.
- The y column is always plus 2.
- x times 2 makes y

The pattern that we want to pay attention to is turning x into y. At first I thought it might be plus 2 like on our last slide because 2 + 2 = 4. But then I have to try it for the rest of the rows and 3 + 2 doesn't make 6. So then I try multiplication. 2 x 2 = 4. But then I have to try it for the rest of the rows and 3 x 2 = 6, 4 x 2 = 8, 5 x 2 = 10 and 6 x 2 = 12.



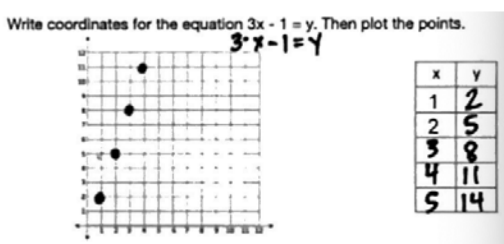
Our equation is x times 2 equals y. Since we have an x, it isn't a great idea to use x for times in our equation. You can show multiplication just by putting the number next to the letter. We write 2x = y. That is just a secret way of writing 2 times x equals y.

Let's Think (Slide 6): Sometimes we are told the rule and we just have to follow it. If we are given an equation, we can plug in numbers to get coordinates.



This equation is 3x - 1 = y. That means 3 times x minus 1 to get y.

Let's start with 1. 3 times 1 is 6 minus 1 is 5. So y is 5. I can plot it the same way I always do like (1, 5)



Let's keep going. You can help me. What is the math for the next row? What should I plot? *Let the kids talk you through the rest of the answers.*

Let's Try it (Slides 7): Now it's time to plot more points together using equations to tell us the rules. I will help you practice before you do it on your own.

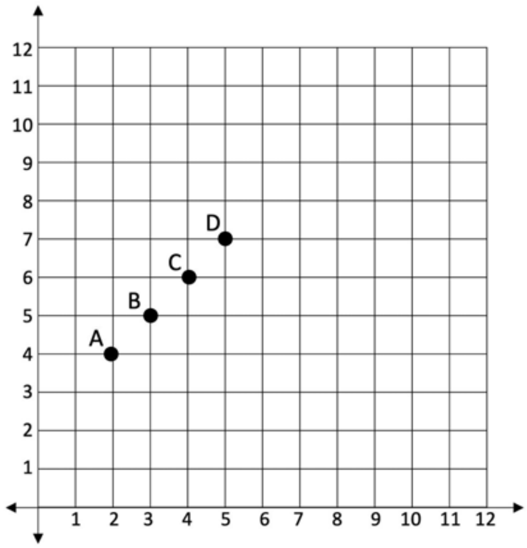
WARM WELCOME

Today we will plot and generate points that follow a rule.

Let's Review:

How do we find locations on the coordinate plane?

Write the coordinates for the points below. Where do we think Point E would go?



A (____, ____)

B (____, ____)

C (____, ____)

D (____, ____)

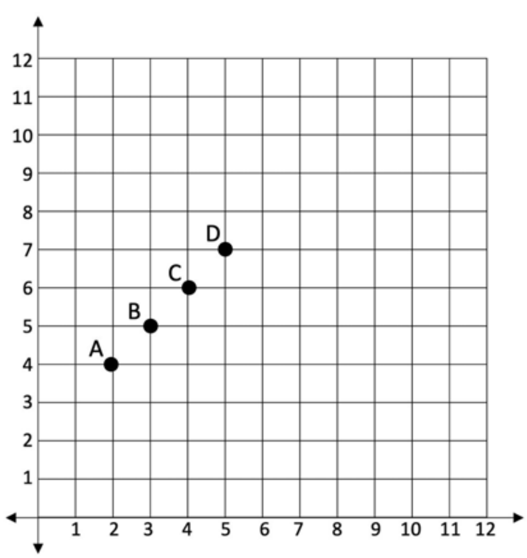
E (____, ____)

x	y

Let's Talk:

When points make a straight line, we can write a rule for x and y using an equation.

What operation is being done to x in order to make y? Write an equation for it.



A (2, 4)

B (3, 5)

C (4, 6)

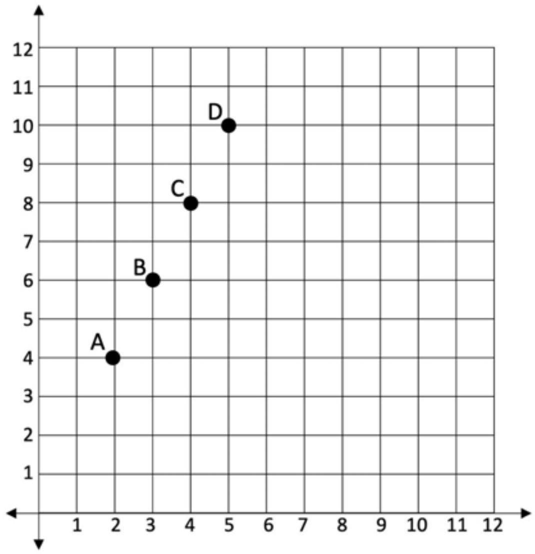
D (5, 7)

E (6, 8)

x	y
2	4
3	5
4	6
5	7
6	8

Let's Talk: Let's try a rule with a different operation!

What operation is being done to x in order to make y? Write an equation for it.



A (____, ____)

B (____, ____)

C (____, ____)

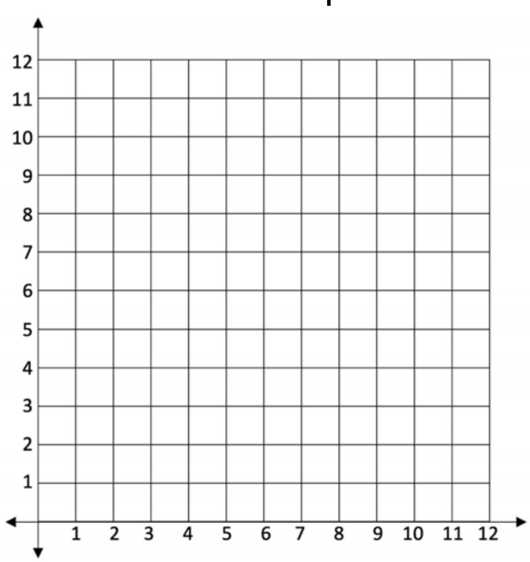
D (____, ____)

E (____, ____)

x	y

Let's Think: If we are given an equation, we can plug in numbers to get coordinates.

Write coordinates for the equation 3x - 1 = y. Then plot the points.



x	y
1	
2	

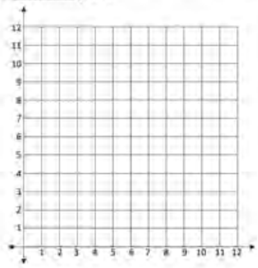
Let's Try It:

Let's practice plotting points for rules written as equations.

Name: ______________________________ G5 U6 Lesson 3 - Let's Try It

Bernard is 5 years old and his brother, Lucas, is 7 years old. As Bernard gets older, Lucas will also get older. In fact Lucas will always be 2 years older than Bernard.

The x-axis will stand for Bernard's age. The y-axis will stand for Lucas' age. Plot the boys' ages on coordinate plane.



x	y
5	7
6	

How old will Lucas be when Bernard is 6? _____ Write the ages on the table and plot on the coordinate plane.

Continue the pattern and plot the points.

What kind of picture do the points make on the coordinate plane?

____

Write an equation to represent the relationship between x and y. ______________________

On your Own:

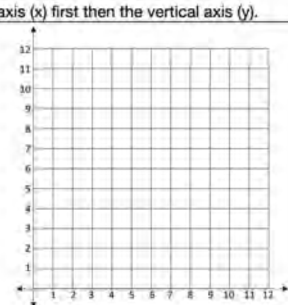
Now it's time for you to plot coordinates that follow rules written as equations.

Name: ______________________________ G5 U6 Lesson 3 - Independent Work

Remember: We find our coordinates on the horizontal axis (x) first then the vertical axis (y).

1. Use the rule $x + 6 = y$ to fill in the table. Then graph the points.

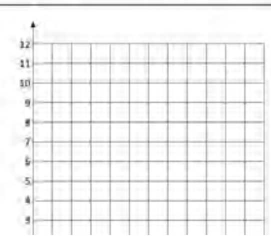
x	y
1	
2	
3	



What shape did the rule make on the graph?

2. Use the rule $2x = y$ to fill in the table. Then graph the points.

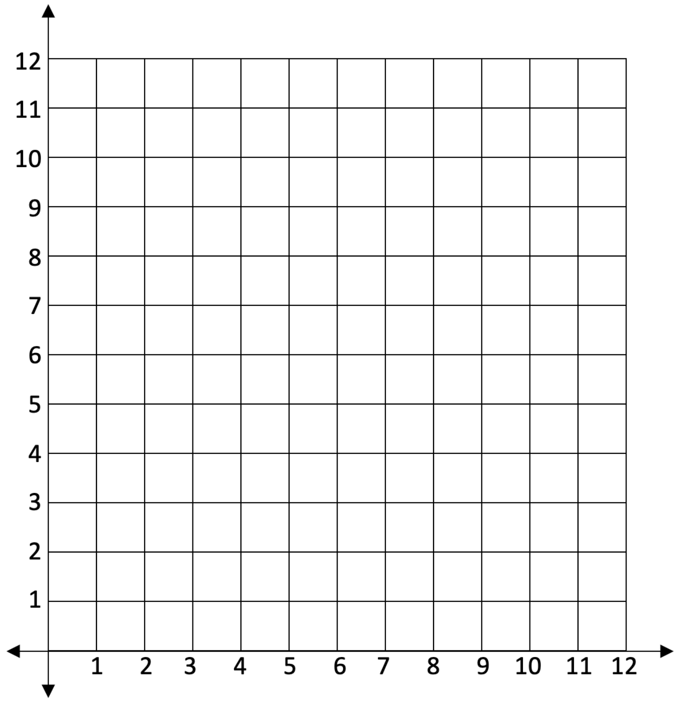
x	y
1	
2	
3	



What shape did the rule make on the graph?

Bernard is 5 years old and his brother, Lucas, is 7 years old. As Bernard gets older, Lucas will also get older. In fact Lucas will always be 2 years older than Bernard.

The x-axis will stand for Bernard's age. The y-axis will stand for Lucas' age. Plot the boys' ages on coordinate plane.



x	y
5	7
6	

How old will Lucas be when Bernard is 6? _______ Write the ages on the table and plot on the coordinate plane.

Continue the pattern and plot the points.

What kind of picture do the points make on the coordinate plane?

____

Write an equation to represent the relationship between x and y. ______________________________

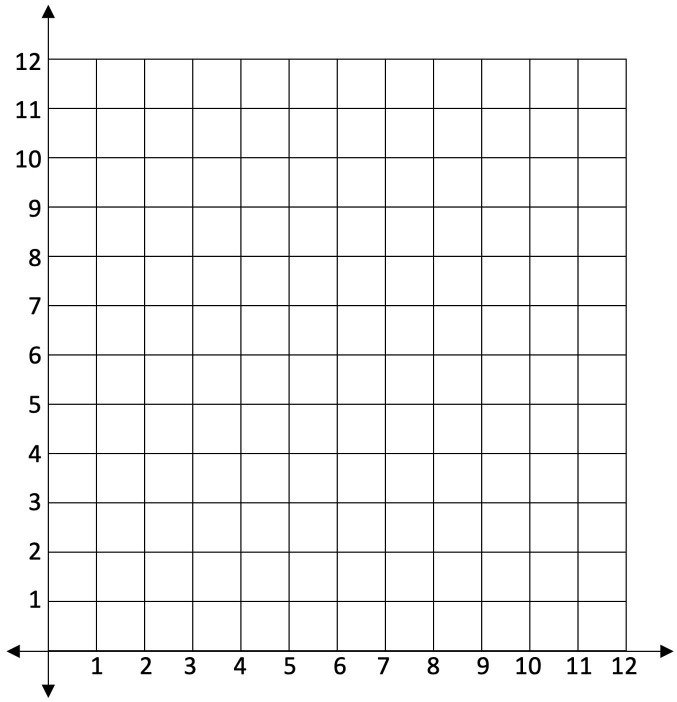
Which of the coordinates below also fit your rule?

(a) (2, 3) (b) (3, 5) (c) (4, 2) (d) (0, 4)

How do you know?

____

Complete the table with coordinates that fit the equation: $2x + 1 = y$. Graph the coordinates.



x	y
1	
2	

What kind of picture do the points make on the coordinate plane?

____

Which of the coordinates below also fit your rule?

(b) (2, 4)　　(b) (7, 3)　　(c) (4, 9)　　(d) (0, 2)

How do you know?

____

____

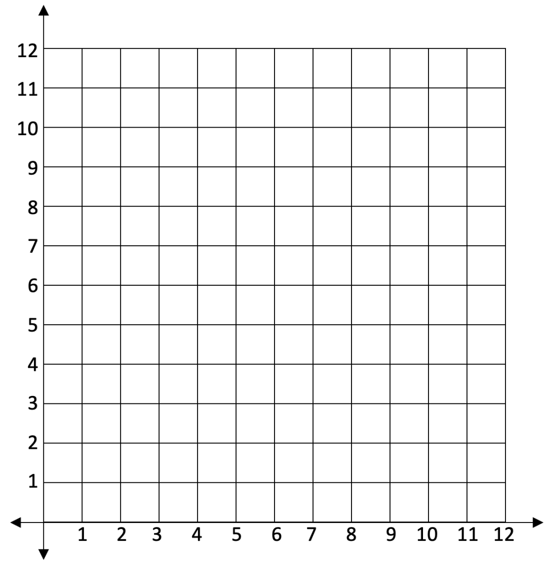
Name: ____ G5 U6 Lesson 3 - Independent Work

Remember: We find our coordinates on the horizontal axis (x) first then the vertical axis (y).

1. Use the rule x + 6 = y to fill in the table.
Then graph the points.

x	y
1	
2	
3	

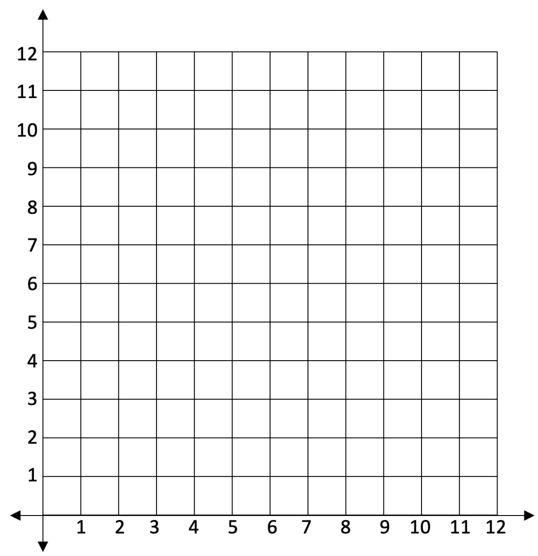
What shape did the rule make on the graph?



2. Use the rule 2x = y to fill in the table.
Then graph the points.

x	y
1	
2	
3	

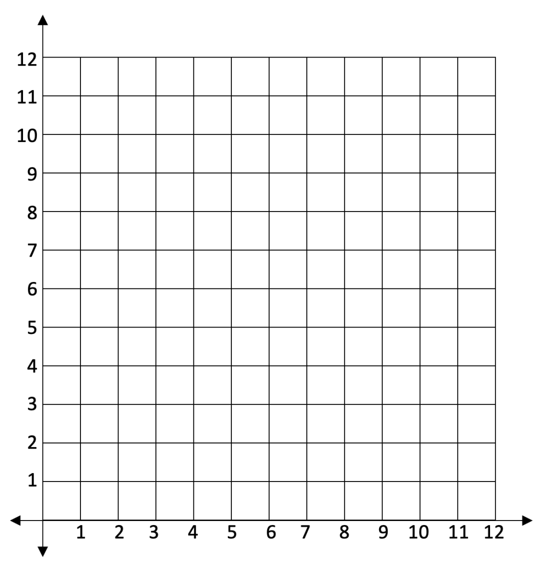
What shape did the rule make on the graph?



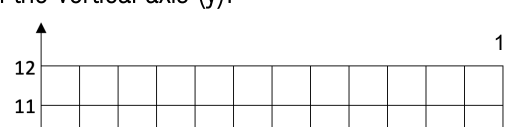
3. Use the rule 3x - 1 = y to fill in the table.
Then graph the points.

x	y
1	
2	
3	

What shape did the rule make on the graph?



Remember: We find our coordinates on the horizontal axis (x) first then the vertical axis (y).



4. Use the rule $3x = y$ to fill in the table.
Then graph the points.

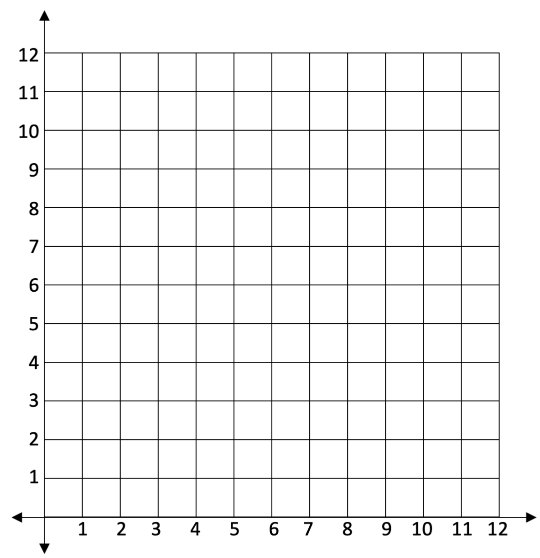
x	y
0	
1	
2	

What shape did the rule make on the graph?

5. Use the rule $x - 2 = y$ to fill in the table.
Then graph the points.

x	y
3	
4	
5	

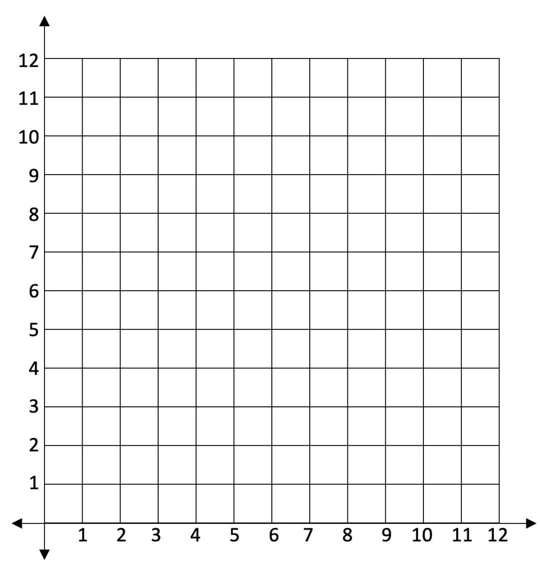
What shape did the rule make



6. Use the rule $2x + 1 = y$ to fill in the table.
Then graph the points.

x	y
1	
2	
3	

What shape did the rule make on the graph?

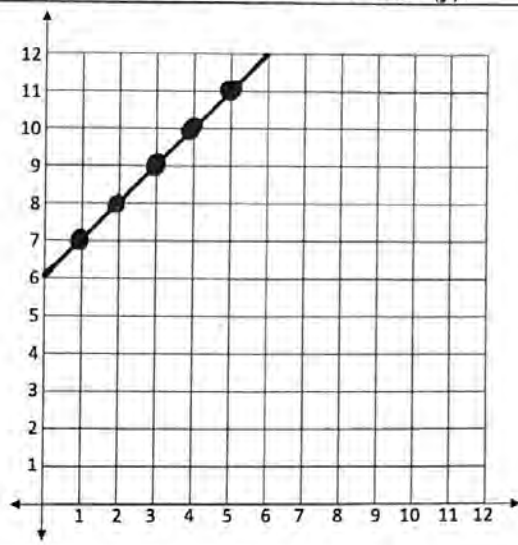


Name: ANSWER KEY

Remember: We find our coordinates on the horizontal axis (x) first then the vertical axis (y).

1. Use the rule x + 6 = y to fill in the table.
Then graph the points.

x	y
1	7
2	8
3	9
4	10
5	11

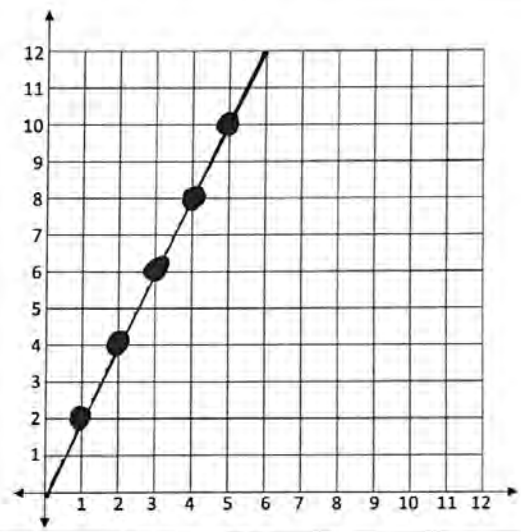


What shape did the rule make on the graph?

a straight line

2. Use the rule 2x = y to fill in the table.
Then graph the points.

x	y
1	2
2	4
3	6
4	8
5	10

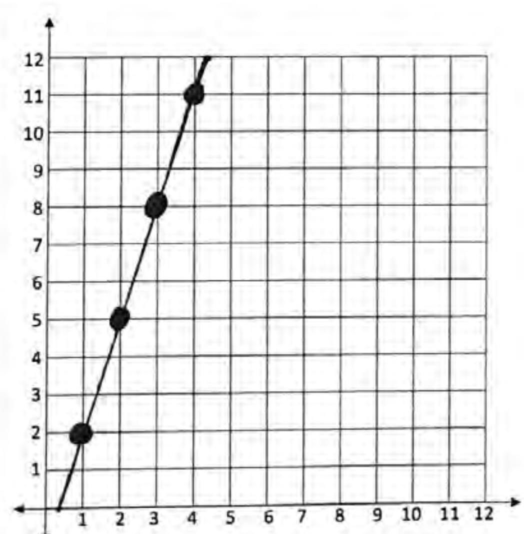


What shape did the rule make on the graph?

a straight line

3. Use the rule 3x - 1 = y to fill in the table.
Then graph the points.

x	y
1	2
2	5
3	8
4	11



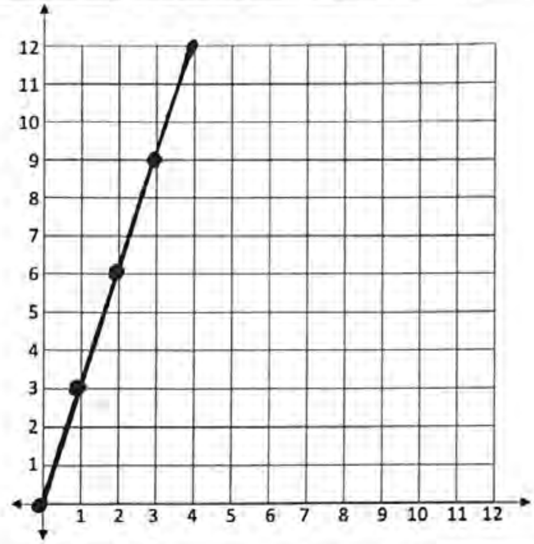
What shape did the rule make on the graph?

a straight line

Remember: We find our coordinates on the horizontal axis (x) first then the vertical axis (y).

4. Use the rule 3x = y to fill in the table.
Then graph the points.

x	y
0	0
1	3
2	6
4	12

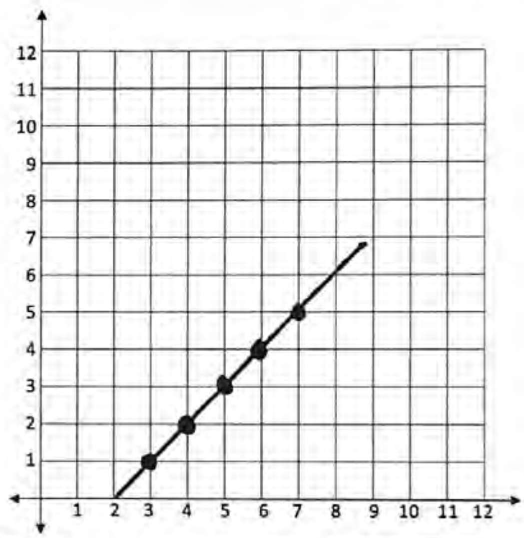


What shape did the rule make on the graph?

a straight line

5. Use the rule x - 2 = y to fill in the table.
Then graph the points.

x	y
3	1
4	2
5	3
6	4
7	5

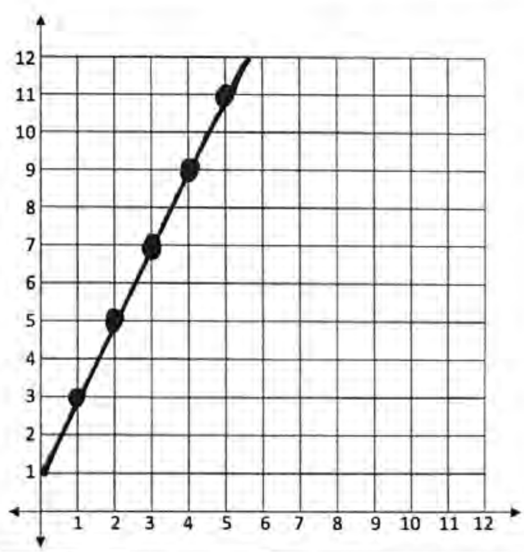


What shape did the rule make on the graph?

a straight line

6. Use the rule 2x + 1 = y to fill in the table.
Then graph the points.

x	y
1	3
2	5
3	7
4	9
5	11



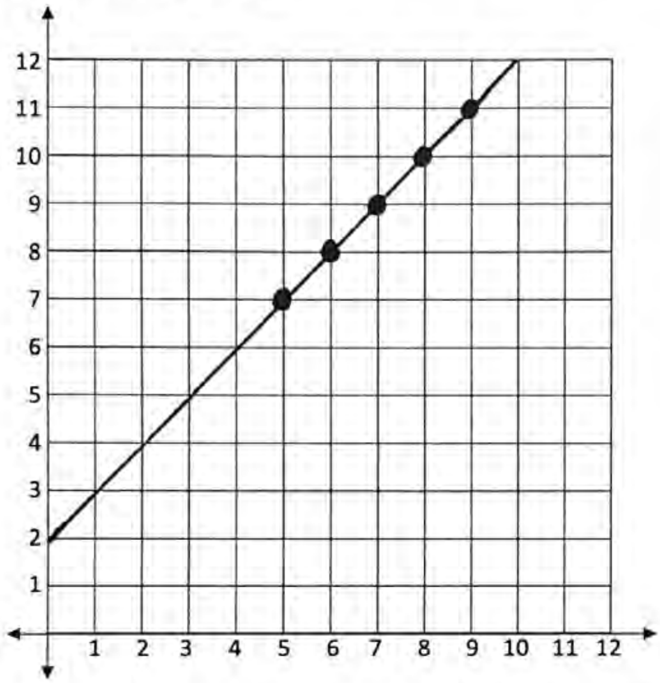
What shape did the rule make on the graph?

a straight line

Name: ANSWER KEY

Bernard is 5 years old and his brother, Lucas, is 7 years old. As Bernard gets older, Lucas will also get older. In fact Lucas will always be 2 years older than Bernard.

The x-axis will stand for Bernard's age. The y-axis will stand for Lucas' age. Plot the boys' ages on coordinate plane.



x	y
5	7
6	8
7	9
8	10
9	11

How old will Lucas be when Bernard is 6? 8 Write the ages on the table and plot on the coordinate plane.

Continue the pattern and plot the points.

What kind of picture do the points make on the coordinate plane?

They make a straight diagonal line.

Write an equation to represent the relationship between x and y. $x + 2 = y$

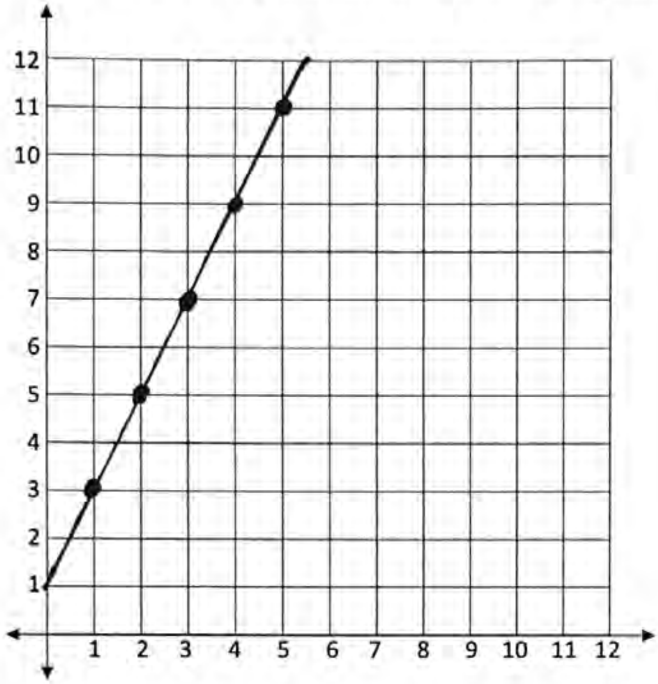
Which of the coordinates below also fit your rule?

(a) (2, 3) (b) (3, 5) (c) (4, 2) (d) (0, 4)

How do you know?

I know because x is 3 and y is 5 and $3 + 2 = 5$.

Complete the table with coordinates that fit the equation: 2x + 1 = y. Graph the coordinates.



x	y
1	3
2	5
3	7
4	9
5	11

What kind of picture do the points make on the coordinate plane?

They make a straight diagonal line.

Which of the coordinates below also fit your rule?

(b) (2, 4) (b) (7, 3) (c) (4, 9) (d) (0, 2)

How do you know?

I know because x is 4 and y is 9. 2 times 4 is 8 plus 1 is 9.

G5 U6 Lesson 4

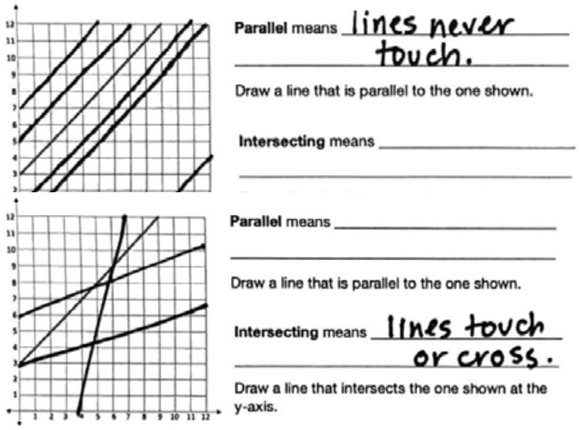
Compare the graphs of addition equations and multiplication equations

G1 U1 Lesson 4 - Today we will compare the graphs of addition equations and multiplication equations.

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): Today we are going to compare the equations and graphs of different lines using everything that we've been working on.

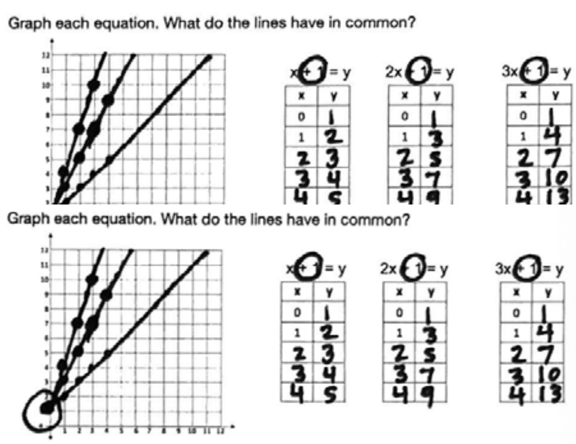
Let's Review (Slide 3): Before we can start, we need to review the meaning of two key words: parallel and intersecting.



Parallel means the lines never touch. They run side by side like train tracks. *Show parallel lines with your arms.* Parallel lines point the same direction and they increase the same way. Here are some examples of lines that are parallel to this one. *Draw a few examples then erase the board so you can go to the next vocabulary word.*

Intersecting means the lines touch. That means they might kind of look like they are going in the same direction but not exactly. *Show lines that are not parallel with your arms.* Intersecting lines eventually crash or cross. Here are some examples of lines that intersect this one. *Draw a few examples.*

Let's Talk (Slide 4): We have been noticing patterns in certain types of lines. Let's explore whether there are similarities between the lines when they all have the same addition in their equations.



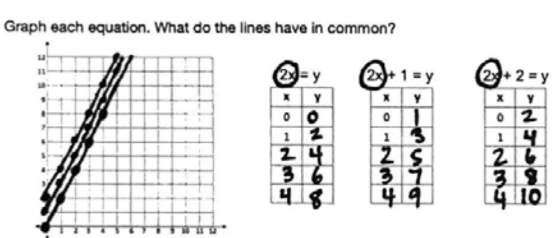
All of these equations have +1. *Circle the +1 in each equation.* Let's use each equation to complete the table and graph the points. Who can do the first point with x as zero? *Collect answers from the class. Record them in the table and graph them. As the kids talk, the teacher should write. So that this doesn't take too long, do not have kids come up to the board one at a time.*

We know how to do all of that and we are great at it! Now, we know that the equations all have a +1. That is what is the same about the equations. What is the same about the graphs of the lines? What do the lines have in common? Possible Student Answers, Key Points:

- They all touch at the beginning.
- They intersect at the y-axis.

The fancy word for this is the y-intercept. You don't need to know this yet but it doesn't hurt to hear it. The main point is when the equations have the same addition then they intersect the same point right here. *Point to the intersection and circle it.*

Let's Talk (Slide 5): Let's explore a different similarity. Let's explore whether there are similarities between the lines when they all have the same multiplication in their equations.



All of these equations have 2x. *Circle the 2x in each equation.* Let's use each equation to complete the table and graph the points. Who can do the first point with x as zero? *Collect answers from the class. Record them in the table and graph them. As the kids talk, the teacher should write. So that this doesn't take too long, do not have kids come up to the board one at a time.*

We know how to do all of that and we are great at it! Now, we know that the equations all have 2x. That is what is the same about the equations. What is the same about the graphs of the lines? What do the lines have in common? Possible Student Answers, Key Points:

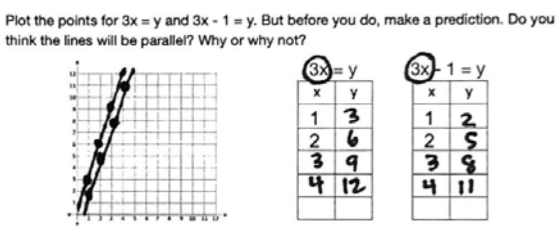
- They go the same direction.
- They are side by side.

- They are parallel.

They are parallel! This is the big idea of the lesson - when the equations have the same multiplication times x then they will be parallel. In fancy math talk, we say they have the same slope. You don't need to know that word yet but it helps to start hearing it.

Let's Think (Slide 6): Now that you know that special thing about multiplying times x, you can predict if lines will be parallel or not. Because when lines have the same multiplication times x, they will be parallel. Let's make a prediction about these two lines. *Read the directions on the slide.* What do you think? Possible Student Answers, Key Points:

- Yes because they have the same 3x.
- They will be parallel because they have the same number multiplied times x.



We see 3x in each equation. *Circle the 3x in each equation.* Since that is the same we expect the lines to be parallel. Let's use each equation to complete the table and graph the points. Who can do the first point with x as zero? *Collect answers from the class. Record them in the table and graph them. As the kids talk, the teacher should write. So that this doesn't take too long, do not have kids come up to the board one at a time.* Look! We were right! The lines are parallel!

Let's Try it (Slides 7): Now it's time to plot equations together, and we will do the same predicting about whether they will be parallel. I will guide you step by step.

WARM WELCOME

Today we will compare the graphs of addition equations and multiplication equations.

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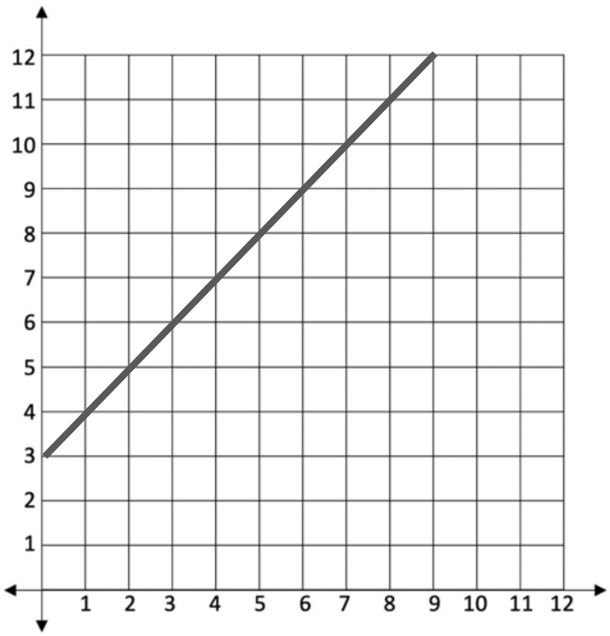
Let's Review:

Let's review the meaning of parallel and intersecting.



Parallel means ______________________________

____

Draw a line that is parallel to the one shown.

Intersecting means ______________________________

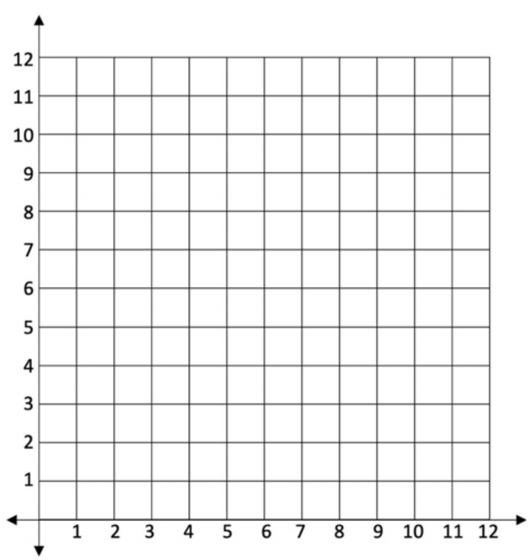
____

Draw a line that intersects the one shown at the y-axis.

Let's Talk:

Let's look at graphs that have the same addition in their equations.

Graph each equation. What do the lines have in common?



$x + 1 = y$

x	y
0	
1	

$2x + 1 = y$

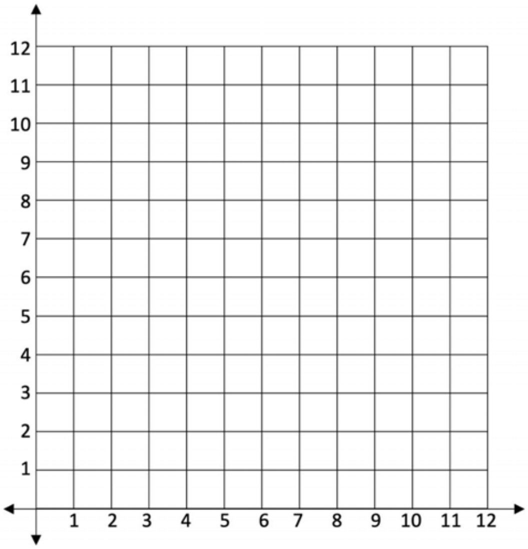
x	y
0	
1	

$3x + 1 = y$

x	y
0	
1	

Let's Talk: Let's look at graphs that have the same multiplication in their equations.

Graph each equation. What do the lines have in common?



$2x = y$

x	y
0	
1	

$2x + 1 = y$

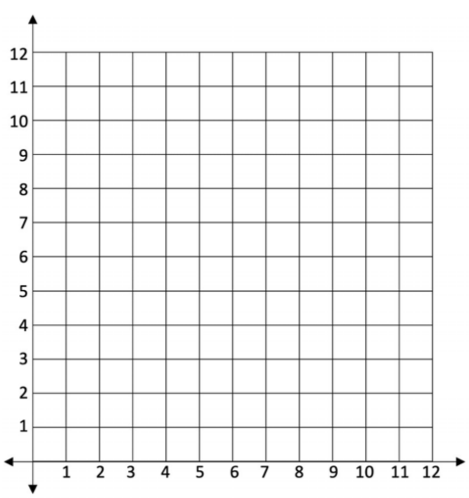
x	y
0	
1	

$2x + 2 = y$

x	y
0	
1	

Let's Think: When lines have the same multiplication times x, they will be parallel.

Plot the points for $3x = y$ and $3x - 1 = y$. But before you do, make a prediction. Do you think these lines will be parallel? Why or why not?



$3x = y$

x	y
1	
2	

$3x - 1 = y$

x	y
1	
2	

Let's Try It:

Let's practice plotting two equations and we will notice patterns in their graphs.

Name: ______________________________ G5 U6 Lesson 4 - Let's Try It

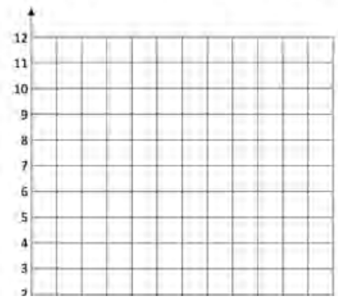
Jennifer had $1 then she got a job that paid $2 per hour. If x is the number of hours she works then y is the number of dollars she will have.

The equation to show the relationship for Jennifer is $2x + 1 = y$.

Elijah had $2 then he got a job that paid $2 per hour. If x is the number of hours he works then y is the number of dollars he will have.

The equation to show the relationship for Elijah is $2x + 2 = y$.

Fill in the table for each equation and graph the coordinates.



Jennifer

x	y
0	
1	

Elijah

x	y
0	
1	

On your Own:

Now it's time for you to plot two equations and you can make a prediction about them!

Name: ______________________________ G5 U6 Lesson 4 - Independent Work

Follow the directions. Then fill in each table using the equations and graph the points.

1. What similarities do you see in the equations?

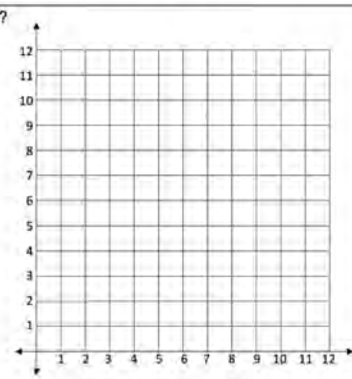
Do you expect the lines to be parallel?

$2x = y$

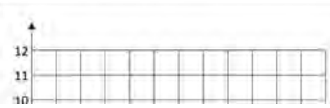
x	y
1	
2	
3	

$2x + 2 = y$

x	y
1	
2	
3	



2. What similarities do you see in the equations?



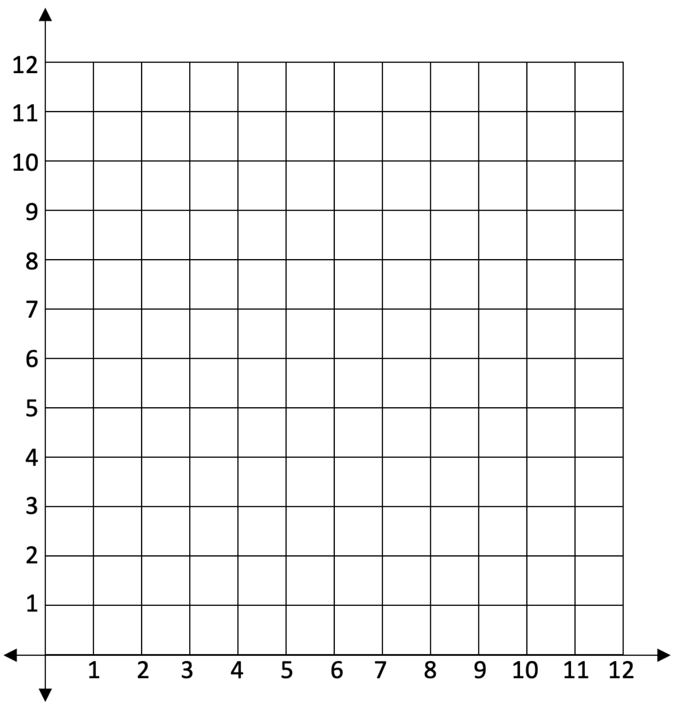
Jennifer had \$1 then she got a job that paid \$2 per hour. If x is the number of hours she works then y is the number of dollars she will have.

The equation to show the relationship for Jennifer is $2x + 1 = y$.

Elijah had \$2 then he got a job that paid \$2 per hour. If x is the number of hours he works then y is the number of dollars he will have.

The equation to show the relationship for Elijah is $2x + 2 = y$.

Fill in the table for each equation and graph the coordinates.



Jennifer

x	y
0	
1	

Elijah

x	y
0	
1	

How much money will Jennifer have after working 4 hours? ______

How much money will Elijah have after working 4 hours? ______

What do you notice about the lines you made? ____

____

In the equations, what part is the same? ____

Whenever equations have the same ______________, they will ________________________________.

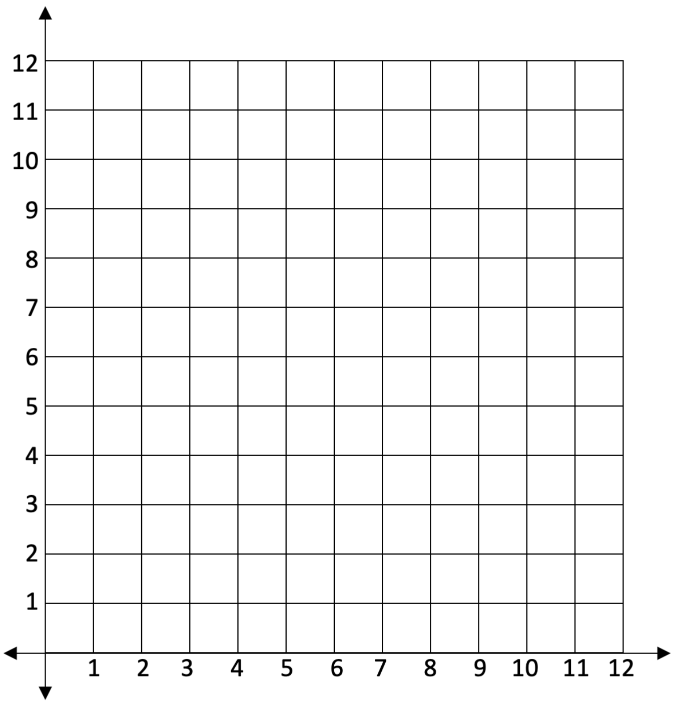
Miles had \$3 then he got a job that paid \$1 per hour. If x is the number of hours he works then y is the number of dollars he will have.

The equation to show the relationship for Miles is $1x + 3 = y$.

Nathaniel had $3 then he got a job that paid $2 per hour. If x is the number of hours he works then y is the number of dollars he will have.

The equation to show the relationship for Nathaniel is $2x + 3 = y$.

Fill in the table for each equation and graph the coordinates.



Miles

x	y
0	
1	

Nathaniel

x	y
0	
1	

How much money will Miles have after working 4 hours? _______

How much money will Nathaniel have after working 4 hours? _______

What do you notice about the lines you made? ____

____

In the equations, what part is the same? ____

Whenever equations have the same _______________, they will _____________________________________.

Name: ____

Follow the directions. Then fill in each table using the equations and graph the points.

1. What similarities do you see in the equations?

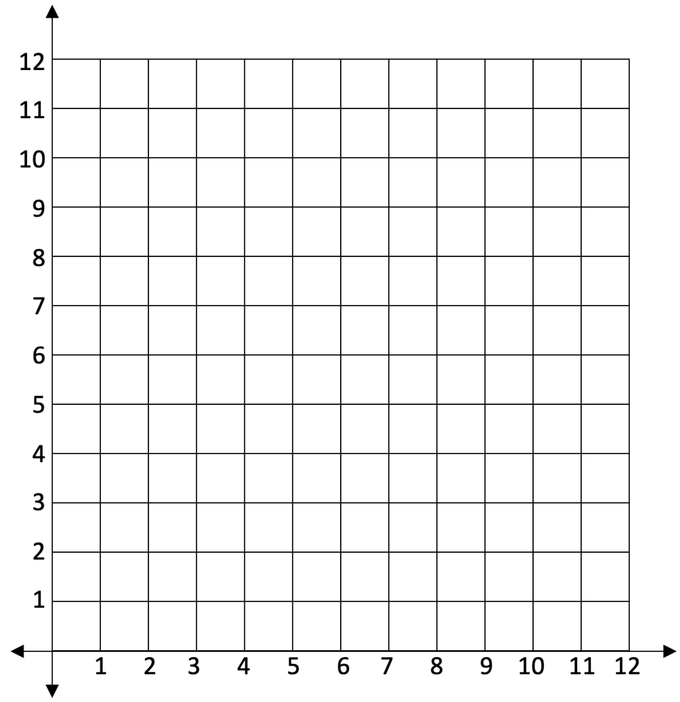
Do you expect the lines to be parallel?

$2x = y$

x	y
1	
2	
3	

$2x + 2 = y$

x	y
1	
2	
3	



2. What similarities do you see in the equations?

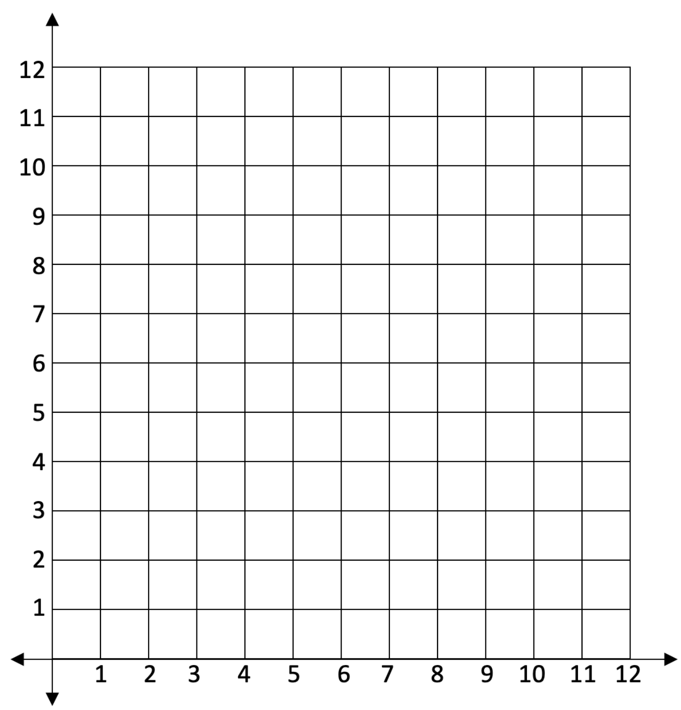
Do you expect the lines to be parallel?

$x + 1 = y$

x	y
1	
2	
3	

$2x + 1 = y$

x	y
1	
2	
3	



3. What similarities do you see in the equations?

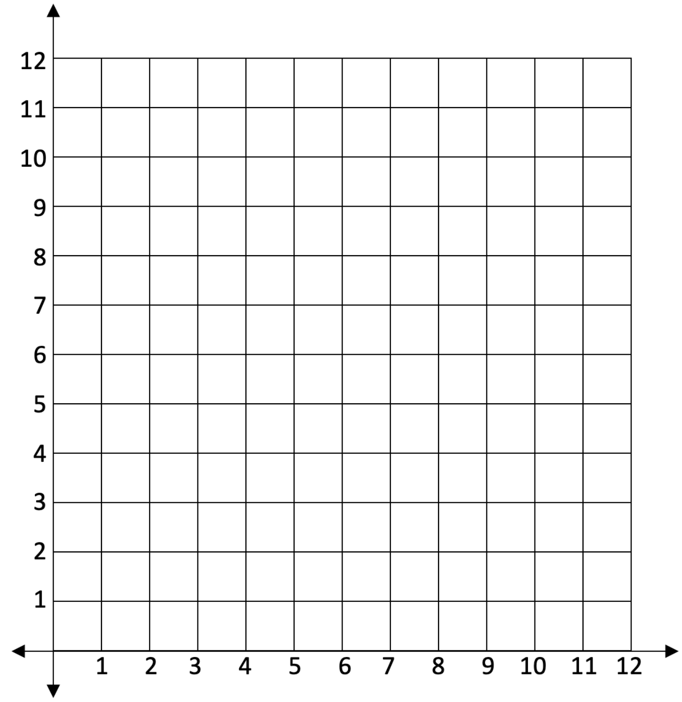
Do you expect the lines to be parallel?

$2x = y$

x	y
0	
1	
2	

$3x = y$

x	y
0	
1	
2	



4. What similarities do you see in the equations?

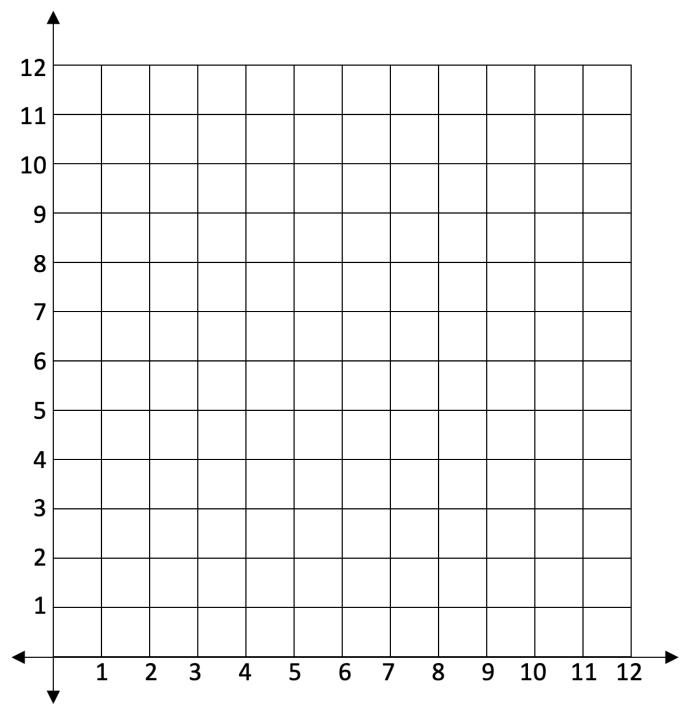
Do you expect the lines to be parallel?

$x = y$

x	y
1	
2	
3	

$x + 1 = y$

x	y
1	
2	
3	



What do equations have to have in common in order to be parallel when graphed?

____

____

Name: ANSWER KEY

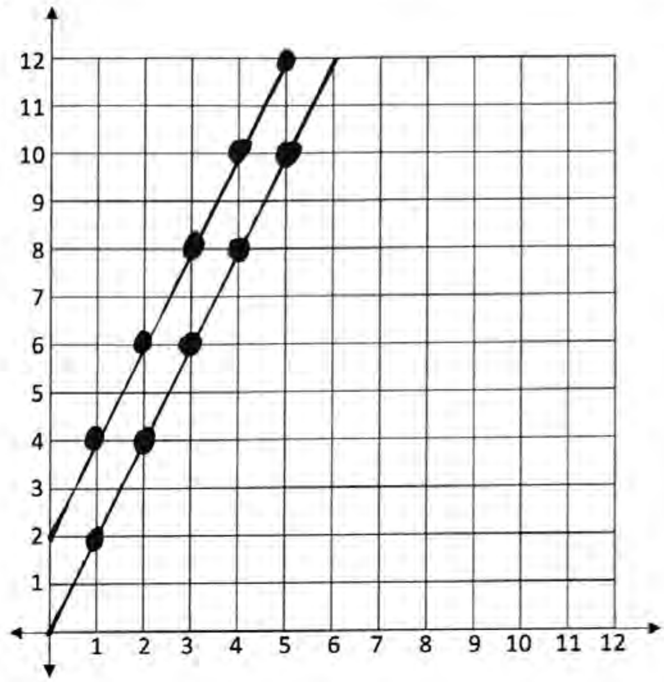
G5 U6 Lesson 4 - Independent Work

Follow the directions. Then fill in each table using the equations and graph the points.

1. What similarities do you see in the equations?

They both have 2x.

Do you expect the lines to be parallel? yes



$2x = y$

x	y
1	2
2	4
3	6
4	8
5	10

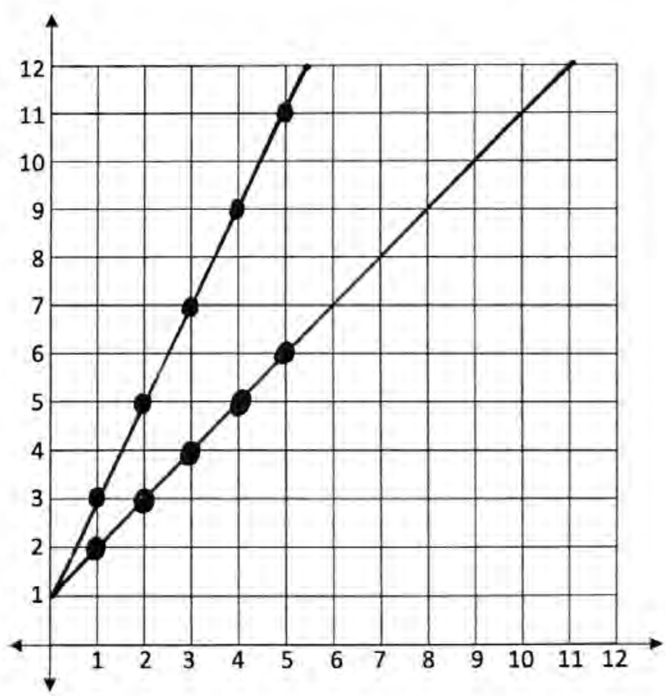
$2x + 2 = y$

x	y
1	4
2	6
3	8
4	10
5	12

2. What similarities do you see in the equations?

They both have +1

Do you expect the lines to be parallel? no



$x + 1 = y$

x	y
1	2
2	3
3	4
4	5
5	6

$2x + 1 = y$

x	y
1	3
2	5
3	7
4	9
5	11

3. What similarities do you see in the equations?

They don't have any + or −.

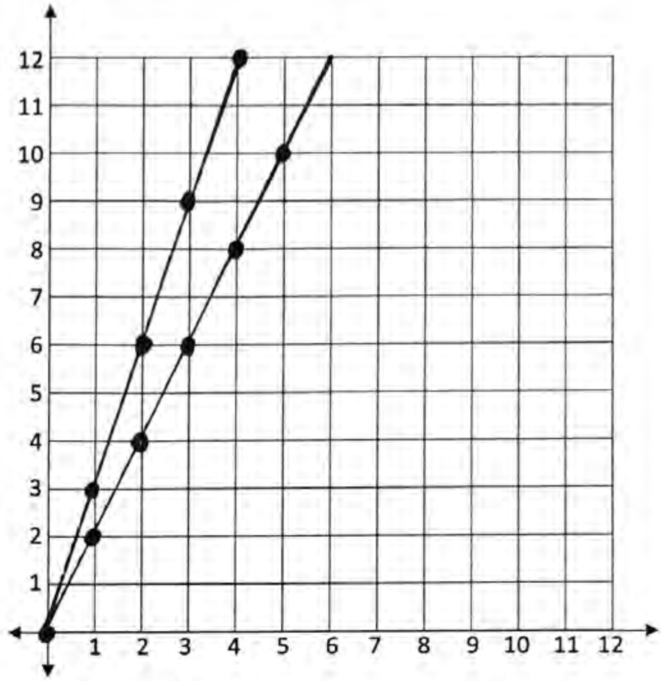
Do you expect the lines to be parallel? no

$2x = y$

x	y
0	0
1	2
2	4
3	6
4	8

$3x = y$

x	y
0	0
1	3
2	6
3	9
4	12



4. What similarities do you see in the equations?

They both have x alone.

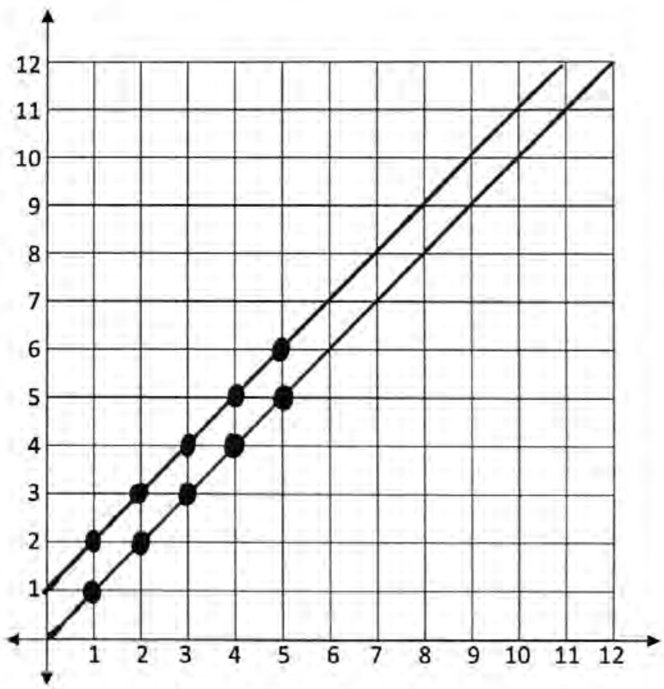
Do you expect the lines to be parallel? yes

$x = y$

x	y
1	1
2	2
3	3
4	4
5	5

$x + 1 = y$

x	y
1	2
2	3
3	4
4	5
5	6



What do equations have to have in common in order to be parallel when graphed?

They have to have the same number multiplied times x.

Name: ANSWER KEY

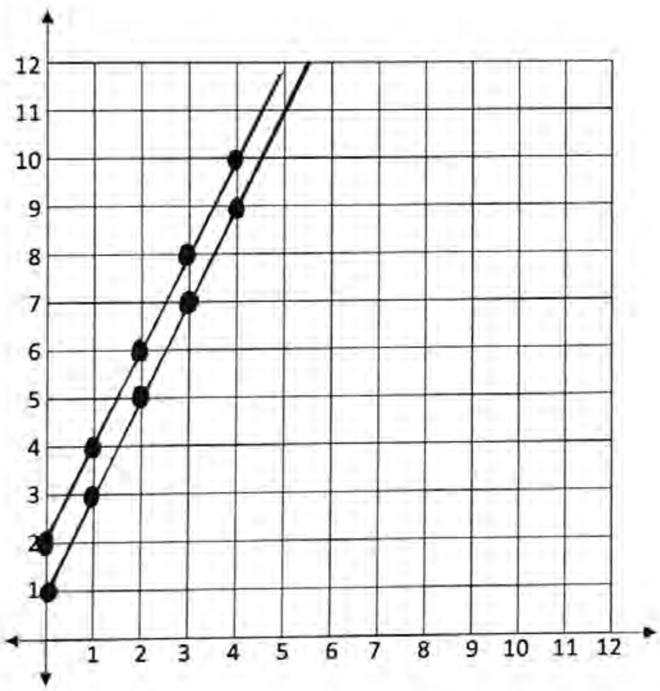
Jennifer had \$1 then she got a job that paid \$2 per hour. If x is the number of hours she works then y is the number of dollars she will have.

The equation to show the relationship for Jennifer is $2x + 1 = y$.

Elijah had \$2 then he got a job that paid \$2 per hour. If x is the number of hours he works then y is the number of dollars he will have.

The equation to show the relationship for Elijah is $2x + 2 = y$.

Fill in the table for each equation and graph the coordinates.



Jennifer

x	y
0	1
1	3
2	5
3	7
4	9

Elijah

x	y
0	2
1	4
2	6
3	8
4	10

How much money will Jennifer earn for working 4 hours? 9

How much money will Elijah earn for working 4 hours? 10

What do you notice about the lines you made? They are parallel. They don't intersect.

In the equations, what part is the same? They both have 2x

Whenever equations have the same multiplier**, they will** be parallel.

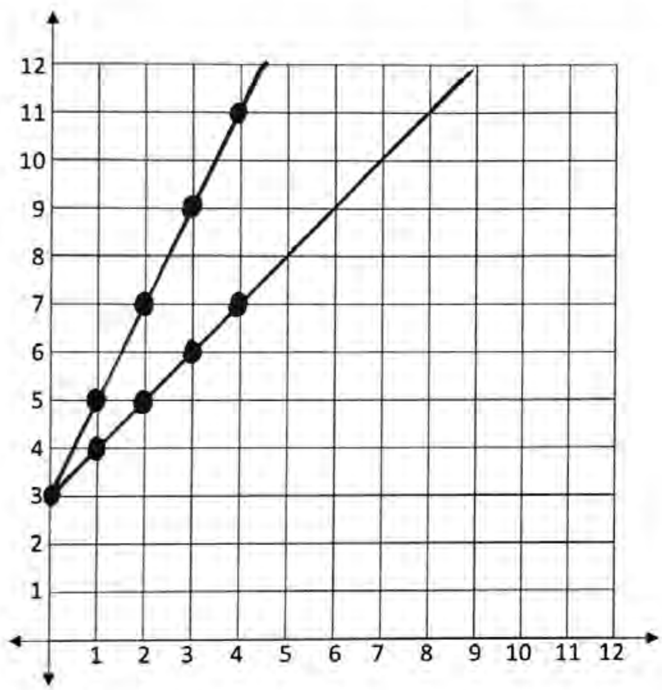
Miles had $3 then he got a job that paid $1 per hour. If x is the number of hours he works then y is the number of dollars he will have.

The equation to show the relationship for Miles is 1x + 3 = y.

Nathaniel had $3 then he got a job that paid $2 per hour. If x is the number of hours he works then y is the number of dollars he will have.

The equation to show the relationship for Nathaniel is 2x + 3 = y.

Fill in the table for each equation and graph the coordinates.



Miles

x	y
0	3
1	4
2	5
3	6
4	7

Nathaniel

x	y
0	3
1	5
2	7
3	9
4	11

How much money will Miles earn for working 4 hours? 7

How much money will Nathaniel earn for working 4 hours? 11

What do you notice about the lines you made? They are not parallel. They intersect.

In the equations, what part is the same? Both equations have +3.

Whenever equations have the same addend**, they will** intersect.

G5 U6 Lesson 5

Write equations for parallel lines

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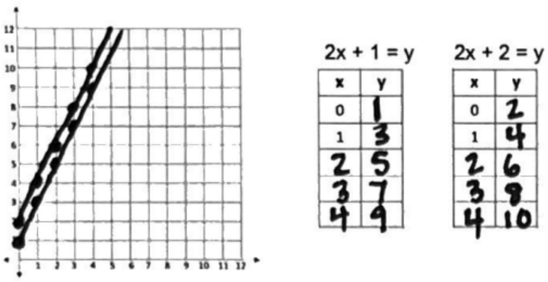
G1 U1 Lesson 5 - Today we will write equations for parallel lines.

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): This is the last day of the graphing equations on the coordinate plane. You guys are getting really good at this and we are not really doing anything new. We are just applying what we've already learned to come up with some of our own equations. Let's go!

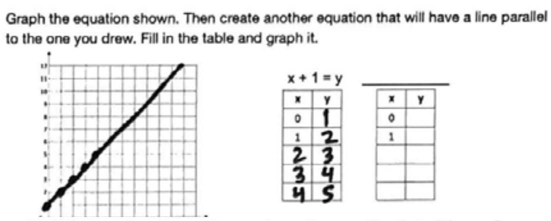
Let's Review (Slide 3): We discussed this question in our last lesson so now you can tell me. What similarity will the equations of parallel lines have? Possible Student Answers, Key Points:

- When the equations have the same number at the beginning they will be parallel lines.
- Equations with the same number multiplying x will make parallel lines.

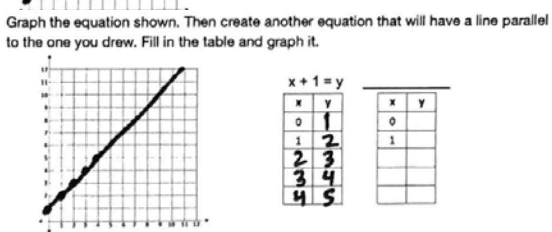


So we expect these two lines to be parallel. Let's check. Who can find the first point and tell me how to graph it? What about the next point? *Collect answers from the class. Record them in the table and graph them. As the kids talk, the teacher should write. So that this doesn't take too long, do not have kids come up to the board one at a time.* And look! The lines are parallel just like we predicted.

Let's Talk (Slide 4): Now let's try to construct parallel lines on our own. *Read the directions on the slide.*



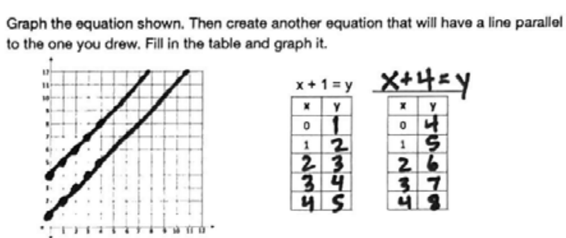
We'll do the equation we're given first. Who can find the first point and tell me how to graph it? What about the next point? *Collect answers from the class. Record them in the table and graph them. As the kids talk, the teacher should write. So that this doesn't take too long, do not have kids come up to the board one at a time.*



Now we need another equation and we need it to be parallel to the one we already drew. We know that parallel lines have equations with the same number multiplying the x. What number is multiplying the x in the equation we were given? *Survey the class. It is likely one of the kids will say that nothing is multiplying the x. That is incorrect and you will want to be very explicit about saying that it is not nothing.* It is easy to think that nothing is multiplying x because we don't see a number before the x. But in math, nothing means zero. So if it were really nothing, there would be a zero there. This is hard to see but it is actually 1. When x is all by itself, we are secretly saying there is 1x. *Write the 1 before the x in the equation.*

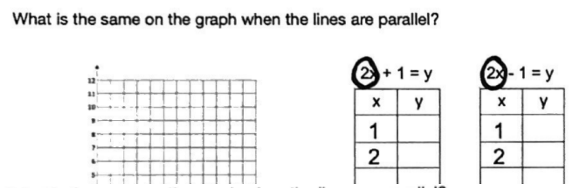
Back to finding another equation. We need it to be parallel to the one we already drew. We know that parallel lines have equations with the same number multiplying the x. And now we know this equation has 1x. Who can give me an equation that will be parallel to this one? Possible Student Answers, Key Points:

- x = y or 1x = y
- x + 2 = y or 1x + 2 = y
- x + 3 = y or 1x + 3 = y



There are many right answers. *Possible answers are x = y or 1x = y, x + 2 = y or 1x + 2 = y, etc.* As long as we have x on it's own which is secretly 1x, we'll have a parallel line. Let's do x + 4 = y. *Write the equation on the line.* Who can find the first point and tell me how to graph it? What about the next point? *Collect answers from the class. Record them in the table and graph them. As the kids talk, the teacher should write. So that this doesn't take too long, do not have kids come up to the board one at a time.* And look! The line is parallel! Hooray!

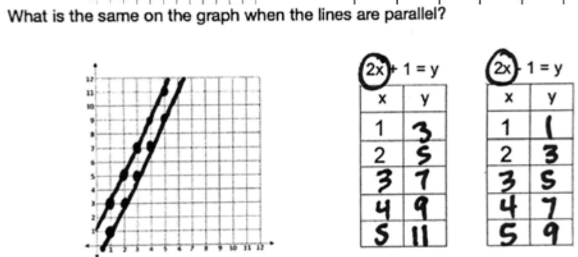
Let's Think (Slide 5): We know if the number multiplying x is the same, the lines will be parallel. Let's be really clear on what is the same on the graph when the lines are parallel.



Let's graph these and I'll show you what I mean. First of all, do you think they will be parallel? Why or why not? Possible Student Answers, Key Points:

- Yes, they both have 2x.
- They will be parallel because they have the same number multiplying x.

Circle the 2x on both equations.

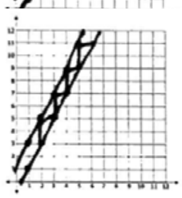


Let's graph these. Who can find the first point and tell me how to graph it? What about the next point? *Collect answers from the class. Record them in the table and graph them. As the kids talk, the teacher should write. So that this doesn't take too long, do not have kids come up to the board one at a time.*

Great job! We see they are parallel just like we predicted. Now we were asked what is the same on the graph when the lines are parallel. Why do you think these lines never touch? Possible Student Answers, Key Points:

- They are side by side and never touch.
- They go the same way.
- They follow the same path.
- They point in the same direction.

The reason that they go side by side and never touch is because they go in the exact same direction. They go up the same way. One way for us to see that is to think about each point going up like a staircase. Up and over and up and over. In this case, up 2 over 1, up 2 over 1. *Draw in the staircase for the first line.*



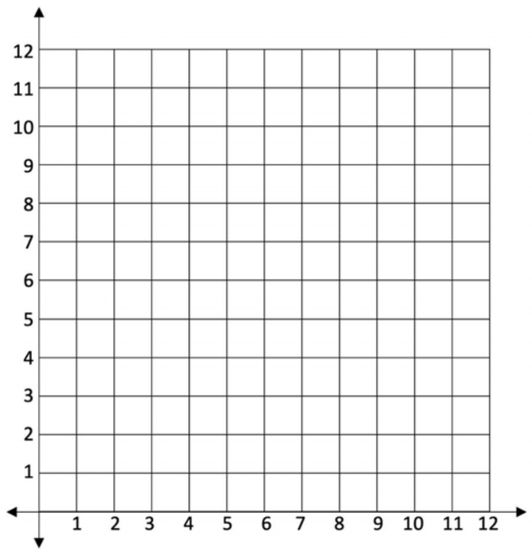
Erase it and then draw in the staircase for the next line. The up and over is the same for both lines. Up 2 over 1, up 2 over 1. The staircase is the same for both lines. We call that the slope. You don't need to draw the slope or find the slope yet. But it is a good way to make sure the lines are really parallel.

Let's Try it (Slides 7): Now we'll write equations for more parallel lines together. I will walk you through step by step.

WARM WELCOME

Today we will write equations for parallel lines.

Let's Review: What similarity will the equations of parallel lines have?



$2x + 1 = y$

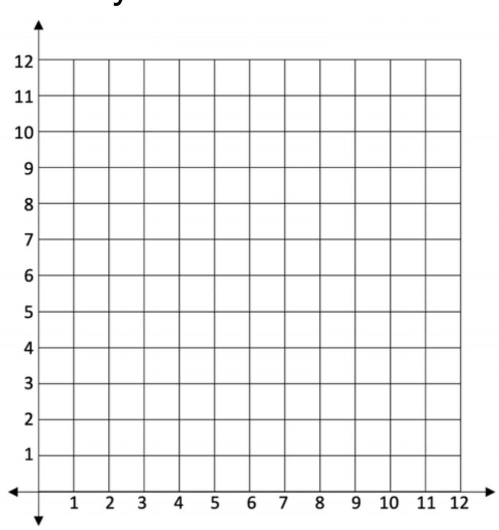
x	y
0	
1	

$2x + 2 = y$

x	y
0	
1	

Let's Talk: Let's try to construct parallel lines of our own.

Graph the equation shown. Then create another equation that will have a line parallel to the one you drew. Fill in the table and graph it.



$x + 1 = y$

x	y
0	
1	

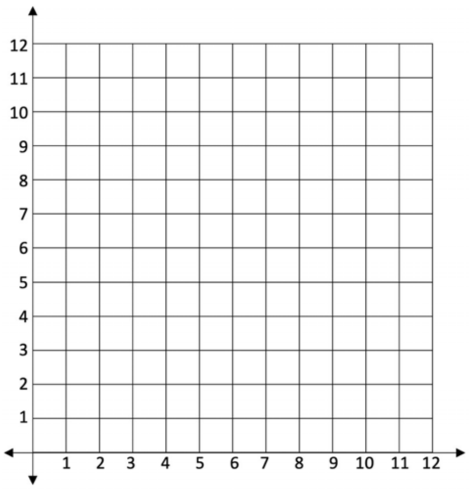
____

x	y
0	
1	

Let's Think:

We know if the number multiplying x is the same, the lines will be parallel.

What is the same on the graph when the lines are parallel?



$2x + 2 = y$

x	y
1	
2	

$2x - 2 = y$

x	y
1	
2	

Let's Try It:

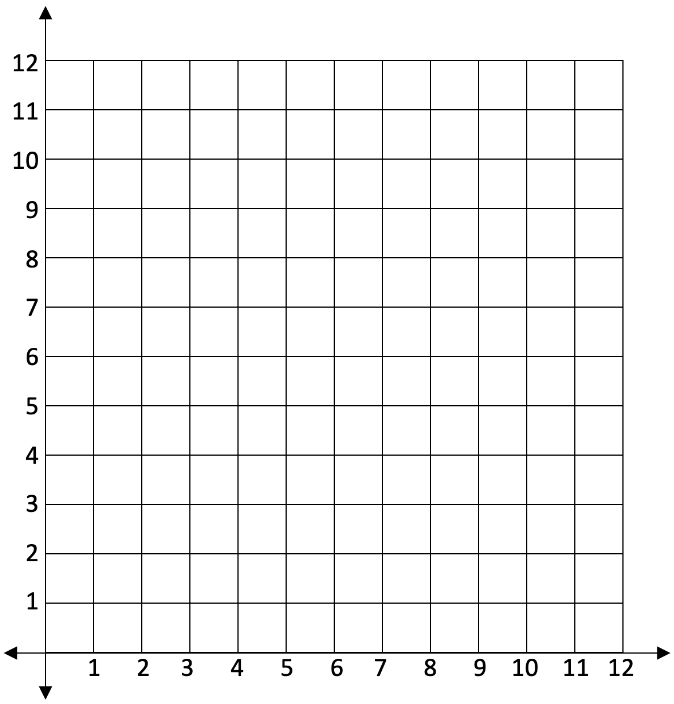
Let's practice plotting two equations and we will notice patterns in their graphs.

On your Own:

Now it's time for you to plot two equations and you can make a prediction about them!

Name: ______________________________________

Graph the first equation.



$2x + 1 = y$

x	y
0	
1	

____

x	y
0	
1	

Use the question below to write a second equation that will have a line that is parallel to the first one.

What does the second equation need to have to have a line parallel to the first equation? ___________

Graph the second equation. Is it parallel to the first one? ___________

Draw a staircase on each line and check that they are parallel. Each line goes up ___ and over ___.

Name: ______________________________________ G5 U6 Lesson 5 - Independent Work

Remember: Equations with the same multiplication will be parallel.

1. Use the rule $x + 1 = y$ to fill in the first table.

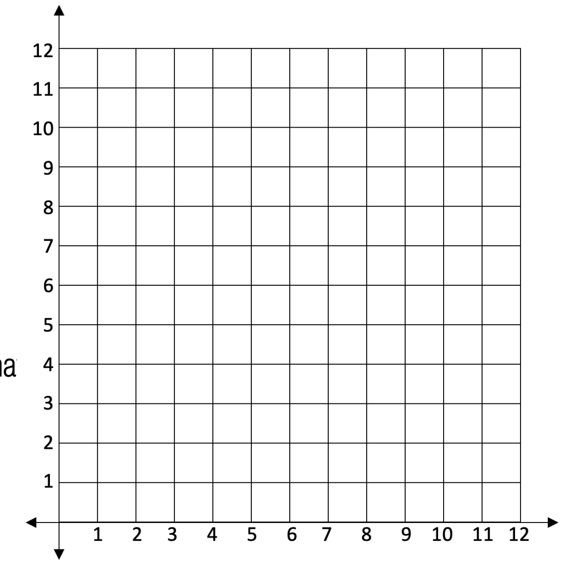
x	y
0	
1	

x	y
0	
1	

Create another equation tha
the one you drew.

____

Use it to fill in the second table and graph it.



2. Use the rule $2x = y$ to fill in the first table.

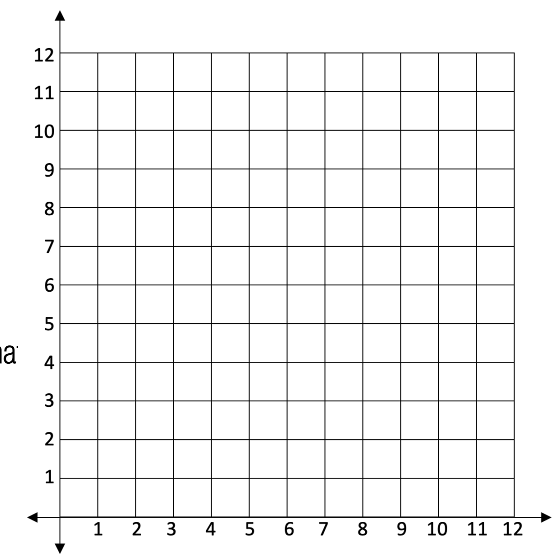
x	y
0	
1	

x	y
0	
1	

Create another equation tha
the one you drew.

____

Use it to fill in the second table and graph it.



3. Use the rule $3x + 2 = y$ to fill in the first table.

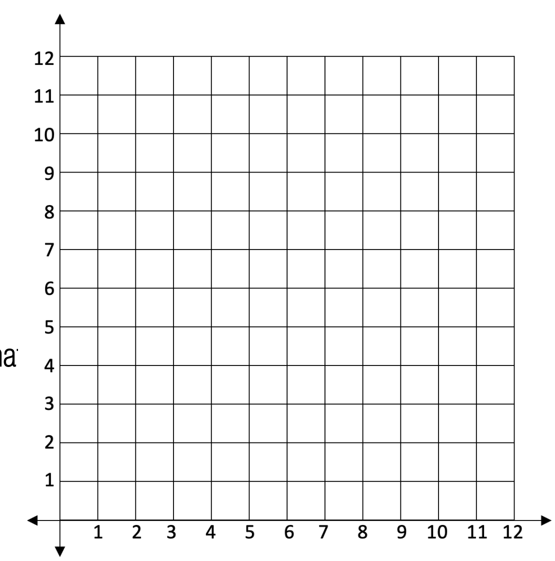
x	y
0	
1	

x	y
0	
1	

Create another equation tha
the one you drew.

____

Use it to fill in the second table and graph it.

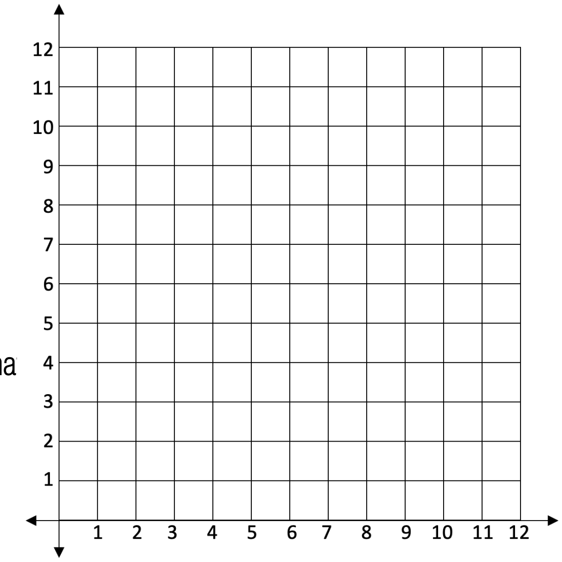


Remember: Equations with the same multiplication will be parallel.

1. Use the rule 3x + 1 = y to fill in the first table.

x	y
0	
1	

x	y
0	
1	



Create another equation tha
the one you drew.

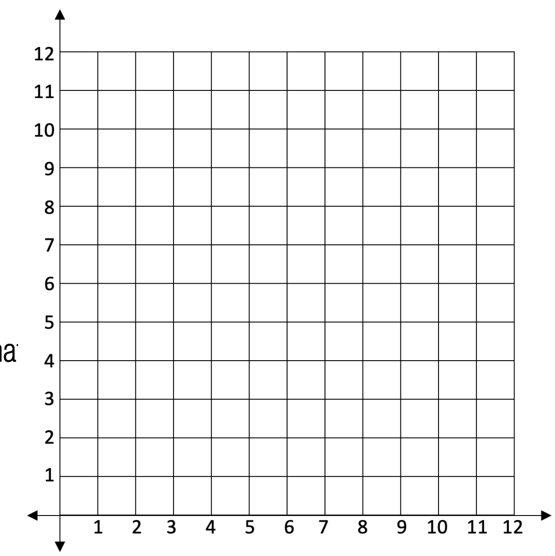
____

Use it to fill in the second table and graph it.

2. Use the rule x + 3 = y to fill in the first table.

x	y
0	
1	

x	y
0	
1	



Create another equation tha
the one you drew.

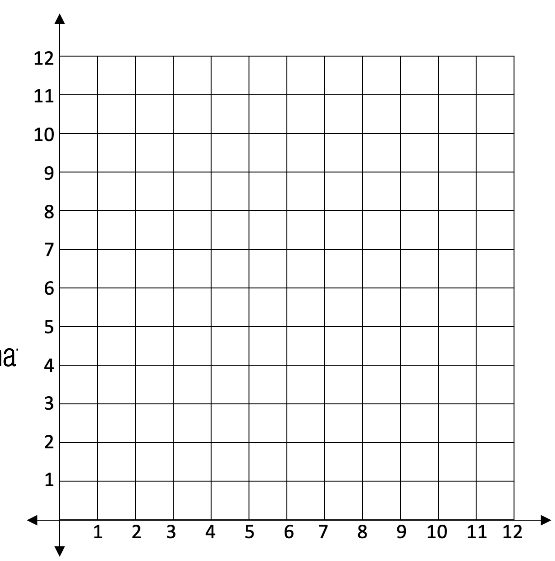
____

Use it to fill in the second table and graph it.

3. Use the rule 2x + 2 = y to fill in the first table.

x	y
0	
1	

x	y
0	
1	



Create another equation tha
the one you drew.

____

Use it to fill in the second table and graph it.

Name: ANSWER KEY

G5 U6 Lesson 5 - Independent Work

Remember: Equations with the same multiplication will be parallel.

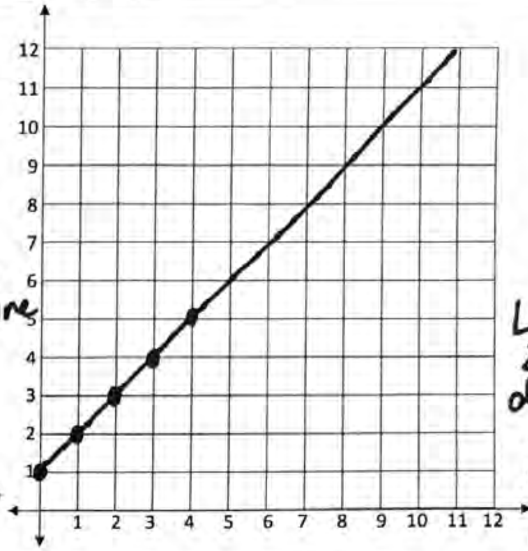
1. Use the rule x + 1 = y to fill in the first table.

x	y
0	1
1	2
2	3
3	4
4	5

x	y
0	
1	
2	
3	
4	

Tables and graphs will vary.

There is more than one right equation



Location of 2nd line depends on equation. It must be parallel!

Create another equation that will have a line parallel to the one you drew.

x=y or x+2=y, x+3=y, etc.

Use it to fill in the second table and graph it.

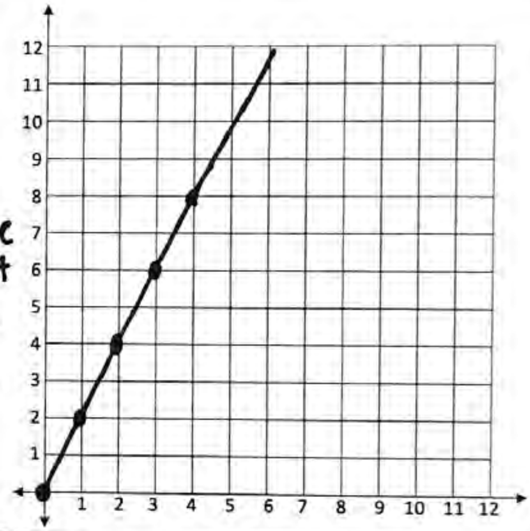
2. Use the rule 2x = y to fill in the first table.

x	y
0	0
1	2
2	4
3	6
4	8

x	y
0	
1	
2	
3	
4	

Tables and graphs will vary.

There is more than one right equation.



Create another equation that will have a line parallel to the one you drew.

2x-1=y or 2x+1=y, etc.

Use it to fill in the second table and graph it.

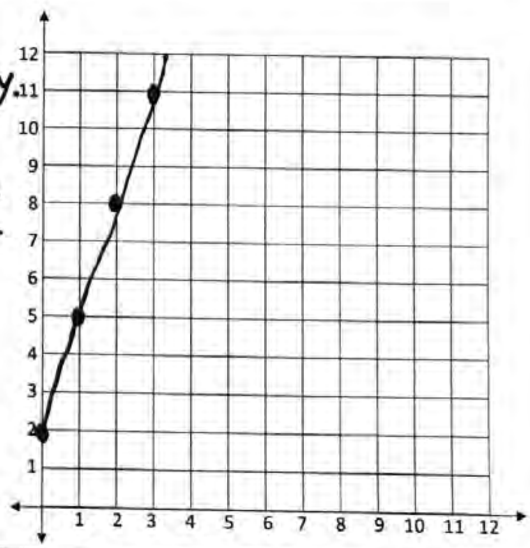
3. Use the rule 3x + 2 = y to fill in the first table.

x	y
0	2
1	5
2	8
3	11
4	14

x	y
0	
1	
2	
3	
4	

Tables and graphs will vary.

There is more than one right equation.



Create another equation that will have a line parallel to the one you drew.

3x=y, 3x-1=y, 3x+3=y, etc.

Use it to fill in the second table and graph it.

Remember: Equations with the same multiplication will b

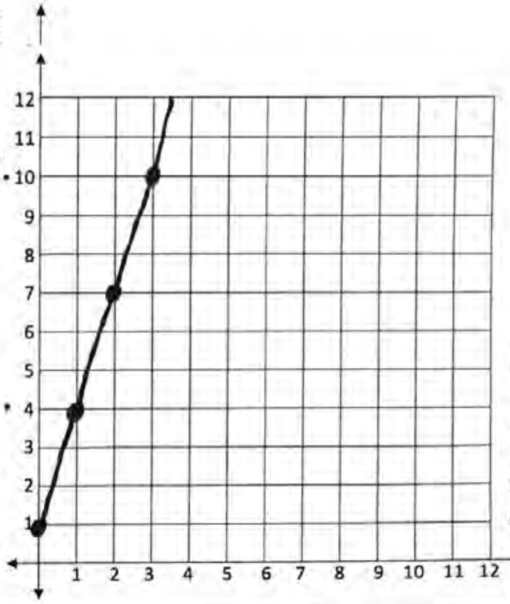
1. Use the rule 3x + 1 = y to fill in the first table.

x	y
0	1
1	4
2	7
3	10
4	13

x	y
0	
1	
2	
3	
4	

Tables and graphs will vary.

There is more than one right equation.



Location of the second line depends on the equation. It must be parallel.

Create another equation that will have a line parallel to the one you drew.

3x = y, 3x + 2 = y, 3x + 3 = y, etc.

Use it to fill in the second table and graph it.

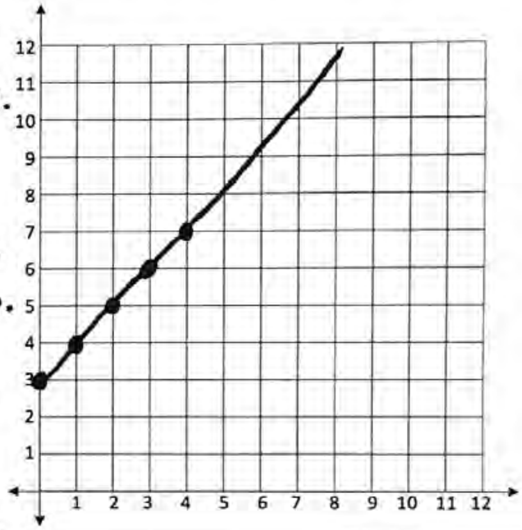
2. Use the rule x + 3 = y to fill in the first table.

x	y
0	3
1	4
2	5
3	6
4	7

x	y
0	
1	
2	
3	
4	

Tables and graphs will vary.

There is more than one right equation.



Create another equation that will have a line parallel to the one you drew.

x = y, x + 1 = y, x + 2 = y, etc.

Use it to fill in the second table and graph it.

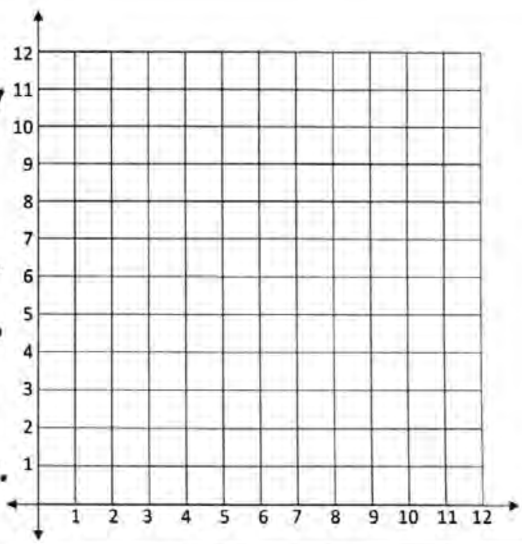
3. Use the rule 2x + 2 = y to fill in the first table.

x	y
0	2
1	4
2	6
3	8
4	10

x	y
0	
1	
2	
3	
4	

Tables and graphs will vary

There is more than one right equation.



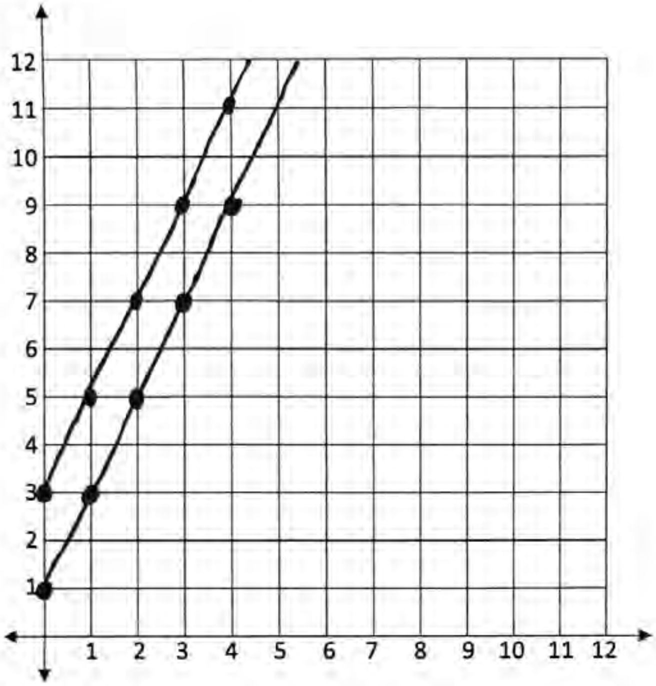
Create another equation that will have a line parallel to the one you drew.

2x = y, 2x + 1 = y, 2x + 3 = y, etc.

Use it to fill in the second table and graph it.

Name: ANSWER KEY

Graph the first equation.



$2x + 1 = y$

x	y
0	1
1	3
2	5
3	7
4	9

$2x + 3 = y$

x	y
0	3
1	5
2	7
3	9
4	11

(The table will vary based on the equation.)

(There is more than one right equation. You can choose any one that has 2x in it.)

Use the question below to write a second equation that will have a line that is parallel to the first one.

What does the second equation need to have to have a line parallel to the first equation? 2x

Graph the second equation. Is it parallel to the first one? yes (The second line will vary depending on the equation.)

Draw a staircase on each line and check that they are parallel. Each line goes up 2 and over 1.