CITYTUTOR DC

Sixth Grade Math Lesson Materials

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Identification of the copyrighted work claimed to have been infringed, or, if multiple copyrighted works allegedly have been infringed, then a representative list of such copyrighted works;

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CITYTUTOR DC

G6 Unit 4:

Arithmetic in Fractions and Base Ten

G6 U4 Lesson 1

Understand division with unit fractions

G6 U4 Lesson 1 - Students will explore division with unit fractions

Warm Welcome (Slide 1): Tutor choice.

Frame the Learning/Connect to Prior Learning (Slide 2): Today we will explore division with unit fractions. In fifth grade, you explored division with unit fractions, so we're going to come back to this before we get into division with non-unit fractions in the next lesson. Remember a unit fraction is a fraction where the numerator is 1. So, one-fourth (*write* $\frac{1}{4}$) is a unit fraction because there's a 1 as the numerator. One half (*write* $\frac{1}{2}$) is also a unit fraction. Today we're going to explore how to divide a whole number by unit fractions for example 5 $\div \frac{1}{4}$ (*write*) AND how to divide unit fractions by a whole number for example $\frac{1}{4} \div 5$ (*write*). Perhaps some of you already know how to do this, if so, stick with me because it'll be important practice for our next lesson.

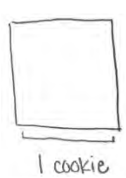
Let's Talk (Slide 3): So, before we start doing this math, I want to have a discussion. **Let's start by discussing, how are multiplication and division related?** Possible Student Answers, Key Points:

- Multiplication and division are opposites. Multiplication undoes division and division undoes multiplication.
- For example, 3 x 4 = 12 so 12 ÷ 4 = 3 (3 groups of 4 is 12 and 12 split into 4 groups is 3).

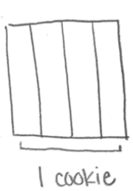
So, we know that multiplication and division are related. **Now let's think about how dividing with fractions is similar to multiplying with fractions…**Possible Student Answers, Key Points:

- If you're dividing a number by a unit fraction, you can just multiply by the denominator. Or, if you're multiplying a number by a unit fraction, you can just divide by the denominator.
- For example, dividing 8 by 4 gives the same result as multiplying 8 by $\frac{1}{4}$.

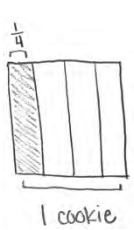
Let's Think (Slide 4): Those are interesting ideas, let's look at a problem to see how dividing with fractions is similar to multiplying with fractions. Let's start with thinking about what it means to divide a unit fraction by a whole number. Let's read the problem on the slide together, "Let's imagine that I want to share one-fourth of a cookie equally between 3 people." Okay, well let me make sure I understand this first, this means that I want to divide one-fourth into 3 equal pieces—I have one-fourth of a cookie and I want to split it equally between three people, that seems easy enough. Let's start by drawing a picture to help us this about how to solve this problem:



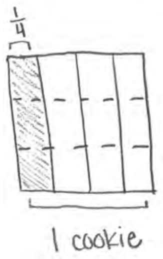
I am going to start with a bar or a box to show 1 whole cookie. Here's my cookie…I could draw a circle but it'll be easier to split a box. I'm going to label it 1 cookie so I remember this is 1 whole.



Now, I know that I have one-fourth of this cookie, so I need to split this cookie into four equal pieces, like this.



I'm going to shade in the one-fourth cookie that I have and I'll label it, like this.
And finally, I want to divide one fourth by 3. That means, I want to cut or split this one-fourth piece into three pieces. Well look, I can make 2 cuts going across and now I split this piece into 3 pieces, remember I have to do this to all of my fourths. Let's look this back over and see what we did, I started with 1 whole cookie, I split it into fourths and then I took each fourth and split it into three pieces.



Now, here is where things get tricky. I cut my fourths so they aren't fourths anymore. Let's count to see how many pieces there are in the whole now. There are 12 pieces which means that I have twelfths now. And each person will get $\frac{1}{12}$. For example, if we were splitting it…I would get this piece (*point to one twelfth*), you would get this piece (*point to one twelfth*) and you would get this piece (*point again*). So we each get $\frac{1}{12}$.

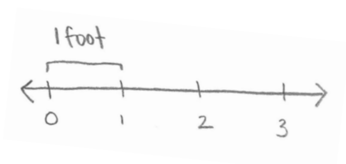
$$\frac{1}{4} \div 3 = \frac{1}{12}$$

Now let's write it as a number sentence. We just used our fraction model to show that, $\frac{1}{4}$ divided by 3 is $\frac{1}{12}$.

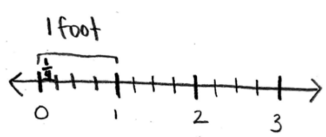
$$\frac{1}{4} \times \frac{1}{3} = \frac{1}{12}$$

So, if $\frac{1}{4}$ of a cookie is divided into 3 equal parts, each person will receive $\frac{1}{3}$ of the $\frac{1}{4}$ of the cookie. So, we could also write as multiplication, like this.

Let's Think (Slide 5): Now let's switch our brains to think about what it means to divide a whole number by a unit fraction. For example, let's read the problem on the slide together, "I want to cut a 3-foot string into ¼ foot sections." Let me make sure I understand this, I have 3 feet of string and I want to cut each foot into ¼ foot sections. In other words, I want to think about how many fourths of a foot there are in my 3 feet of rope. I could draw a bar model to help me solve but I can also use a number line, like this:



I know that I have three feet of rope so I'll draw 0 to 3 to represent the 3 one-foot sections of rope that I have. This is a foot (*point to 0-1*), this is a foot (*point to 1-2*) and this is a foot (*point to 2-3*). There are 3 feet of rope.



Now, I want to cut this into one-fourth foot sections. So, I want to cut EACH foot into fourths. I'll cut this foot into 4 pieces (*make 3 cuts*), I'll cut this foot into 4 pieces (*make 3 cuts*) and finally, I'll cut this fourth into 4 pieces (*make 3 cuts*). So, there are 4 fourths here and 4 fourths here and 4 fourths here (*point as you narrate*). That means that there are 4 and 4 and 4, which makes 12. So there are 12 one-fourth pieces of rope.

$$3 \div \frac{1}{4} = 12$$

$$3 \times 4 = 12$$

So, we just divided 3 by ¼ and got 12! We can also write it as multiplication and use the inverse. There are 4 fourths in each whole foot. To find the number of fourths in 3 feet, I can multiply 3 x 4 and get 12. When I divide 3 by ¼, I am dividing 3 into parts smaller than 1. So, there will be more than 3 of those parts.

Let's Try it (Slides 6-7): Now let's work on dividing with unit fractions together. We're going to work on this page together, step-by-step. Remember, when we are dividing, we are splitting or cutting.

WARM WELCOME

Today we will explore division with unit fractions.

Let's Talk:

How are multiplication and division related?

How is dividing with fractions similar to multiplying with fractions?

Let's Think:

What does it mean to divide a unit fraction by a whole number?

Let's imagine that I want to share $\frac{1}{4}$ of a cookie equally between 3 people.

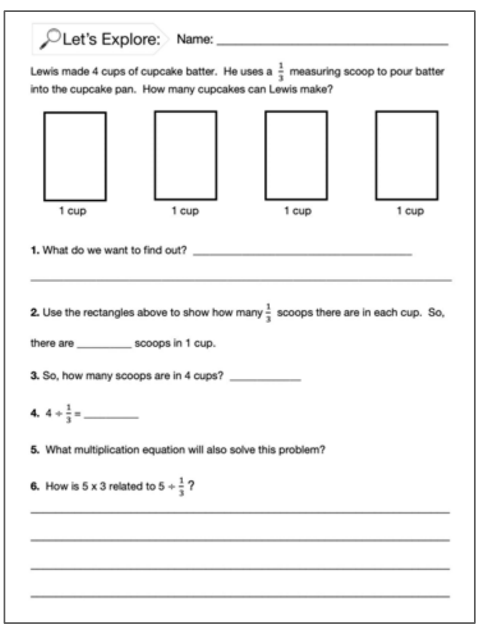
Let's Think:

What does it mean to divide a whole number by a fraction?

Let's imagine I want to cut a 3 foot string into $\frac{1}{4}$ foot sections.

Let's Try It:

Let's explore dividing unit fractions together.

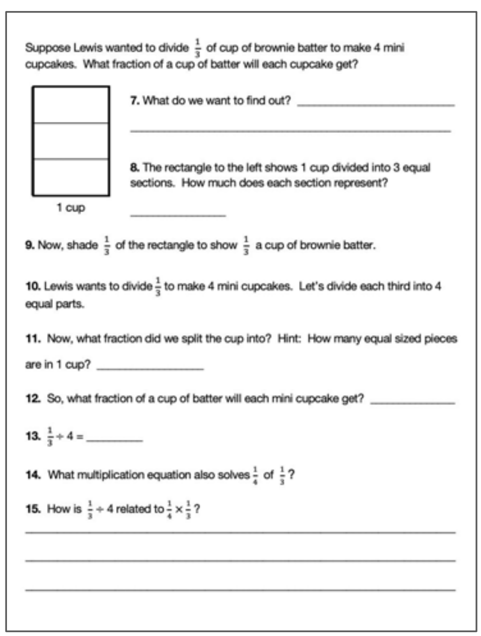


Let's Explore: Name: ____________

Lewis made 4 cups of cupcake batter. He uses a $\frac{1}{3}$ measuring scoop to pour batter into the cupcake pan. How many cupcakes can Lewis make?

1 cup 1 cup 1 cup 1 cup

1. What do we want to find out? ____________
2. Use the rectangles above to show how many $\frac{1}{3}$ scoops there are in each cup. So, there are ________ scoops in 1 cup.
3. So, how many scoops are in 4 cups? ________
4. $4 \div \frac{1}{3} =$ ________
5. What multiplication equation will also solve this problem?
6. How is 5 x 3 related to $5 \div \frac{1}{3}$?



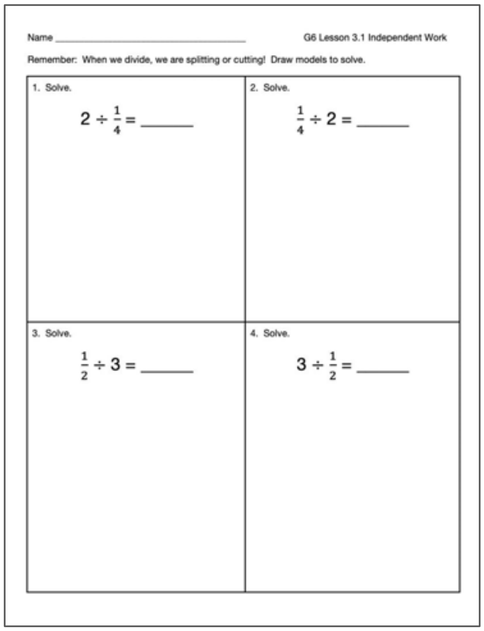
Suppose Lewis wanted to divide $\frac{1}{3}$ of cup of brownie batter to make 4 mini cupcakes. What fraction of a cup of batter will each cupcake get?

1 cup

7. What do we want to find out? ____________
8. The rectangle to the left shows 1 cup divided into 3 equal sections. How much does each section represent? ________
9. Now, shade $\frac{1}{3}$ of the rectangle to show $\frac{1}{3}$ a cup of brownie batter.
10. Lewis wants to divide $\frac{1}{3}$ to make 4 mini cupcakes. Let's divide each third into 4 equal parts.
11. Now, what fraction did we split the cup into? Hint: How many equal sized pieces are in 1 cup? ________
12. So, what fraction of a cup of batter will each mini cupcake get? ________
13. $\frac{1}{3} \div 4 =$ ________
14. What multiplication equation also solves $\frac{1}{4}$ of $\frac{1}{3}$?
15. How is $\frac{1}{3} \div 4$ related to $\frac{1}{4} \times \frac{1}{3}$?

On your Own:

Now it's time to explore division with unit fractions on your own.



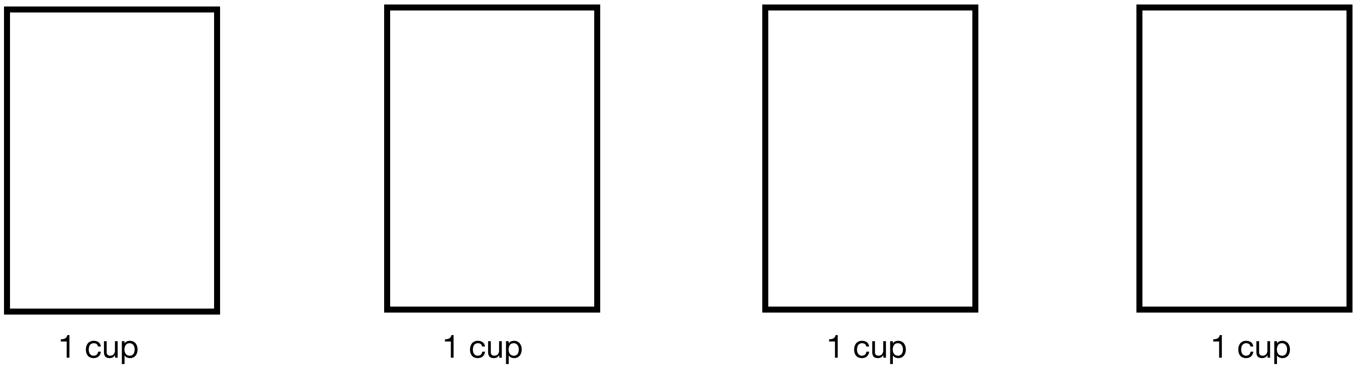
Name ______________________________ G6 Lesson 3.1 Independent Work

Remember: When we divide, we are splitting or cutting! Draw models to solve.

1. Solve. $2 \div \frac{1}{4} =$ ______	2. Solve. $\frac{1}{4} \div 2 =$ ______
3. Solve. $\frac{1}{2} \div 3 =$ ______	4. Solve. $3 \div \frac{1}{2} =$ ______

Name ____________________________________

Lewis made 4 cups of cupcake batter. He uses a $\frac{1}{3}$ measuring scoop to pour batter into the cupcake pan. How many cupcakes can Lewis make?



1. What do we want to find out? ____

____

2. Use the rectangles above to show how many $\frac{1}{3}$ scoops there are in each cup. So, there are __________ scoops in 1 cup.

3. So, how many scoops are in 4 cups? ____________

4. $4 \div \frac{1}{3} =$ __________

5. What multiplication equation will also solve this problem?

6. How is 4 x 3 related to $4 \div \frac{1}{3}$?

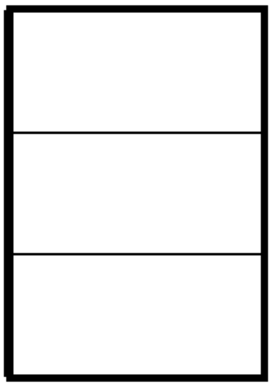
____

____

____

____

Suppose Lewis wanted to divide $\frac{1}{3}$ cup of brownie batter to make 4 mini cupcakes. What fraction of a cup of batter will each cupcake get?



7. What do we want to find out? ______________________________

____

8. The rectangle to the left shows 1 cup divided into 3 equal sections. How much does each section represent?

____

9. Now, shade $\frac{1}{3}$ of the rectangle to show $\frac{1}{3}$ a cup of brownie batter.

10. Lewis wants to divide $\frac{1}{3}$ to make 4 mini cupcakes. Let's divide each third into 4 equal parts.

11. Now, what fraction did we split the cup into? Hint: How many equal sized pieces are in 1 cup? __________________

12. So, what fraction of a cup of batter will each mini cupcake get? ______________

13. $\frac{1}{3} \div 4 =$ __________

14. What multiplication equation also solves $\frac{1}{4}$ of $\frac{1}{3}$?

15. How is $\frac{1}{3} \div 4$ related to $\frac{1}{4} \times \frac{1}{3}$?

____

____

____

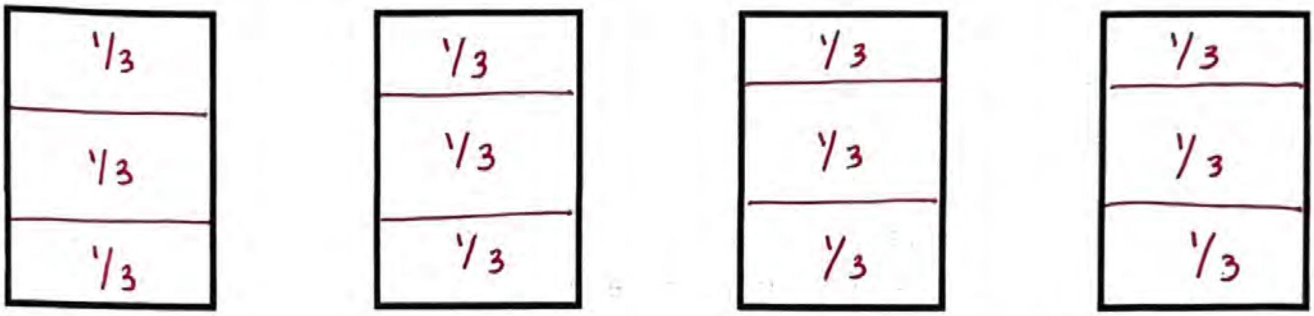
Name ____ G6 U4 Lesson 1 - Independent Work

Remember: When we divide, we are splitting or cutting! Draw models to solve.

1. Solve. $2 \div \frac{1}{4} =$ _______	2. Solve. $\frac{1}{4} \div 2 =$ _______
3. Solve. $\frac{1}{2} \div 3 =$ _______	4. Solve. $3 \div \frac{1}{2} =$ _______

Name ANSWER KEY

Lewis made 4 cups of cupcake batter. He uses a $\frac{1}{3}$ measuring scoop to pour batter into the cupcake pan. How many cupcakes can Lewis make?



1 cup 1 cup 1 cup 1 cup

1. What do we want to find out? How many cupcakes Lewis can make.

2. Use the rectangles above to show how many $\frac{1}{3}$ scoops there are in each cup. So, there are 3 scoops in 1 cup.

3. So, how many scoops are in 4 cups? 12

4. $4 \div \frac{1}{3} =$ 12

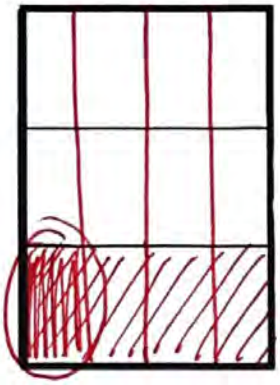
5. What multiplication equation will also solve this problem? $4 \times \frac{3}{1} = 12$

6. How is 4 x 3 related to $4 \div \frac{1}{3}$?

Multiplication and division are opposites so if you do the opposite operation you flip the fraction. So, $4 \div 1/3$ is the same as $4 \times 3/1$ ... I just flipped the numerator and denominator.

Suppose Lewis wanted to divide $\frac{1}{3}$ cup of brownie batter to make 4 mini cupcakes. What fraction of a cup of batter will each cupcake get?

$\frac{1}{12}$



7. What do we want to find out? How much batter goes into each mini cupcake

8. The rectangle to the left shows 1 cup divided into 3 equal sections. How much does each section represent?

1/3

9. Now, shade $\frac{1}{3}$ of the rectangle to show $\frac{1}{3}$ a cup of brownie batter.

10. Lewis wants to divide $\frac{1}{3}$ to make 4 mini cupcakes. Let's divide each third into 4 equal parts. ✓

11. Now, what fraction did we split the cup into? Hint: How many equal sized pieces are in 1 cup? twelfths

12. So, what fraction of a cup of batter will each mini cupcake get? 1/12

13. $\frac{1}{3} \div 4 =$ $\frac{1}{12}$

14. What multiplication equation also solves $\frac{1}{4}$ of $\frac{1}{3}$? $\frac{1}{3} \times \frac{1}{4} = \frac{1}{12}$

15. How is $\frac{1}{3} \div 4$ related to $\frac{1}{4} \times \frac{1}{3}$?

They are the same dividing by 4 is the same thing as multiplying by 1/4.

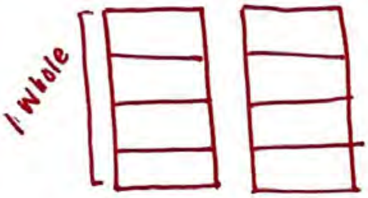
Name ANSWER KEY

G6 U4 Lesson 1 - Independent Work

Remember: When we divide, we are splitting or cutting! Draw models to solve.

1. Solve.

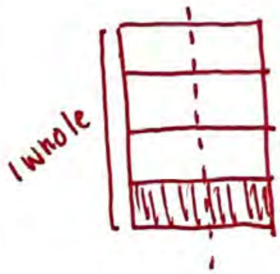
$$2 \div \frac{1}{4} = \underline{8}$$



$$\frac{2}{1} \times \frac{4}{1} = \frac{8}{1}$$

2. Solve.

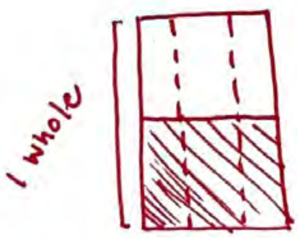
$$\frac{1}{4} \div 2 = \underline{\frac{1}{8}}$$



$$\frac{1}{4} \times \frac{1}{2} = \frac{1}{8}$$

3. Solve.

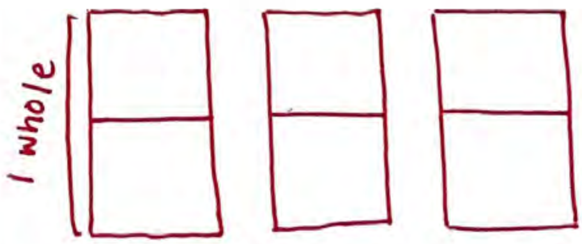
$$\frac{1}{2} \div 3 = \underline{\frac{1}{6}}$$



$$\frac{1}{2} \times \frac{1}{3} = \frac{1}{6}$$

4. Solve.

$$3 \div \frac{1}{2} = \underline{6}$$



$$\frac{3}{1} \times \frac{2}{1} = \frac{6}{1}$$

G6 U4 Lesson 2

Divide unit fractions in word problems

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G6 U4 Lesson 2 - Student will divide unit fractions in word problems

Warm Welcome (Slide 1): Tutor choice.

Frame the Learning/Connect to Prior Learning (Slide 2): Today we will use what we learned yesterday to solve word problems that ask us to divide with fractions. We know that sometimes we divide a whole number by a fraction or other times we divide a fraction by a whole number. Today when we're solving problems it will be really important for us to read the problem and pause to make sure we understand. One way we can make sure we understand is to retell the problem in our own words. And then before we put our pencils to paper we should think to ourselves, "What am I trying to figure out?" That will help us make sure we really understand the question before we solve it.

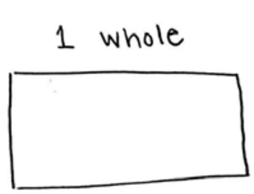
Let's Talk (Slide 3): So, let's start by collecting everything we know about dividing with fractions. Share what you know about dividing with fractions and try to give an example. I know some of us are thinking about dividing a whole number by a fraction and others are thinking about dividing a fraction into whole numbers. Those are similar and easy to get mixed up so let's quickly talk about how they're the same and how they're different. **How is dividing a fraction by a whole number the same or different from dividing a whole number by a fraction?** Possible Student Answers, Key Points:

- When I'm dividing with fractions, I am cutting or splitting.
- If we are dividing a whole number by a fraction it means we are breaking something into smaller pieces so the answer will be bigger than the whole number.
- If we are dividing a fraction by a whole number, we are breaking a piece into more, smaller pieces so the answer will be smaller than the first fraction.
- When we divide with fractions, we flip our fraction and multiply.

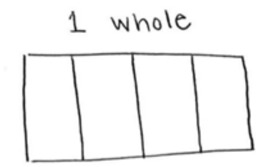
Let's Think (Slide 4): That's a lot of good information about dividing fractions. So let's apply what we know about dividing with fractions to a word problem. Today when we solve word problems we're going to make sure we read, retell, and think BEFORE we start solving. I'm going to read this question out loud and then you can reread the question on your own. "Jeni has ¼ of a pizza. She wants to share the pizza equally with a friend. How much of the original whole pizza will each of them get?" Okay now before we start to solve, let's pause and make sure we can retell the story. It's important to use our own words and understandings to retell the story.

- *Note: The actions and context of the story are more important than the actual numbers. The purpose of retelling is to make sure students understand what is happening and what they're trying to solve for. If students struggle to recall the numbers, you should tell them. You might need to cover up the story so that students use their own words. It might sound like this: "A person has a piece of a pizza and she wants to split that piece into two parts. We want to know how much of the whole pizza each person will get."*

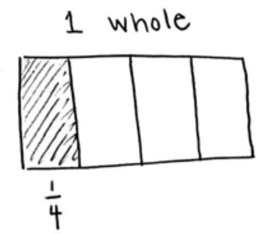
Now that we retold the story, let's pause and think about what we are trying to figure out or solve for. We want to know how much of the original pizza each person will get. Okay, now that we understand the story and know exactly what we want to figure out, we can pick up our pencils and start to solve).



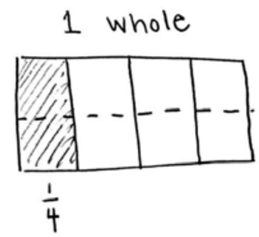
Let's start with a model, we know that Jeni has ¼ of a pizza so let's start with 1 whole. Most pizzas are circles but it's easier to draw the whole as a bar model, like this.



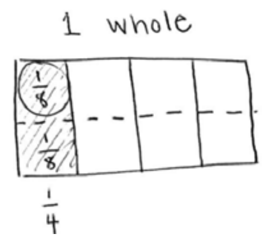
Now, we want to cut the whole into four equal pieces. There are lots of ways to cut this whole into fourths, I'm going to do it with vertical lines, like this.



Jeni has one fourth that means that she has ONE of these pieces, let's shade it in to show that's what Jeni has.



And the problem says that Jeni wants to split her piece with a friend so we want to cut each fourth into two pieces. So now, we don't have fourths anymore, we cut each fourth into two pieces so now we have eighths…1, 2, 3, 4, 5, 6, 7, 8.



So Jeni's friend gets this piece (*point*) and Jeni gets this piece (*point*). And let's go back to the original question, "How much of the original pizza will each of them get?" So they each get ⅛ of the pizza because we cut Jeni's ¼ into two pieces. Let's write that as a sentence, "*They each get ⅛ of the pizza.*"

$$\frac{1}{4} \div 2 = \_\_\_$$

$$\frac{1}{4} \times \frac{1}{2} = \frac{1}{8}$$

Now that we drew a bar model to help us solve, let's see if we can write an equation to help us do the math. We took ¼ and split it into 2 pieces. That means we did one fourth divided by 2.

We know that when we are solving division with fractions, we can do the opposite so we can multiply and then flip the fraction.

They each get $\frac{1}{8}$ of the pizza.

So, ¼ x ½, multiply the numerators, 1x1 is 1. Now multiply the denominators, 4x2 is 8. So ¼ divided by 2 is ⅛, the same answer!

Let's Try it (Slides 5-6): Now let's work on dividing with unit fractions in word problems together. We're going to work on this page together, step-by-step. Remember, when we are solving word problems there's a lot of work to do before we solve them. First we have to read and retell and then we have to think, "What am I trying to figure out?"

WARM WELCOME

Today we will divide unit fractions in word problems.

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Let's Talk:

What do you know about dividing with fractions? Give an example.

How is dividing a fraction by a whole number the same or different from dividing a whole number by a fraction?

Let's Think:

How can we use what we know about dividing with fractions to solve this problem…

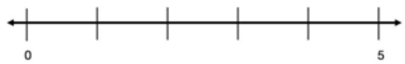
Jeni has ¼ of a pizza. She wants to share the pizza equally with a friend. How much of the original whole pizza will each of them get? Let's draw a model and write an equation to represent and solve the problem.

Let's Try It:

Let's explore how to solve word problems with dividing fractions together.

Let's Try It: Name: ______________________ G6 3.2

1. Malik is running a 5-mile race. There are water stops every $\frac{1}{2}$ mile, including at the 5-mile finish line. How many stops are there? Show how you solved on the number line.



Write an equation to show how you solved.

2. Kerri used $\frac{1}{4}$ yard of string to create a border around a triangle. If each side of the triangle is the same length, how much string did Kerri use for each side? Draw a picture to show how you solve.

Write an equation to show how you solved.

3. Quick Practice.

$5 \div \frac{1}{3} =$ ______	$\frac{1}{2} \div 2 =$ ______

On your Own:

Now it's time to try on your own.

Name ______________________ G6 Lesson 3.2 Independent Work

Remember: When we divide, we are splitting or cutting! Draw models to solve.

1. Alisha makes 3 loafs of bread that each weight 1 pound. She cuts each loaf into $\frac{1}{4}$ pound pieces. How many pieces of bread does Alisha have now? Draw a model and write an equation to solve.

2. Leanna has 4 sheets of paper to make valentine's day cards. Each card requires $\frac{1}{3}$ sheet of paper. How many cards can Leanna make? Draw a model and write an equation to solve.

3. Samiere picked $\frac{1}{2}$ pound of raspberries. She poured the berries equally into 4 containers. What fraction of a pound is in each container? Draw a model and write an equation to solve.

1. Malik is running a 5-mile race. There are water stops every $\frac{1}{2}$ mile, including at the 5-mile finish line. How many stops are there? Show how you solved on the number line.

Write an equation to show how you solved.

2. Kerri used $\frac{1}{4}$ yard of string to create a border around a triangle. If each side of the triangle is the same length, how much string did Kerri use for each side? Draw a picture to show how you solved.

Write an equation to show how you solved.

3. Quick Practice.

$5 \div \frac{1}{3} =$ ________	$\frac{1}{2} \div 2 =$ ________

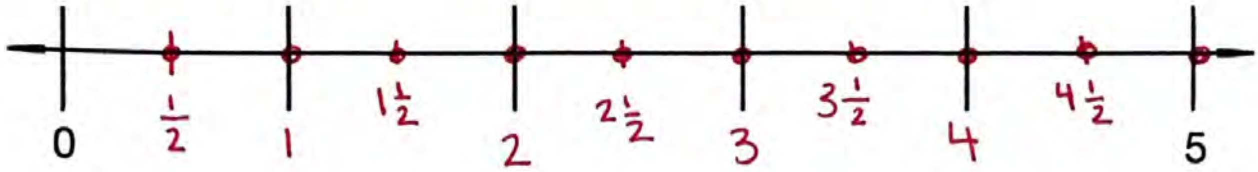
Name ______________________________________ G6 U4 Lesson 2 - Independent Work

Remember: When we divide, we are splitting or cutting! Draw models to solve.

1. Alisha makes 3 loaves of bread that each weigh 1 pound. She cuts each loaf into $\frac{1}{4}$ pound pieces. How many pieces of bread does Alisha have now? Draw a model and write an equation to solve.
2. Leanna has 4 sheets of paper to make valentine's day cards. Each card requires $\frac{1}{3}$ sheet of paper. How many cards can Leanna make? Draw a model and write an equation to solve.
3. Samiere picked $\frac{1}{2}$ pound of raspberries. She poured the berries equally into 4 containers. What fraction of a pound is in each container? Draw a model and write an equation to solve.

Name ANSWER KEY

1. Malik is running a 5-mile race. There are water stops every $\frac{1}{2}$ mile, including at the 5-mile finish line. How many stops are there? Show how you solved on the number line.



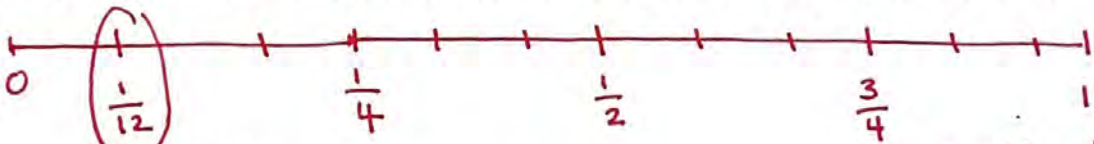
Write an equation to show how you solved.

$5 \div \frac{1}{2} = 10$

There are 10 water stops.

$\frac{5}{1} \times \frac{2}{1} = \frac{10}{1}$

2. Kerri used $\frac{1}{4}$ yard of string to create a border around a triangle. If each side of the triangle is the same length, how much string did Kerri use for each side? Draw a picture to show how you solved.

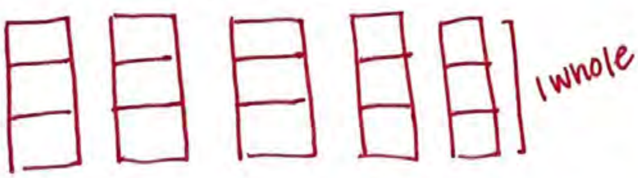


$\frac{1}{4} \div 3 = \frac{1}{12}$ $\frac{1}{4} \times \frac{1}{3} = \frac{1}{12}$

Write an equation to show how you solved.

$\frac{1}{4} \div 3 = \frac{1}{12}$ or $\frac{1}{4} \times \frac{1}{3} = \frac{1}{12}$

3. Quick Practice.

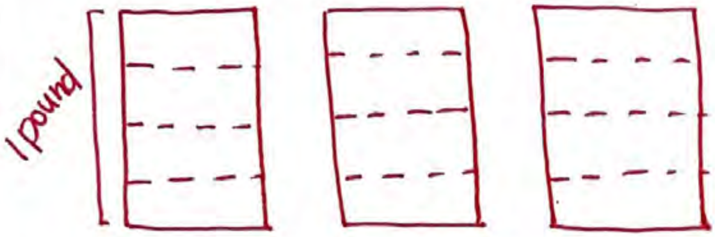
$5 \div \frac{1}{3} =$ 15 	$\frac{1}{2} \div 2 =$ 1/4  $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$

$\frac{5}{1} \times \frac{3}{1} = \frac{15}{1}$

Name ANSWER KEY

Remember: When we divide, we are splitting or cutting! Draw models to solve.

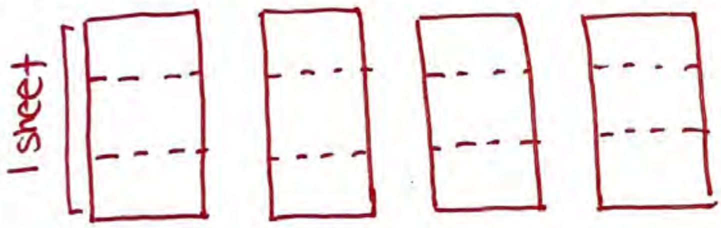
1. Alisha makes 3 loaves of bread that each weigh 1 pound. She cuts each loaf into $\frac{1}{4}$ pound pieces. How many pieces of bread does Alisha have now? Draw a model and write an equation to solve.



Alisha has 12 pieces of bread.

$3 \div \frac{1}{4} = 12$ or $\frac{3}{1} \times \frac{4}{1} = \frac{12}{1}$

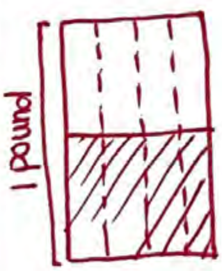
2. Leanna has 4 sheets of paper to make valentine's day cards. Each card requires $\frac{1}{3}$ sheet of paper. How many cards can Leanna make? Draw a model and write an equation to solve.



Leanna can make 12 cards.

$4 \div \frac{1}{3} = 12$ or $\frac{4}{1} \times \frac{3}{1} = \frac{12}{1}$

3. Samiere picked $\frac{1}{2}$ pound of raspberries. She poured the berries equally into 4 containers. What fraction of a pound is in each container? Draw a model and write an equation to solve.



There are $\frac{1}{8}$ pound of berries in each container.

$\frac{1}{2} \div 4 = \frac{1}{8}$ or $\frac{1}{2} \times \frac{1}{4} = \frac{1}{8}$

G6 U4 Lesson 3

Explore division with fractions

G6 U4 Lesson 3 - Students will explore division with fractions

Warm Welcome (Slide 1): Tutor choice.

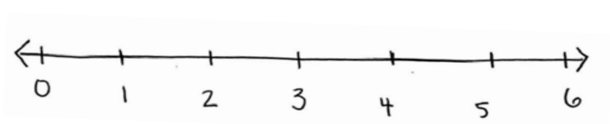
Frame the Learning/Connect to Prior Learning (Slide 2): Today we are going to explore division with non-unit fractions. We already practiced dividing with unit fractions, where the numerator is 1 for example ½ or ⅓. Today, we are going to use non-unit fractions, non-unit fractions are fractions where the numerator is greater than one. So, an example of a unit fraction is ⅓. An example of a non-unit fraction is ⅔. So, we'll use what we already know about dividing whole numbers by unit fractions or unit fractions by whole numbers except we'll have to extend it to non-unit fractions.

Let's Talk (Slide 3): So, let's open with a brainstorm. How might this be different and the same as dividing with unit fractions? **In other words, today when we divide by ⅔ instead of ⅓ or ¾ instead of ¼, how might it be different or the same?** Possible Student Answers, Key Points:

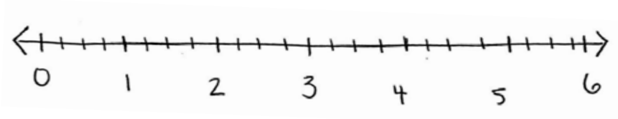
- We are still dividing, so we are still cutting.
- Well if we divide 2 by ¾ we're still cutting each whole into fourths but we're seeing how many groups of three-fourths we can make.
- It's likely still multiplying by the inverse but it'll be different because the numerator isn't 1 anymore.

Let's Think (Slide 4): Interesting ideas, let's do some more exploring of how we can divide with non-unit fractions. I want to start with this problem, listen as I read it, "I have 6 yards of ribbon. I cut the ribbon into pieces that are ¾ yard long. How many pieces of ribbon do I have?" Now, let me pause to make sure I understand this, I have 6 yards of ribbon so a yard and then another yard and another yard. And I want to cut this long ribbon (stretch your arms out to exaggerate) that's 6 yards long into smaller pieces that are ¾ of a yard long. And once I cut this big long piece of ribbon into smaller pieces, I want to see how many pieces of ribbon I have. Interesting, let's pause and think, **after I cut the ribbon into ¾ yard long pieces, do you think I'll have more or less than 6 pieces of yarn?** Possible Student Answers, Key Points:

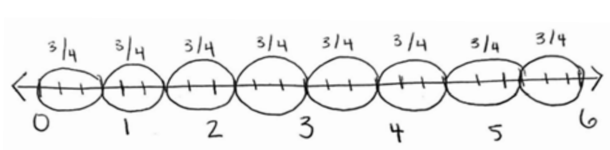
- You'll have more than 6 because each piece isn't a full yard.
- You'll have more than 6 because if you cut the piece of ribbon into 1 yard pieces, you'd have exactly 6 pieces of ribbon. But instead, you're cutting it into pieces that are smaller than 1 yard so you can cut more than 6 pieces.



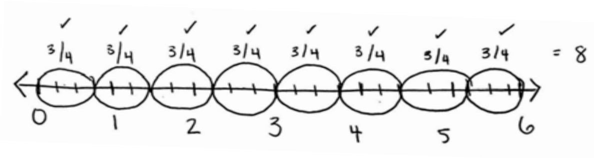
Let's find out whether our predictions are right. So let's draw a model to see how we can solve this problem. I know that I could use bar models but I'm going to use a number line to help me since a number line is kind of like this long piece of ribbon in the story problem. I know that this piece of ribbon is 6 yards long, so I am going to show 0 to 6 on a number line, like this:



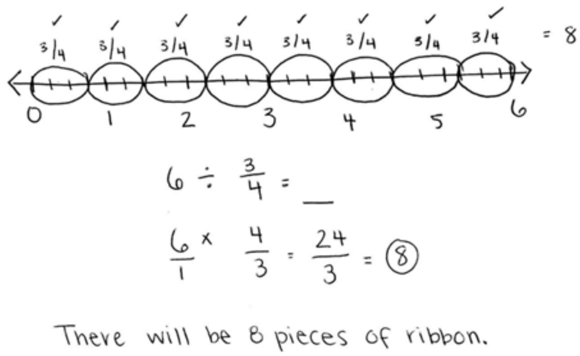
Now I know that I am cutting this ribbon into ¾ yard pieces so I need to cut each whole into fourths. So, this yard is cut into fourths, this yard is cut into fourths, etc. Oh, and don't forget, I only need to make 3 cuts to get fourths.



Okay, now here's where we need to stretch our thinking. When we were doing unit fractions, we were done here. But we aren't dividing 6 by ¼, we're dividing 6 by ¾. So we want to see how many ¾s there are in 6. So I am going to make groups of three fourths, like this (*circle*). So here are ¾ and 1, 2, 3 and another three fourths. And another.



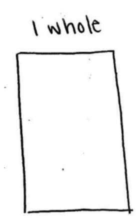
So we make groups of three fourths. Let's go back and see how many three fourths there are in 6, remember we are counting these groups (point to the groups of ¾), to keep track, I'm going to check off each group as I count it (Note: this can be difficult for students so be sure to slow down here and narrate what you're doing). So, 6 divided by ¾ is 8. When we cut the 6 yard ribbon in pieces that were ¾ yard long, we got 8 pieces of ribbon–our predictions were right, there were more than 6 pieces!



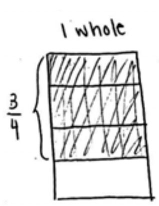
Now let's think about how we write this as an equation. We know that we were solving 6 ÷ ¾. And when we were solving division with unit fractions we discovered that we could flip the fraction and multiply. So now, we have 6 x $\frac{4}{3}$. Now let's multiply across. 6x4 is 24. and 1x3 is 3. So we have $\frac{24}{3}$ but that's an improper fraction so let's fix it. $\frac{24}{3}$ is the same as 8! So, when we did it with the equation, we got the same answer.

Let's Think (Slide 5): Okay, now let's think about a problem with similar numbers but it's a different situation. Listen to me read it, "I want to pour ¾ quart of juice equally into 6 glasses. How much juice is in each glass?" This sounds kind of like the 6 yards of ribbon except it's a little bit different. This time we have ¾ quart of juice. I'm imagining a big bottle of juice. And I want to pour the same amount into 6 different cups. So instead of dividing 6 by ¾, I'm diving ¾ by 6. **Hmm, so if I divide ¾ quart of juice into 6 cups, do you think I will have more or less than ¾ quart of juice in each cup? Why?** Possible Student Answers, Key Points:

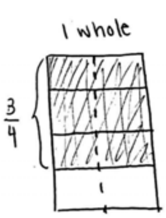
- You'll have less than ¾ quart because you're splitting that amount into 6 different cups.
- You'll have less because you'll pour a little bit of the whole amount into each cup.



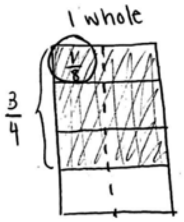
Let's draw a picture to help us think about this problem. I know that I have ¾ quart of juice. That's less than 1 whole so I am going to start with 1 whole, I'll just draw it as a bar since that's how I represent fractions.



Now, I know that I have ¾ quart so I am going to split the whole into fourths and I'll shade in the three-fourths that I have.



There, this shaded part, is the ¾ quart juice that I have. And, I want to make these three pieces into six pieces. Hmm, what should I do to each fourth so that I can split this into 6 parts? That's right, I should cut each fourth into two pieces. Now, I don't call these fourths anymore because there aren't 4 equal parts in this whole, there are 1, 2, 3…8 (count them all) equal pieces.



So each cup has this amount in it (*point to one of the new shaded pieces*). So, since each piece is an eighth, this is ⅛. That means that each person gets ⅛ quart of juice.

$$\frac{3}{4} \div 6 = \text{—}$$

$$\frac{3}{4} \times \frac{1}{6} = \frac{3}{24} = \frac{1}{8}$$

Each person gets $\frac{1}{8}$ quart of juice.

Now let's think about how we write this as an equation. We know that we were solving ¾ ÷ 6. And when we were solving division with unit fractions we discovered that we could flip the fraction and multiply. So, now we have ¾ x ⅙. Let's multiply the numerator, 3x1 is 3 and then let's multiply the denominator, 4/6 is 24. So, now we have $\frac{3}{24}$ which we can simplify to ⅛. So, when we did it with the equation, we got the same answer.

So, we just solved two different problems and they both had 6 and ¾ in them. **But they weren't the same so let's talk about how they were the same and how they were different.** Possible Student Answers, Key Points:

- What we were starting with, or the whole, changed in each problem. In the purple problem, 6 was the whole that we were dividing. In the green problem, ¾ was the whole that we were dividing.
- In the purple problem, the answer was bigger than the starting number. In the green problem, the answer was smaller than the starting number.
- They're sort of like opposites. Instead of dividing 6 by ¾, in the second one we are dividing ¾ by 6.

Let's Try it (Slides 6-7): Now let's work on dividing non-unit fractions together. We're going to work on this page together, step-by-step. Remember, when we are dividing, we are splitting or cutting and we can ALWAYS draw a fraction model to help us solve.

WARM WELCOME

Today we will explore division with non-unit fractions.

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Let's Talk:

Today we will divide with non unit fractions. How might this be different and the same as dividing with unit fractions?

Let's Think:

I want to pour ¾ quart of juice equally into 6 glasses. How much juice is in each glass?

Let's Think:

I have 6 yards of ribbon. I cut the ribbon into pieces that are ¾ yard long. How many pieces of ribbon do I have?

Let's Think:

I have 6 yards of ribbon. I cut the ribbon into pieces that are ¾ yard long. How many pieces of ribbon do I have?

I want to pour ¾ quart of juice equally into 6 glasses. How much juice is in each glass?

We just solved two different problems. How were they the same? How were they different?

Let's Try It:

Let's explore together.

Let's Try It: Name: ____________________ G6 3.3

I have $\frac{2}{3}$ yards of fabric to make quilt pieces. Each quilt piece requires $\frac{1}{6}$ yard of fabric. How many quilt pieces can I make?

1. What do we want to find out? ____________________

2. Use the number line above to show my fabric. Label each point on the number line.

3. The number line is split into thirds. But each quilt piece only requires $\frac{1}{6}$ yard. How can I turn thirds in sixths? Show it on the number line.

4. So, how many sixths are there in $\frac{2}{3}$ = ________

5. How many quilt pieces can I make? ________

6. $\frac{2}{3} \div \frac{1}{6} =$ ________

7. $\frac{2}{3} \times 6 =$ ________

8. Draw a different model to show $\frac{2}{3} \div \frac{1}{6}$.

Tre has 6 cups of flour. It takes $\frac{3}{8}$ cup of flour to make one cake. How many cakes can Tre make?

1. What do we want to find out? ____________________

2. Do you think the number of cakes Tre can make is greater or less than 6? Why?

3. Below is 1 cup of flour. Draw rectangles to represent the 6 cups of flour Tre has.

4. What do you need to split each cup into? ________

5. If each cake needs $\frac{3}{8}$ cup of flour. How many groups of $\frac{3}{8}$ are in the model?

6. $6 \div \frac{3}{8} =$ ________

On your Own:

Now it's time to try on our own.

Name ____________________ G6 Lesson 3.3 Independent Work

Remember: When we divide, we are splitting or cutting! Draw models to solve.

1. Solve. $3 \div \frac{4}{5} =$ ______	2. Solve. $\frac{3}{4} \div \frac{1}{2} =$ ______
3. Solve. $\frac{8}{6} \div \frac{2}{3} =$ ______	4. Solve. $5 \div \frac{2}{3} =$ ______

I have $\frac{2}{3}$ yards of fabric to make quilt pieces. Each quilt piece requires $\frac{1}{6}$ yard of fabric. How many quilt pieces can I make?

1. What do we want to find out? ____

____

2. Use the number line above to show my fabric. Label each point on the number line.

3. The number line is split into thirds. But each quilt piece only requires $\frac{1}{6}$ yard. How can I turn thirds in sixths? Show it on the number line.

4. So, how many sixths are there in $\frac{2}{3}$ = __________

5. How many quilt pieces can I make? __________

6. $\frac{2}{3} \div \frac{1}{6}$ = _______

7. $\frac{2}{3} \times 6$ = _______

8. Draw a different model to show $\frac{2}{3} \div \frac{1}{6}$.

Tre has 6 cups of flour. It takes $\frac{3}{8}$ cup of flour to make one cake. How many cakes can Tre make?

1. What do we want to find out? ____

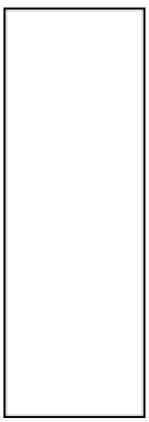
____

2. Do you think the number of cakes Tre can make is greater or less than 6? Why?

____

____

3. Below is 1 cup of flour. Draw rectangles to represent the 6 cups of flour Tre has.



4. What do you need to split each cup into? ___________

5. If each cake needs $\frac{3}{8}$ cup of flour. How many groups of $\frac{3}{8}$ are in the model?

6. $6 \div \frac{3}{8} =$ ______

Name ____ G6 U4 Lesson 3 - Independent Work

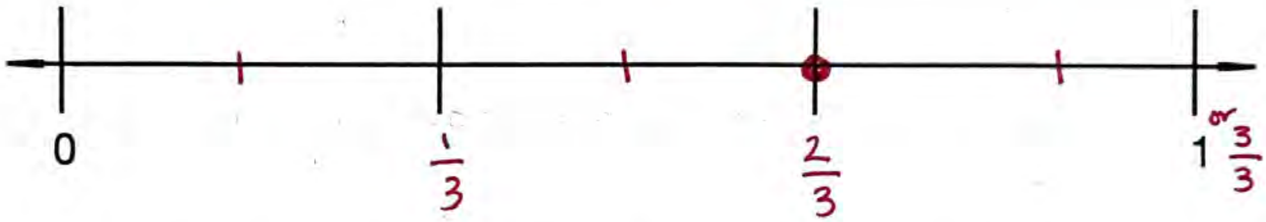
Remember: When we divide, we are splitting or cutting! Draw models to solve.

1. Solve. $3 \div \frac{4}{5} = $ ________	2. Solve. $\frac{3}{4} \div \frac{1}{2} = $ ________
3. Solve. $2 \div \frac{2}{3} = $ ________	4. Solve. $5 \div \frac{2}{3} = $ ________

Name ______________________

I have $\frac{2}{3}$ yards of fabric to make quilt pieces. Each quilt piece requires $\frac{1}{6}$ yard of fabric. How many quilt pieces can I make?

1. What do we want to find out? How many quilt pieces we can make



2. Use the number line above to show my fabric. Label each point on the number line.

3. The number line is split into thirds. But each quilt piece only requires $\frac{1}{6}$ yard. How can I turn thirds in sixths? Show it on the number line. Cut each third in half.

4. So, how many sixths are there in $\frac{2}{3}$ = 4

5. How many quilt pieces can I make? 4!

6. $\frac{2}{3} \div \frac{1}{6}$ = 4

7. $\frac{2}{3} \times 6$ = 4 $\quad \frac{2}{3} \times \frac{6}{1} = \frac{12}{3} = 4$

8. Draw a different model to show $\frac{2}{3} \div \frac{1}{6}$.

= 4

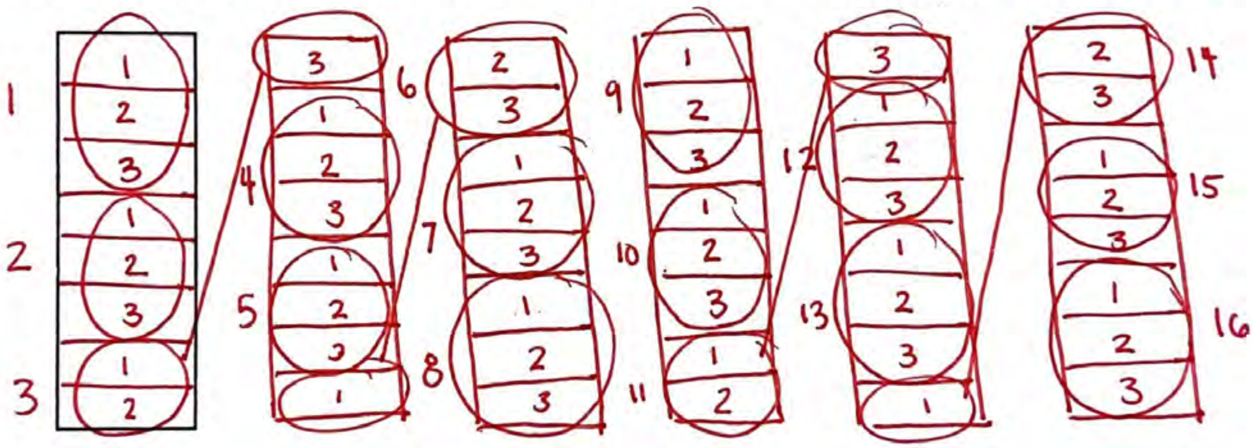
Tre has 6 cups of flour. It takes $\frac{3}{8}$ cup of flour to make one cake. How many cakes can Tre make?

1. What do we want to find out? How many cakes Tre can make

2. Do you think the number of cakes Tre can make is greater or less than 6? Why?

More! Because it takes less than 1 cup of flour to make a cake.

3. Below is 1 cup of flour. Draw rectangles to represent the 6 cups of flour Tre has. ✓



4. What do you need to split each cup into? eighths!

5. If each cake needs $\frac{3}{8}$ cup of flour. How many groups of $\frac{3}{8}$ are in the model? 16

6. $6 \div \frac{3}{8} =$ 16

$$\frac{6}{1} \times \frac{8}{3} = \frac{48}{6} = 16$$

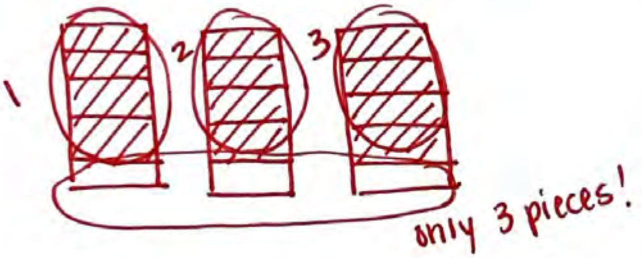
Tre can make 16 cakes.

Name ______________________ G6 U4 Lesson 3 - Independent Work

Remember: When we divide, we are splitting or cutting! Draw models to solve.

1. Solve. "How many 4/5 are in 3?"

$3 \div \frac{4}{5} =$ <u>3 3/4</u>



$\frac{3}{1} \times \frac{5}{4} = \frac{15}{4} = 3\frac{3}{4}$

$\frac{4}{4}$ $\frac{4}{4}$ $\frac{4}{4}$ 3/4

2. Solve. "How many halves are in 3/4?"

$\frac{3}{4} \div \frac{1}{2} =$ <u>$1\frac{1}{2}$</u>

$\frac{3}{4} \times \frac{2}{1} = \frac{6}{4} = 1\frac{1}{2}$

$\frac{4}{4}$ $\frac{2}{4}$

3. Solve. "How many $\frac{2}{3}$ are in 2?"

$2 \div \frac{2}{3} =$ <u>3</u>

$\frac{2}{1} \times \frac{3}{2} = \frac{6}{2} = 3$

$\frac{2}{2}$ $\frac{2}{2}$ $\frac{2}{2}$

4. Solve. "How many 2/3 are in 5?"

$5 \div \frac{2}{3} =$ <u>$7\frac{1}{2}$</u>

$\frac{5}{1} \times \frac{3}{2} = \frac{15}{2} = 7\frac{1}{2}$

G6 U4 Lesson 4

Divide fractions in word problems

G6 U4 Lesson 4 - Students will divide fractions in word problems

Warm Welcome (Slide 1): Tutor choice.

Frame the Learning/Connect to Prior Learning (Slide 2): Today we will use everything we know about division with fractions to help us solve word problems. Just like we did a few days ago, today it's going to be really important to read, retell and think BEFORE we start solving.

Let's Talk (Slide 3): So, let's start by using what we know to compare these two problems. The purple problem, on the left, is 4 divided by ⅔. The green problem on the right is ⅔ divided by 4. **Let's think, how are these two problems related and how are they similar or different?** Possible Student Answers, Key Points:

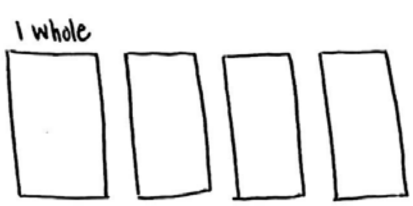
- They have the same two numbers in them, 4 and ⅔.
- They both are division.
- When you solve 4 divided by ⅔ you get 6 and when you solve ⅔ divided by 4, you get ⅙.
- When you do 4 divided by ⅔, your answer will be bigger than 4. When you do ⅔ divided by 4, your answer will be smaller than ⅔.

Note: Students should discuss how they are the same and different before they solve and then you should cue them to solve as extra practice.

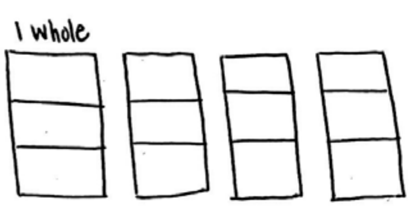
Let's Think (Slide 4): You all know a lot about division with fractions! Let's work together to solve a problem. Listen as I read it out loud, "Charlie is growing vegetables in planters. He has 4 bags of soil and uses ⅔ of a bag of soil to fill each planter. How many planters can he fill?" Now let's read it one more time together to make sure we really understand what the story is saying. Okay, now let's cover the story and retell it in our own words.

- Note: The actions and context of the story are more important than the actual numbers. The purpose of retelling is to make sure students understand what is happening and what they're trying to solve for. If students struggle to recall the numbers, you can tell them. You might need to cover up the story so that students use their own words. It might sound like this: "A person has 4 big bags of soil that he's using to fill planters. He uses some of each bag to fill one planter and we want to know how many planters he can fill using those 4 bags."

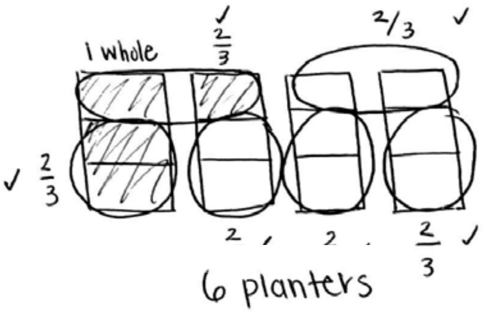
Now that we retold the story, let's pause to think about what we're trying to figure out or solve for. We want to know how many planters, or little pots, Charlie can fill if each one takes ⅔ of a bag. Now that we read, retold, and thought about the story, we're ready to solve it.



Let's start with a model. I know that Charlie has 4 whole bags of soil so I am going to draw 4 bars for the 4 whole bags of soil. There, we have 4 bags of soil.



Now we know that it takes ⅔ of a bag to fill a planter. So I am going to split each bag into thirds, I only need to make 2 cuts to make thirds. So I need to split this bag into thirds (model doing so) and this bag (continue narrating what you're doing until you split all 4 bags).



Okay now I know that it takes ⅔ of a bag to fill a planter so let me see how many groups of ⅔ I can make. So here's ⅔ (circle or shade), here's ⅓ from this bag and I can take ⅓ from this bag, that makes ⅔. (Note: This idea of combining thirds from separate whole bags might be confusing for students. If they struggle, talk it through. Example: "Well there's ⅓ left from this bag and I can dump another ⅓ from this bag and ⅓ and ⅓ makes ⅔!"). So let's
see how many groups of ⅔ I could make, or how many planters I could fill. Here's ⅔ and another ⅔. So, I can fill 6 planters.

$$4 \div \frac{2}{3} = \_\_\_$$

$$\frac{4}{1} \times \frac{3}{2} = \frac{12}{2} = 6$$

He can fill 6 planters.

Now that we drew a bar model to help us solve, let's see if we can write an equation to help us do the math. We took 4 and we tried to figure out how many ⅔ there were across all 4 bags. That means we did (4 divided by ⅔). Now we know that we can multiply and flip so now we are doing $\frac{4}{1}$ x $\frac{3}{2}$ and when we multiply our numerators, 4x3 we get 12 and then when we multiply the denominators, 1x2 we get 2. So we have $\frac{12}{2}$ which is the same as 6. So he can fill 6 planters.

Let's Try it (Slides 5-6): Now let's work on dividing with unit fractions together. We're going to work on this page together, step-by-step. Remember, when we are solving word problems there's a lot of work to do before we solve them. First we have to read and retell and then we have to think, "What am I trying to figure out?"

WARM WELCOME

Today we will divide with fractions in word problems.

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Let's Talk:

How are these two problems related?

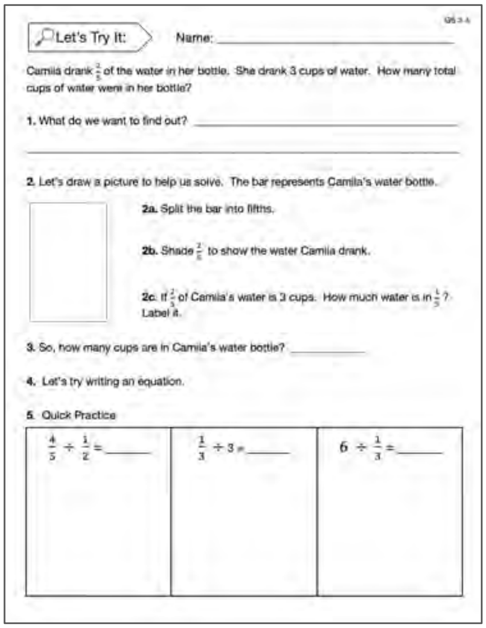
$4 \div \frac{2}{3}$ $\frac{2}{3} \div 4$

Let's Think:

Charlie is growing vegetables in planters. He has 4 bags of soil and uses ⅔ of a bag of soil to fill each planter. How many planters can he fill?

Let's Try It:

Let's explore together.



Let's Try It: Name: ____________

Camila drank $\frac{2}{5}$ of the water in her bottle. She drank 3 cups of water. How many total cups of water were in her bottle?

1. What do we want to find out? ____________

2. Let's draw a picture to help us solve. The bar represents Camila's water bottle.

2a. Split the bar into fifths.

2b. Shade $\frac{2}{5}$ to show the water Camila drank.

2c. If $\frac{2}{5}$ of Camila's water is 3 cups. How much water is in $\frac{1}{5}$? Label it.

3. So, how many cups are in Camila's water bottle? ________

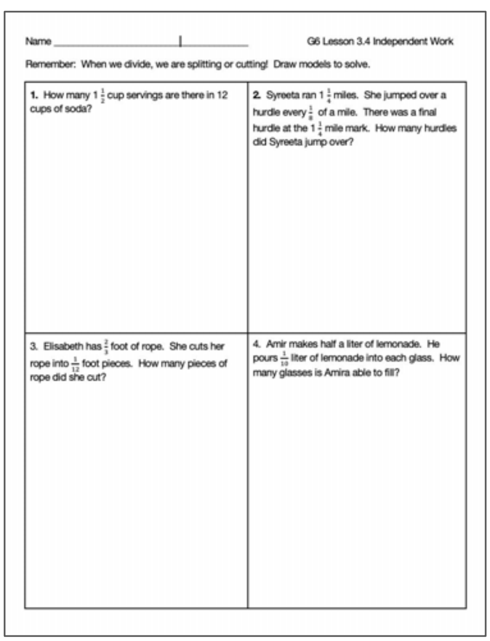
4. Let's try writing an equation.

5. Quick Practice

$\frac{4}{5} \div \frac{1}{2} =$ ______	$\frac{1}{3} \div 3 =$ ______	$6 \div \frac{1}{3} =$ ______

On your Own:

Now it's time to try on your own.



Name ____________ G6 Lesson 3.4 Independent Work

Remember: When we divide, we are splitting or cutting! Draw models to solve.

1. How many $1\frac{1}{2}$ cup servings are there in 12 cups of soda?	**2.** Syreeta ran $1\frac{1}{4}$ miles. She jumped over a hurdle every $\frac{1}{8}$ of a mile. There was a final hurdle at the $1\frac{1}{4}$ mile mark. How many hurdles did Syreeta jump over?
3. Elisabeth has $\frac{2}{3}$ foot of rope. She cuts her rope into $\frac{1}{12}$ foot pieces. How many pieces of rope did she cut?	4. Amir makes half a liter of lemonade. He pours $\frac{1}{10}$ liter of lemonade into each glass. How many glasses is Amira able to fill?

Camila drank $\frac{2}{5}$ of the water in her bottle. She drank 3 cups of water. How many total cups of water were in her bottle?

1. What do we want to find out? ____

____

2. Let's draw a picture to help us solve. The bar represents Camila's water bottle.

2a. Split the bar into fifths.

2b. Shade $\frac{2}{5}$ to show the water Camila drank.

2c. If $\frac{2}{5}$ of Camila's water is 3 cups. How much water is in $\frac{1}{5}$? Label it.

3. So, how many cups are in Camila's water bottle? ____________

4. Let's try writing an equation.

5. Quick Practice.

$\frac{4}{5} \div \frac{1}{2} =$ ______	$\frac{1}{3} \div 3 =$ ______	$6 \div \frac{1}{3} =$ ______

Name ____ G6 U4 Lesson 4 - Independent Work

Remember: When we divide, we are splitting or cutting! Draw models to solve.

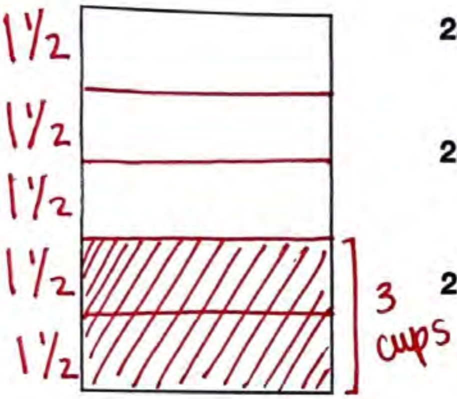
1. How many $1\frac{1}{2}$ cup servings are there in 12 cups of soda?	**2.** Syreeta ran $1\frac{1}{4}$ miles. She jumped over a hurdle every $\frac{1}{8}$ of a mile. There was a final hurdle at the $1\frac{1}{4}$ mile mark. How many hurdles did Syreeta jump over?
3. Elisabeth has $\frac{2}{3}$ foot of rope. She cuts her rope into $\frac{1}{12}$ foot pieces. How many pieces of rope did she cut?	4. Amir makes half a liter of lemonade. He pours $\frac{1}{10}$ liter of lemonade into each glass. How many glasses is Amira able to fill?

Name ANSWER KEY

Camila drank $\frac{2}{5}$ of the water in her bottle. She drank 3 cups of water. How many total cups of water were in her bottle?

1. What do we want to find out? The total amount of cups that fit in Camila's bottle

2. Let's draw a picture to help us solve. The bar represents Camila's water bottle.



2a. Split the bar into fifths. ✓

2b. Shade $\frac{2}{5}$ to show the water Camila drank. ✓

2c. If $\frac{2}{5}$ of Camila's water is 3 cups. How much water is in $\frac{1}{5}$? Label it.

$3 \div 2 = 1\frac{1}{2}$

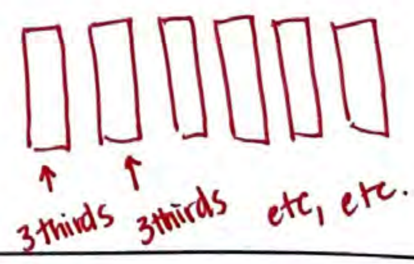
3. So, how many cups are in Camila's water bottle? $4\frac{1}{2}$ cups

$1\frac{1}{2} + 1\frac{1}{2} + 1\frac{1}{2} + 1\frac{1}{2} + 1\frac{1}{2} = 7\frac{1}{2}$

4. Let's try writing an equation.

$\left(\cancel{\frac{5}{2}}\right)\cancel{\frac{2}{5}} \cdot x = \frac{3}{1} \cdot \left(\frac{5}{2}\right) \rightarrow x = \frac{15}{2} = 7\frac{1}{2}$

5. Quick Practice.

$\frac{4}{5} \div \frac{1}{2} =$ ____	$\frac{1}{3} \div 3 = \frac{1}{9}$	$6 \div \frac{1}{3} = 18$
$\frac{4}{5} \times \frac{2}{1} = \frac{8}{5} = 1\frac{3}{5}$	$\frac{1}{3} \times \frac{1}{3} = \frac{1}{9}$	$\frac{6}{1} \times \frac{3}{1} = \frac{18}{1}$
		

Name ANSWER KEY

G6 U4 Lesson 4 - Independent Work

Remember: When we divide, we are splitting or cutting! Draw models to solve.

1. How many $1\frac{1}{2}$ cup servings are there in 12 cups of soda?

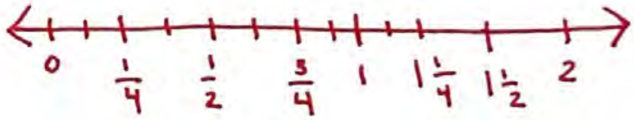
$$12 \div \frac{3}{2} = 8$$

$$\frac{12}{1} \times \frac{2}{3} = \frac{24}{3} = 8$$

8 servings

Hint:
"How many times can 1½ fit into 12?"

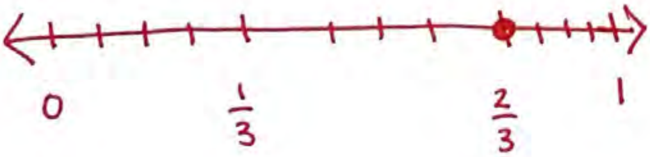
2. Syreeta ran $1\frac{1}{4}$ miles. She jumped over a hurdle every $\frac{1}{8}$ of a mile. There was a final hurdle at the $1\frac{1}{4}$ mile mark. How many hurdles did Syreeta jump over?



Syreeta jumped over 10 hurdles.

$$\frac{5}{4} \div \frac{1}{8} = \frac{5}{4} \times \frac{8}{1} = \frac{40}{4} = 10$$

3. Elisabeth has $\frac{2}{3}$ foot of rope. She cuts her rope into $\frac{1}{12}$ foot pieces. How many pieces of rope did she cut?



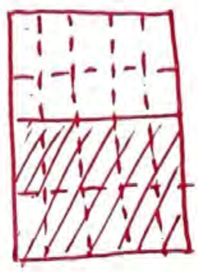
$$\frac{2}{3} \div \frac{1}{12} = \frac{2}{3} \times \frac{12}{1} = \frac{24}{3} = 8$$

She cut 8 pieces of rope.

Hint: "How many twelfths are there in 2/3?"

4. Amir makes half a liter of lemonade. He pours $\frac{1}{10}$ liter of lemonade into each glass. How many glasses is Amira able to fill?

$$\frac{1}{2} \div \frac{1}{10} = \frac{1}{2} \times \frac{10}{1} = \frac{20}{2} = 10$$



G6 U4 Lesson 5

Calculate sums, differences, and products of decimals in the context of money

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G6 U4 Lesson 5 - Students will calculate sums, differences, and products of decimals in the context of money

Warm Welcome (Slide 1): Tutor choice.

Frame the Learning/Connect to Prior Learning (Slide 2-3): Before we launch into learning, take a look at this table. I'm curious. **What do you notice or wonder about what you see?** Possible Student Answers, Key Points:

- I notice some of the numbers are decimals but another is just a whole number.
- I notice some of these look like money. I notice some boxes are blank.
- I wonder what this chart is about. I wonder what numbers go in the missing blanks. I wonder if these are amounts of money.

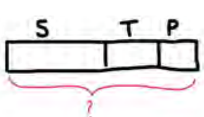
I think you're onto something with those ideas! Today we will explore decimals in the context of money. You've been learning about money in math since you were in 1st or 2nd grade, and in 5th grade you learned a variety of strategies to add, subtract, multiply, and divide with decimal numbers. Today, we're going to get a chance to revisit many of these skills as a way to launch us into learning even more about decimal operations in 6th grade.

Let's Talk (Slide 4): Now I'm going to show you a bit more about this chart we looked at. Oh I see we have labels in the table now, the first column says ITEM and the second column says COST and shows the dollar sign. So, the numbers represent the costs of some items. It looks like sunglasses cost $4.15, t-shirts cost $7, and postcards cost $0.89. Based on our new information, **What questions could somebody ask us about what is presented here?** Possible Student Answers, Key Points:

- How much does it cost to buy _____?
- I have $____. How much change would I get back if I bought ____?
- Do I have enough to buy ______ if I have $______.
- How many ______ can I buy with $_______.

There are so many different types of questions we can ask about money, and depending on what we're being asked, we'll have to use a different strategy and/or operation to answer the question. As we look at different problems today, we'll draw models and make estimates to help us make sense of the question, and then we'll use addition, subtraction, or multiplication to help us answer the questions!

Let's Think (Slide 5): Here's one question we can ask about the information in the table. Listen as I read the first question, how much do the items cost in all? Before we jump straight into the math, let's pause and visualize what we're being asked.



The question says, How much do the items cost in all. That means that we want to buy sunglasses, a t-shirt, and a postcard. I'm going to draw a bar that represents the sunglasses and label it with an S so I don't forget what it represents. Then I'll connect that to a bar for the t-shirt labeled T and a bar for the postcard labeled P. I'll put a question mark around the whole model, since we are finding the total amount for the sunglasses, the t-shirt, and the postcard. Note: Either model matches.

So how can we find the total? Add! That's right, we can join the three parts. We can add everything up. We can combine the three values.

So we want to add a pair of sunglasses, a t-shirt, and a postcard. We can use estimation to help us make a smart guess. So, the sunglasses cost ***about*** how much? $4! The t-shirt costs $7, and about how much does a postcard cost? $1! So if I'm estimating, I know our answer should be about $4 + $7 + $1. Our answer should be about $12.

$$\cancel{\begin{array}{r} 4.15 \\ 7 \\ +\ 0.89 \\ \hline \end{array}}$$

Let's do that! Anytime we add or subtract with money, we have to be extra careful about our place value. We have to add/subtract dollars with dollars and cents with cents. *(Show non-example)* **Did I rewrite this vertical equation correctly? Why or why not?** Possible Student Answers, Key Points:

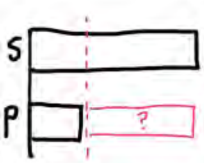
- We didn't write 7 as $7.00. We're adding 7 dollars to pennies.
- Our place values aren't lined up.
- You have to line up the decimals, 7 i s the same as 7.00.
- You have to add dollars with dollars and cents with cents.

$$\begin{array}{r} {\scriptstyle 1\ \ 1} \\ 4.15 \\ 7.00 \\ +\ 0.89 \\ \hline \$12.04 \end{array}$$

Great. Let's rewrite our vertical addition so our dollars are lined up with our dollars and our cents are lined up with our cents. Aligning the decimals is a quick way to make sure we're adding or subtracting like units. Now that we're lined up, let's add.

Finally, let's stop and look at our answer and think about whether it's reasonable. Well, we estimated that our answer would be about $12. And look, $12.04 is really close to our estimate.

Let's Think (Slide 6): Now, let's look at the next question, listen as I read. How much more do sunglasses cost than a postcard? Before we start, let's visualize what we're being asked. We know that the sunglasses cost more than the postcard–we'd have to pay moer money for them! And this question is asking us EXACTLY how much more the sunglasses cost than the postcard. That makes sense because when I look at the table, I see that sunglasses cost ***about*** $4 and the postcard costs ***about*** $1.



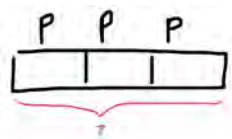
Let me draw a model, I see that the sunglasses cost the most, so I'll draw a big bar labeled S. The postcard costs less, so I'll draw a smaller bar labeled P. We're trying to find the difference, so I'll label the empty space between the postcard and sunglasses with a question mark. This is the part of the sunglasses that cost MORE than the postcard (*point to the red*). We know the sunglasses cost more than the postcard, and we're trying to find the difference between the costs. We can use subtraction to find the difference.

Before we do the math, can we estimate how much we think our answer will be? Well, let's look. The sunglasses cost about $4. The postcard costs about $1. So, 4 - 1 = 3, so the sunglasses cost about $3 more than the postcard.

$$\begin{array}{r} {\scriptstyle 3\ \ 10} \\ \cancel{4}.\cancel{1}5 \\ -\ 0.89 \\ \hline \$3.26 \end{array}$$

Let's see if your estimate is correct. Line up each place value so we can subtract cents from cents and dollars from dollars, and let's carefully subtract. (*Vertically stack each digit and subtract. Slow down while regrouping as this can be the trickiest spot for students when subtracting.)* Great! Did the exact difference in prices match your earlier estimate? Yes!

Let's Think (Slide 7): And finally, let's look at one more. This question says, how much would 3 postcards cost? Hm, I can think of this one a few ways. Let's visualize it.We know that one postcards costs $0.89 and we want to know the total cost of THREE postcards.



Let's draw a model to show this. We want to show three postcards so let me draw a bar that shows 3 postcards and label each part with P for postcard. Now, I'll put a question mark over the whole model because that's what I don't know! **So, what are you thinking we could do to find the total?** Possible Student Answers, Key Points:

- *We can add $0.89 three times.*
- *We can multiply $0.89 times three.*

That's right, we could add the price of the postcard, $0.89, three times, OR we can multiply since we have three equal groups of 89 cents. Before we do the math, let's estimate what you think the answer might be? Well, we know each postcard is about $1, so 1 + 1 + 1 = 3. Or 3 x 1 = 3. Our answer should be about $3. Great. Let's try multiplying this time. In 5th grade, when we multiplied with decimals we learned we can write our decimals as fractions to help us multiply.

$$\frac{89}{100} \times 3 = \frac{267}{100}$$

$$\frac{267}{100} = \$2.67$$

What would 0.89 be as a decimal? 89/100! It's 89/100. An easy way to think of that is to read the decimal. We would say 0.89 is 89 hundredths. Now we can multiply 89/100 x 3. Let's do that. 89 x 3 gets us to 267. So 89/100 x 3 is 267/100. That fraction looks funny if we're talking about money, so let's write it as a decimal. 267 hundredths is 2.67 or $2.67. Does that match our estimate? Yes!

We just solved a variety of money problems using what we know about decimal operations. As we see problems, let's commit to first visualizing with a drawing or model AND thinking of an estimate for our answer. After we do that, we can use an appropriate operation. Remember to add/subtract dollars with dollars and cents with cents. And if we have to multiply, we can write our decimal in fraction form to help us multiply.

Let's Try it (Slides 8-9): Now let's work together on calculating sums, differences, and products of decimals in the context of money. We're going to work on this page together, step-by-step. Remember we want to pay close attention to the place value of dollars and cents as we work, and we can always use a drawing and estimation to help make sure our answer makes sense and is reasonable.

WARM WELCOME

Today we will calculate sums, differences, and products of decimals in the context of money.

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Let's Talk:

What do you notice? What do you wonder?

	3.15
	7
	0.89

Let's Talk:

Emma is at a gift shop. What questions could we ask about the items at the gift shop?

ITEM	COST ($)
sunglasses	4.15
t-shirt	7
postcard	0.89

Let's Think:

How much do the items cost in all?

ITEM	COST ($)
sunglasses	4.15
t-shirt	7
postcard	0.89

Let's Think:

How much more do sunglasses cost than a postcard?

ITEM	COST ($)
sunglasses	4.15
t-shirt	7
postcard	0.89

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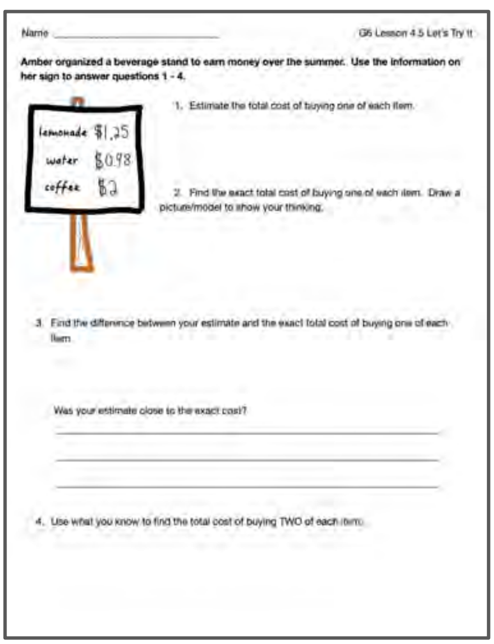
Let's Think:

How much would 3 postcards cost?

ITEM	COST ($)
sunglasses	4.15
t-shirt	7
postcard	0.89

Let's Try It:

Let's add, subtract, and multiply with money!



Name ______________________ G5 Lesson 4.5 Let's Try It

Amber organized a beverage stand to earn money over the summer. Use the information on her sign to answer questions 1 - 4.

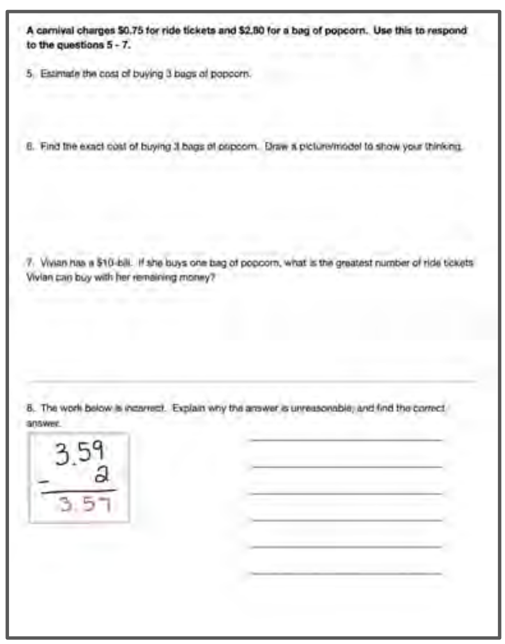
1. Estimate the total cost of buying one of each item.

2. Find the exact total cost of buying one of each item. Draw a picture/model to show your thinking.

3. Find the difference between your estimate and the exact total cost of buying one of each item.

Was your estimate close to the exact cost?

4. Use what you know to find the total cost of buying TWO of each item.



A carnival charges $0.75 for ride tickets and $2.80 for a bag of popcorn. Use this to respond to the questions 5 - 7.

5. Estimate the cost of buying 3 bags of popcorn.

6. Find the exact cost of buying 3 bags of popcorn. Draw a picture/model to show your thinking.

7. Vivian has a $10-bill. If she buys one bag of popcorn, what is the greatest number of ride tickets Vivian can buy with her remaining money?

8. The work below is incorrect. Explain why the answer is unreasonable, and find the correct answer.

$$\begin{array}{r} 3.59 \\ -\quad 2 \\ \hline 3.57 \end{array}$$

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On your Own:

Name ______________________________ G6 Lesson 4.1 Independent Work

1. Bria went to the candy store. Gummy worms cost $2.30 per scoop. Caramels cost $3.59 per scoop.

   Will it cost more for Bria to get 4 scoops of gummy worms or 3 scoops of caramels? Show or explain how you know.

2. The cost of school supplies is shown here.

ITEM	COST ($)
Pen	$1.98
Stapler	$7
Sticky Notes	$0.50

   a. Estimate the cost of 3 pens.

   b. What is the exact cost of 3 pens and 1 stapler?

3. A teacher wants to buy a book that costs $8.50 for each of her 12 students as an end-of-year gift. If she has a budget of $100, will she be able to buy every student a copy of the book?

4. Leo went to the roller skating rink with $20.50. He pays $10 for admission, $4.25 for rental skates, and $0.50 for popcorn. How much money does Leo have left?

Name ________________________________ G6 U4 Lesson 5 - Let's Try It

Amber organized a beverage stand to earn money over the summer. Use the information on her sign to answer questions 1 - 4.

1. Estimate the total cost of buying one of each item.

2. Find the exact total cost of buying one of each item. Draw a picture/model to show your thinking.

3. Find the difference between your estimate and the exact total cost of buying one of each item.

Was your estimate close to the exact cost?

____

____

____

4. Use what you know to find the total cost of buying TWO of each item.

A carnival charges $0.75 for ride tickets and $2.80 for a bag of popcorn. Use this to respond to the questions 5 - 7.

5. Estimate the cost of buying 3 bags of popcorn.

6. Find the exact cost of buying 3 bags of popcorn. Draw a picture/model to show your thinking.

7. Vivian has a $10-bill. If she buys one bag of popcorn, what is the greatest number of ride tickets Vivian can buy with her remaining money?

---

8. Carl had $3.59 and spent $2 on a sports drink. He wanted to figure out how much money he had left, but noticed his work was incorrect. Explain why the answer is unreasonable, and find the correct answer.

$$\begin{array}{r} 3.59 \\ -\quad 2 \\ \hline 3.57 \end{array}$$

1. Bria went to the candy store. Gummy worms cost $2.30 per scoop. Caramels cost $3.59 per scoop.

Will it cost more for Bria to get 4 scoops of gummy worms or 3 scoops of caramels? Show or explain how you know.

2. The cost of school supplies is shown here.

ITEM	COST ($)
Pen	$1.98
Stapler	$7
Sticky Notes	$0.50

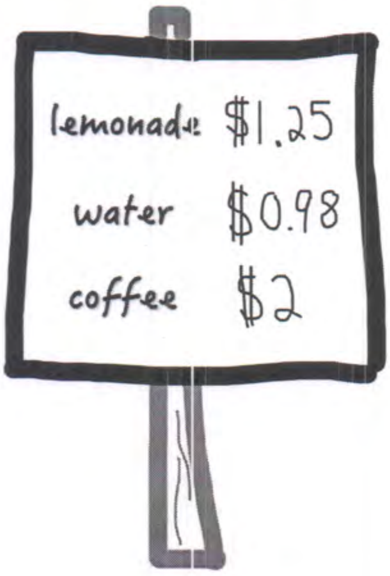
a. Estimate the cost of 3 pens.

b. What is the exact cost of 3 pens and 1 stapler?

3. **A teacher wants to buy a book that costs \$8.50 for each of her 12 students as an end-of-year gift.** If she has a budget of \$100, will she be able to buy every student a copy of the book?	4. **Leo went to the roller skating rink with \$20.50. He pays \$10 for admission, \$4.25 for rental skates, and \$0.50 for popcorn.** How much money does Leo have left?

Name KEY

Amber organized a beverage stand to earn money over the summer. Use the information on her sign to answer questions 1 - 4.



1. Estimate the total cost of buying one of each item.

L	W	C

?

1 + 1 + 2 = 4

1.25 ≈ 1
0.98 ≈ 1
2 → 2

$4

2. Find the exact total cost of buying one of each item. Draw a picture/model to show your thinking.

1.25	0.98	2

$$\begin{array}{r} 2.00 \\ 1.25 \\ +\ 0.98 \\ \hline \$4.23 \end{array}$$

3. Find the difference between your estimate and the exact total cost of buying one of each item.

$$\begin{array}{r} 4.23 \\ -4.00 \\ \hline 0.23 \end{array}$$

$0.23

Was your estimate close to the exact cost?

My estimate was close, yes! I was less than a quarter away from the actual cost.

4. Use what you know to find the total cost of buying TWO of each item.

L	W	C
L	W	C

?

$$\begin{array}{r} 4.23 \\ +4.23 \\ \hline \$8.46 \end{array}$$

OR

$$\frac{423}{100} \times \frac{2}{1} = \frac{846}{100}$$

$8.46

A carnival charges $0.75 for ride tickets and $2.80 for a bag of popcorn. Use this to respond to the questions 5 - 7.

5. Estimate the cost of buying 3 bags of popcorn.

$\$2.80 \approx \$3$

P	P	P

?

$3 \times 3 = 9$

$\approx \$9$

6. Find the exact cost of buying 3 bags of popcorn. Draw a picture/model to show your thinking.

2.80	2.80	2.80

?

$$\begin{array}{r} \overset{2}{}2.80 \\ 2.80 \\ +\,2.80 \\ \hline \$8.40 \end{array}$$

OR

$$\frac{280}{100} \times \frac{3}{1} = \frac{840}{100}$$

$\$8.40$

$$\begin{array}{r} \overset{2}{}280 \\ \times\ 3 \\ \hline 840 \end{array}$$

7. Vivian has a $10-bill. If she buys one bag of popcorn, what is the greatest number of ride tickets Vivian can buy with her remaining money?

$$\begin{array}{r} 10.00 \\ -\,2.80 \\ \hline 7.20 \end{array}$$

$\$7.20$

$$\frac{75}{100} \times \frac{10}{1} = \frac{750}{100} = 7.50 \leftarrow \text{10 tickets}$$

$$\frac{75}{100} \times \frac{9}{1} = \frac{675}{100} = 6.75 \leftarrow \text{9 tickets}$$

$$\begin{array}{r} \overset{4}{}75 \\ \times\ 9 \\ \hline 675 \end{array}$$

9 tickets

8. Carl had $3.59 and spent $2 on a sports drink. He wanted to figure out how much money he had left, but noticed his work was incorrect. Explain why the answer is unreasonable, and find the correct answer.

$$\boxed{\begin{array}{r} 3.59 \\ -\quad 2 \\ \hline 3.57 \end{array}}$$

$3.59 \approx 4$

$$\begin{array}{r} 3.59 \\ -\,2.00 \\ \hline 1.59 \end{array}$$

His answer is too big.
It should be closer to $2.
The correct answer is
$1.59.

1. Bria went to the candy store. Gummy worms cost $2.30 per scoop. Caramels cost $3.59 per scoop.

Will it cost more for Bria to get 4 scoops of gummy worms or 3 scoops of caramels? Show or explain how you know.

$\underbrace{\boxed{GW}\boxed{GW}\boxed{GW}\boxed{GW}}_{?}$

$4 \times 2.30 = ?$

$\frac{4}{1} \times \frac{230}{100} = ?$

$\frac{920}{100} = \$9.20$

$230 \times 4 = 920$

$\underbrace{\boxed{c}\boxed{c}\boxed{c}}_{?}$

$3 \times 3.59 = ?$

$\frac{3}{1} \times \frac{359}{100} = ?$

$\frac{1077}{100} = \$10.77$

$359 \times 3 = 10.77$

It costs more to buy 3 scoops of caramels.

2. The cost of school supplies is shown here.

ITEM	COST ($)
Pen	$1.98
Stapler	$7
Sticky Notes	$0.50

a. Estimate the cost of 3 pens.

$1.98 \approx 2$

$2 \times 3 = 6$

$6

b. What is the exact cost of 3 pens and 1 stapler?

$\underbrace{\boxed{1.98}\boxed{1.98}\boxed{1.98}\boxed{7}}_{?}$

$7.00 + 1.98 + 1.98 + 1.98 = 12.94$

$12.94

3. **A teacher wants to buy a book that costs $8.50 for each of her 12 students as an end-of-year gift.** If she has a budget of $100, will she be able to buy every student a copy of the book?

8.50	8.50	8.50	... x 12

$$\underbrace{8.50 + 8.50 + 8.50 + \dots}_{?}$$

$$8.50 \times 12 = ?$$

$$\frac{850}{100} \times \frac{12}{1} = ?$$

$$\frac{10200}{100}$$

$$\begin{array}{r} 850 \\ \times\ 12 \\ \hline 1700 \\ +\ 8500 \\ \hline 10200 \end{array}$$

$102.00

No, she will not be able to buy all 12 books.

4. **Leo went to the roller skating rink with $20.50. He pays $10 for admission, $4.25 for rental skates, and $0.50 for popcorn.** How much money does Leo have left?

$20.50

10	4.25	0.50	?
adm.	skates	pop.	

$$\begin{array}{r} 10.00 \\ 4.25 \\ +\ 0.50 \\ \hline 14.75 \end{array}$$

$$\begin{array}{r} 20.50 \\ -\ 14.75 \\ \hline 5.75 \end{array}$$

$5.75

G6 U4 Lesson 6

Add and subtract decimals

CITYTUTOR DC

G6 U4 Lesson 6 - Students will add and subtract decimals

Warm Welcome (Slide 1): Tutor choice.

Frame the Learning/Connect to Prior Learning (Slide 2): In our previous lesson, we explored how we can add, subtract, and multiply with money. Today we're going to think about how we can use what we know about money to add and subtract decimals.

Let's Talk (Slide 3): In terms of addition and subtraction, **what was important to keep in mind when we worked with dollars and cents?** Possible Student Answers, Key Points:

- We had to combine or take away dollars with dollars and cents with cents.
- We had to line our decimals up.
- Note: If students say they have to "line up decimals" be sure to ask WHY that is important so students understand it helps us add/subtract like units and isn't simply a "trick."

Today, we're going to continue using that thinking to help us add and subtract decimals that don't represent money. The good thing is, all the same big ideas apply to non-money decimals.

Let's Talk (Slide 4): As we work with decimals today, I want to refresh us on a few handy math tools. First, it can be helpful to use a place value chart like this one on the slide. Not only can this help us keep our digits or models organized, but it also helps us think carefully about place value, which we know is important from when we worked with money.

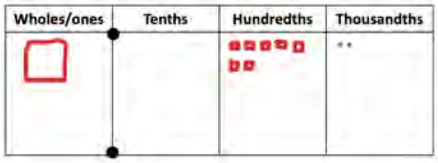
We will also draw models today for some problems to help us add and subtract. You've probably seen models that look like this starting in 4th grade. Let's refresh our brains. We can use a big square like this one to represent a one or a whole (*point to whole*). Now. if we break one whole into ten pieces, we make tenths which look like a rod (*point to tenths*). And if we keep cutting or breaking and we break a tenths rod into ten pieces, we make a small hundredths square like you see here (*point to hundredths*). And finally, if we break a hundredths square up into ten pieces, we make a tiny thousandths dot. Let's go back and review these places together. *(Start from smallest to largest, repeating the questioning below.)* How many thousandths make a hundredth? *Ten!* How many hundredths make a tenth? *Ten!* How many tenths make a whole? *Ten!*

Using these models will help us visualize our subtraction and addition today. Sometimes when we're adding and subtracting we have to regroup–we either have to take a larger group and break it up into small pieces. Like taking one whole and breaking it up into 10 tenths. Or sometimes we have to regroup by making a new group, so taking 10 tenths and making 1 whole. So, knowing that each place value is composed of ten of the place to the right of it will help us if we have to regroup. Let's dive in!

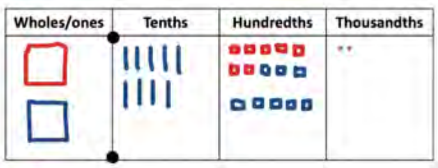
Let's Think (Slide 5): Here we see an addition and a subtraction problem involving decimals. Let's read the addition problem together, 1.072 plus 1.98. **Now, look closely at this addition problem, what do you notice?** Possible Student Answers, Key Points:

- I see a place value chart.
- Each addend has 1 one.
- One addend goes the hundredths, and one goes to the thousandths.
- It's written horizontally.

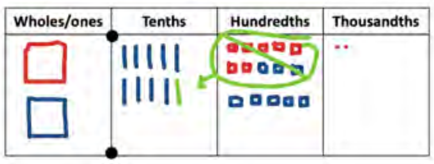
Awesome! You may know other ways to tackle this addition problem, but let's start with a visual model. We want to join 1.072 and 1.98.



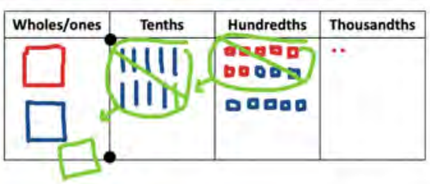
Let’s start by drawing 1 whole, 0 tenths, 7 hundredths, and 2 thousandths.



Now, we want to add 1.98 to that amount. So, I need to add 1 whole/one, 9 tenths, 8 hundredths, and 0 thousandths. Now our model shows the total amount, and all we have left to do is add it altogether.



Let’s go place value by place value, starting in the smallest place, the thousandths. *(Write each digit under the place value chart as you go.)* I see we have two thousandths. I see we have 15 hundredths. We can’t write 15 in the hundredths place, so we have to regroup 10 hundredths and make a tenth.Now we have 5 hundredths.

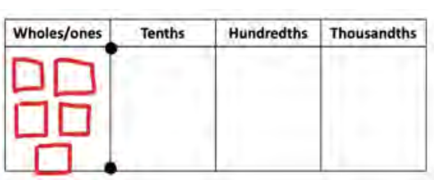


Now look at our tenths, what do you notice about our tenths? We need to regroup. We have 10 tenths. That’s right, we have ten tenths, which regroups to make a whole. *(Draw that on your model)* Now we have 0 tenths and 2 wholes. Our answer is 3.052.

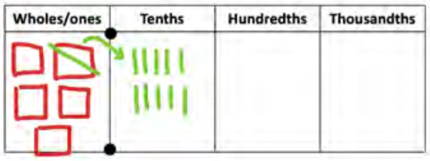
Now that model was helpful but we can also do this without a model and just solve it with the digits. If we want to add with the digits, we aligning our numbers vertically like we did with some of our money examples from last lesson. We have to be careful of how we line up each place value. We can’t write it like this because the place values are not stacked. We’re adding hundredths and tenths or wholes and tenths.

Let’s look at a correctly aligned vertical number sentence. *(Walk through adding each place value starting in the thousandths. Some students may like drawing a place-holder zero to make 1.98 into 1.980; this makes sure every number has a “buddy” to pair with.)* Look, what we did with the digits is the same as what we did with the models. The regrouped in our number sentence show the same thing as when we regrouped ten of a unit and moved it to the next place value in our place value chart. Whether we use a model or a number sentence, we carefully add each place value and regroup when we have more than 10 of a unit.

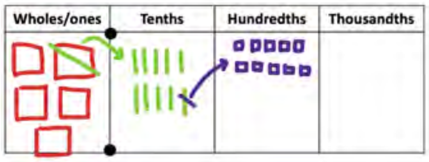
Let’s Think (Slide 6): Let’s look at a subtraction example, before we practice. Here we have 5 minus 2.471. We’ll write this vertically in a moment, but let’s think about the model first.



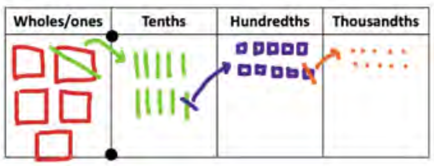
I’ll start by drawing 5 wholes. Now, I am not going to draw 4.271 because I want to take that away from 5! But, I have a problem, when I start to take away the 1 thousandth from 2.471, I realize I don’t have any in my place value chart. Where can I get more thousandths? The 5. You’ll need to regroup from the one’s place.



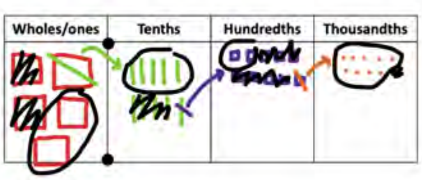
So I’m going to regroup 1 whole, which will make what? Ten tenths! Let’s draw that. *(Cross out 1 whole, draw an arrow to the tenths place, then draw 10 tenths)* But I still don’t have any thousandths, so let’s keep regrouping.



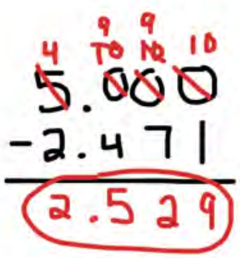
I’ll regroup 1 tenth to make what? Ten hundredths! Let’s draw that. *(Cross out 1 tenth, draw an arrow to the hundredths place, then draw 10 hundredths).*



We’re closer, but we still don’t have any thousandths to take away! So, let’s regroup 1 hundredth to make what? Ten thousandths! Let’s draw that. *(Cross out 1 hundredth, draw an arrow to the thousandths place, then draw 10 thousandths).* Now, let’s check what we see in each place. We see, 4 wholes/ones, 9 tenths (because we regrouped 1 of them), 9 hundredths (because we regrouped 1 of them), and 10 thousandths.



Now we finally have enough to subtract. Let’s take away 1 thousandth, 7 hundredths, 4 tenths, and 2 wholes.. What are we left with? 2 wholes, 5 tenths, 2 hundredths, and 9 thousandths. 2.529 is our final answer.



We know that another way we can subtract is with the vertical number sentence, let’s try it. So, let’s line up our place values carefully. Since 5 is a whole number, it is easiest to think of it as 5.000 so that we have a corresponding digit in each place value. We regroup from the 5, which makes 4 wholes and 10 tenths. Just like in the model, we regrouped one of those 10 tenths to make 10 hundredths. So we had 9 tenths and 10 hundredths. Then just like in the model, we regrouped one of those 10 hundredths to make 10 thousandths. This left us with 4 wholes, 9 tenths, 9 hundredths, and 10 thousandths before we subtracted.

A model is helpful because we can carefully think about what is happening with our units. The vertical number sentence is helpful because it can be more efficient. Either way, if we add or subtract like units and carefully regroup when necessary, we should arrive at our correct sum or difference.

Let’s Try it (Slide 7-8): Now let’s work together on adding and subtract decimals. We’re going to work on this page together, step-by-step. Remember we want to pay close attention to make sure we are adding and subtracting like units. When we’re adding, if we have 10 or more, we have to regroup! If we’re subtracting and we don’t have enough, we have to regroup! Remember, we can use models or make sure our place values are aligned to help us out!

WARM WELCOME

Today we will add and subtract decimals.

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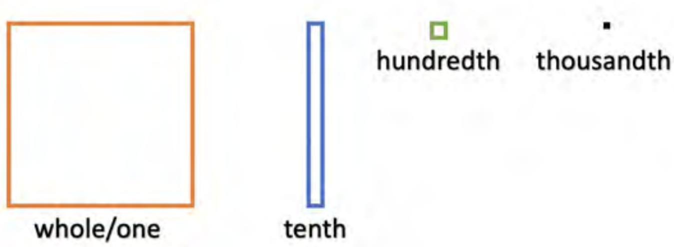
Let's Talk:

In the last lesson we added and subtracted with money. What was important to keep in mind?

Let's Talk:

Wholes/ones	Tenths	Hundredths	Thousandths



Let's Think:

1.072 + 1.98

Wholes/ones	Tenths	Hundredths	Thousandths

Let's Think:

5 - 2.471

Wholes/ones	Tenths	Hundredths	Thousandths

Let's Try It:

Name ______________________ G6 Lesson 4.6 Let's Try It

Let's determine the sum of 4.15 + 0.7.

MODEL

1. In the space provided, draw a model to show 4.15.
2. Beneath that, draw a model to show 0.7.
3. How many hundredths are there in all? Tenths? Wholes?

Wholes (Ones)	Tenths	Hundredths

4. What is the sum?

Now let's find the sum of 2.045 and 1.37.

MODEL

5. What is the sum? Draw a model and write a vertical number sentence.
6. What was the same or different about finding the sum of 4.15 + 0.7 and finding the sum of 2.045 and 1.37?

Time to subtract! Let's find the difference of 2.483 - 1.706 = ?.

7. Model 2.483 in the place value chart.

Wholes/ones	Tenths	Hundredths	Thousandths

8. Take away 1.706. What will we need to do if we don't have enough of a unit to subtract?
9. What is the difference?

Sometimes we have to regroup across multiple zeros.

$$\begin{array}{r} 5.000 \\ \underline{-\ 1.241} \end{array}$$

10. Do you have enough in the thousandths place of 5.000 to subtract the thousandths from 1.241? ____________
11. Where can we regroup more thousandths from?
12. Once we regroup 1 whole from the 5 in 5.000, what happens to the zeros? Why?
13. Find the difference.

On your Own:

Name ______________________ G6 Lesson 4.6 Independent Work

1. **Use the diagram to find 3.45 - 1.62.**
2. **Determine which work below shows how to add 0.5 and 0.008. Then find the sum.**
3. **Find each sum.**
   a. 0.036 + 0.009
   b. 12 + 0.85
   c. 14.5 + 2.95
4. **Bryana subtracted 0.183 from 1.** Explain why her answer is incorrect, and determine the correct answer.

Name ________________________________

Let's determine the sum of 4.15 + 0.7.

MODEL

1. In the space provided, draw a model to show 4.15.

2. Beneath that, draw a model to show 0.7.

3. How many hundredths are there in all? Tenths? Wholes?

Wholes (Ones)	Tenths	Hundredths

4. What is the sum?

Now let's find the sum of 2.045 and 1.37.

MODEL

5. What is the sum? Draw a model and write a vertical number sentence.

6. What was the same or different about finding the sum of 4.15 + 0.7 and finding the sum of 2.045 and 1.37?

Time to subtract! Let's find the difference of 2.483 - 1.706 = ?.

7. Model 2.483 in the place value chart.

Wholes/ones	Tenths	Hundredths	Thousandths

8. Take away 1.706. What will we need to do if we don't have enough of a unit to subtract?

____

____

9. What is the difference?

Sometimes we have to regroup across multiple zeros.

10. Do you have enough in the thousandths place of 5.000 to subtract the thousandths from 1.241? ________________

11. Where can we regroup more thousandths from?

____

____

$$\begin{array}{r} 5.000 \\ \underline{-\ 1.241} \end{array}$$

12. Once we regroup 1 whole from the 5 in 5.000, what happens to the zeros? Why?

____

____

____

13. Find the difference.

1. Use the diagram to find 3.45 - 1.62.

2. Determine which work below shows how to add 0.5 and 0.008. Then find the sum.

					0	.	5
+	0	.	0		0		8

	0	.	5				
+	0	.	0		0		8

			0	.	5		0
+	0	.	0		0		8

3. Subtract. Draw a model and show your work with digits.

1 - 0.04 = ?

Wholes/ones	Tenths	Hundredths	Thousandths

4. Add. Draw a model and show your work with digits.

1.5 + 0.947

Wholes/ones	Tenths	Hundredths	Thousandths

5. Find each sum.

a. 0.036 + 0.009

b. 12 + 0.85

c. 14.5 + 2.95

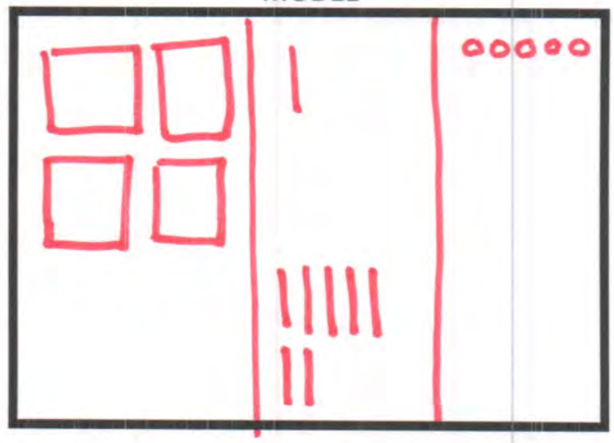
6. Bryana subtracted 0.183 from 1. Explain why her answer is incorrect, and determine the correct answer.

$$\begin{array}{ccccc} & & 10 & 10 & 10 \\ 1 & . & \cancel{0} & \cancel{0} & \cancel{0} \\ 0 & . & 1 & 8 & 3 \\ \hline 1 & . & 9 & 2 & 7 \end{array}$$

Name KEY

Let's determine the sum of 4.15 + 0.7.

MODEL



1. In the space provided, draw a model to show 4.15.

2. Beneath that, draw a model to show 0.7.

3. How many hundredths are there in all? Tenths? Wholes?

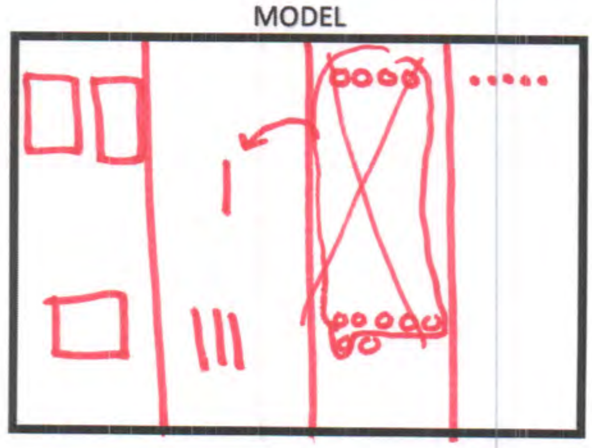
Wholes (Ones)	Tenths	Hundredths
4	8	5

4. What is the sum?

4.85

Now let's find the sum of 2.045 and 1.37.

MODEL



5. What is the sum? Draw a model and write a vertical number sentence.

$$\begin{array}{r} \overset{1}{}\\ 2.045 \\ +\ 1.370 \\ \hline 3.415 \end{array}$$

6. What was the same or different about finding the sum of 4.15 + 0.7 and finding the sum of 2.045 and 1.37?

We added like place values in both. The second expression had more place values to work with and required us to regroup.

Time to subtract! Let's find the difference of 2.483 - 1.706 = ?.

7. Model 2.483 in the place value chart.

Wholes/ones	Tenths	Hundredths	Thousandths

8. Take away 1.706. What will we need to do if we don't have enough of a unit to subtract?

We will regroup 1 from the next place value to make 10 of our unit.

9. What is the difference?

0.777

Sometimes we have to regroup across multiple zeros.

10. Do you have enough in the thousandths place of 5.000 to subtract the thousandths from 1.241? NO

11. Where can we regroup more thousandths from?

We'll need to look all the way left to the 5 ones.

$$\begin{array}{r} 5.000 \\ -\ 1.241 \\ \hline 3.759 \end{array}$$

12. Once we regroup 1 whole from the 5 in 5.000, what happens to the zeros? Why?

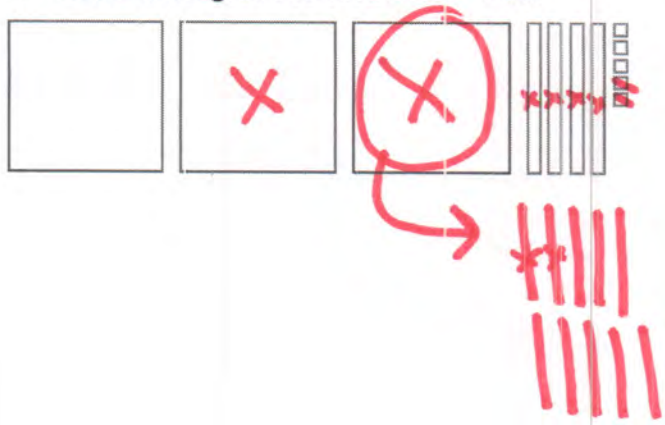
The 0 tenths is now 10 tenths. We borrow one tenth to make 9 tenths and 10 hundredths. Then we regroup 1 hundredth to make 10 thousandths and 9 hundredths.

13. Find the difference.

3.759

Name KEY

1. **Use the diagram to find 3.45 - 1.62.**



1.83

2. **Determine which work below shows how to add 0.5 and 0.008. Then find the sum.**

		0	.	5
+ 0	.	0	0	8

	0	.	5	
+	0	.	0	0 8
	0	.	5	0 8

		0 .	5	0
+ 0	.	0	0	8

3. **Subtract. Draw a model and show your work with digits.**

1 - 0.04 = ?

Wholes/ones	Tenths	Hundredths	Thousandths

$$\begin{array}{r} 1.00 \\ -0.04 \\ \hline 0.96 \end{array}$$

4. **Add. Draw a model and show your work with digits.**

1.5 + 0.947

Wholes/ones	Tenths	Hundredths	Thousandths

$$\begin{array}{r} 1.500 \\ +0.947 \\ \hline 1.447 \end{array}$$

5. Find each sum.

a. 0.036 + 0.009

$$\begin{array}{r} \overset{1}{} \\ 0.036 \\ +\ 0.009 \\ \hline 0.045 \end{array}$$

b. 12 + 0.85

$$\begin{array}{r} 12.00 \\ +\ 0.85 \\ \hline 12.85 \end{array}$$

c. 14.5 + 2.95

$$\begin{array}{r} \overset{1}{} \\ 14.50 \\ +\ 2.95 \\ \hline 17.45 \end{array}$$

6. Bryana subtracted 0.183 from 1. Explain why her answer is incorrect, and determine the correct answer.

$$\begin{array}{rcccc} & & 10 & 10 & 10 \\ 1 & . & \cancel{0} & \cancel{0} & \cancel{0} \\ 0 & . & 1 & 8 & 3 \\ \hline 1 & . & 9 & 2 & 7 \end{array}$$

$$\begin{array}{r} \overset{0}{\cancel{1}}.\overset{9}{\cancel{10}}\overset{9}{\cancel{10}}\overset{10}{\cancel{0}} \\ -\ 0.183 \\ \hline 0.817 \end{array}$$

The correct answer is 0.817. She just made each 0 in 1.000 into 10 without regrouping from the 1 whole, then the 10 tenths and 10 hundredths.

G6 U4 Lesson 7

Solve problems involving decimals

CITYTUTOR DC

G6 U4 Lesson 7 - Students will solve problems involving decimals

Warm Welcome (Slide 1): Tutor choice.

Frame the Learning/Connect to Prior Learning (Slide 2): We've been working with decimals for a few lessons now. We added, subtracted, and multiplied within the context of money, and we also had some practice with decimals that weren't within the context of money. Today we're going to bring some of that work together and work with decimals in a variety of ways.

Let's Talk (Slide 3): Based on our previous lessons, **what's important to keep in mind when we add, subtract, or multiply with decimals?** Feel free to use any of the numbers shown here as an example, if that helps. Possible Student Answers, Key Points:

- We have to add or subtract like units. Ones with ones, tenths with tenths, hundredths with hundredths.
- We can stack each place value vertically to help us add/subtract like units.
- When we multiply, we have to keep track of the place value of our factors. We can write our decimal factors as fractions out of 10, 100, or 1000 to help us.
- We can fill in (or annex) zeros to decimals to help us see each necessary place value. Doing this helps us line up each place value. We need to be careful not to change the place value of any other digit when annexing zeros.

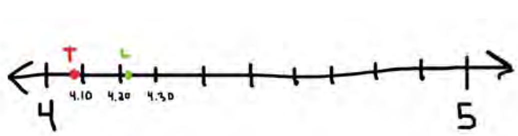
Those are all really important! As we work today, keep all this in mind. And since we're going to see a mixture of problem types today, if we're ever not sure how to solve a problem, we can use a model and/or estimation to help us make sense of the story. Let's jump right in!

Let's Think (Slide 4): Let's read this together, "Three friends measured how far they could throw their paper airplanes." And now it looks like there is a lot of information in the table. **Before we answer some questions, what do you notice or wonder about this story and the table?** Possible Student Answers, Key Points:

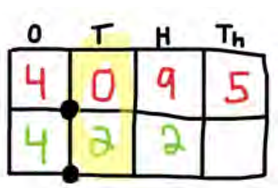
- Jada's plan flew a whole number of meters. It flew the farthest. I wonder how she designed it.
- Terrell and Lucy's planes flew about the same amount. I wonder if their designs looked similar.

We're going to use this information to answer a few different questions using our decimal operation strategies we just reviewed. Let's read this together, "Did Terrell or Lucy's plane fly the greatest distance? By how much?" Okay well, this question is asking us to compare Terrell's distance and Lucy's distance. **Who do you think went farther, and why?** Possible Student Answers, Key Points:

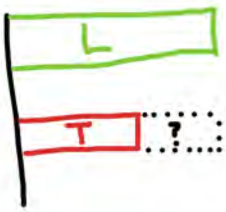
- Lucy's plane went farther, because 4.22 is a bigger number. They're both 4 meters, but Lucy's distance shows 2 tenths while Terrell's shows 0 tenths.
- POSSIBLE INCORRECT ANSWER: Terrell's plane went farther because 95 is bigger than 22.



Lucy's plane went farther. We can think of this a couple ways. If we picture a number line between 4 and 5 *(sketch number line)* and estimate where each plane landed, I can see that Terrell's plane landed a bit before 4.10 and Lucy's was a bit past 4.22.



We could also just think about the value of the digits in each distance *(draw place value chart)*. Lucy's distance is greater because 2 tenths is greater than 0 tenths.

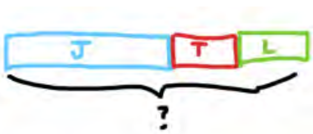


But look, the question also wants to know **exactly** how much farther Lucy's plane went than Terrell's plane. Let's work together to sketch a bar model or tape diagram to picture what is being asked. So, we know that Lucy's plane went 4.22 meters and Terrell's went 4.095, so Lucy's bar is going to be longer than Terrells–since her plane went further! Hmm, so if we want to find exactly how much longer Lucy's plane flew than Terrell's, we can subtract to find the difference.

$$\begin{array}{r} 4.220 \\ -4.095 \\ \hline 0.125\text{ m} \end{array}$$

We could draw a model to show place value or use a vertical number sentence. Let's try a vertical number sentence, since they tend to be more efficient. Line up each digit so we are subtracting like place values. We've done this before, so you talk me through what you would do, and I'll scribe *(write while student shares)*. And if we were estimating, our answer makes sense. Each plane flew about 4 meters, so 4 - 4 means our answer should be close to 0, and it is!

Let's Think (Slide 5): Let's look at the next question. It says, "What was the combined distance of all three planes?" Let's stop and think, what is this question asking us? It's asking about the TOTAL distance.

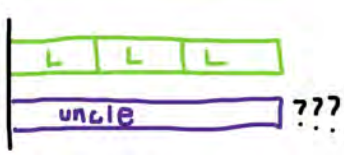


So we have to combine all three. We want to know the distance of Jada's plane AND Terrell's plane AND Lucy's plane. So, wow, let's draw a model to represent it. We're going to put Jada's distance together with Terrell's distance together with Lucy's distance. I'm labeling all of their distances with the first letter of their names.

$$\begin{array}{r} 8.000 \\ 4.095 \\ +4.220 \\ \hline 16.315\text{ m} \end{array}$$

I see that this question is definitely different than the last one even though we're using a lot of the same information. Let's think of a reasonable estimate for the total…Lucy and Terrell each have a distance of about 4 and 4 and 4 makes 8 and then 8 more for Jada's distance, so 8 + 4 + 4…our answer should be about 16 meters. Let's add and see. Again, you talk me through the math, and I'll be your scribe. Awesome! And that sum is close to our estimate from earlier.

Let's Think (Slide 6): Okay and we have one more question, let's read it, "Lucy's uncle made a plane that flew three times as far as Lucy's plane. How far did Lucy's uncle's plan fly?" This one tells us that Lucy's uncle, who is not in the chart, flew a plane three times as far as Lucy.



Here's one way to picture what is happening in the story. Looking at this model, I see we could either add 4.22 three times OR use multiplication. Let's practice multiplying. What is a reasonable estimate? If we estimate, we're thinking the answer should be about 12 meters. Because 4 x 3 = 12.

$$4.22 \times 3 = ?$$

$$\frac{422}{100} \times \frac{3}{1} = \frac{1266}{100}$$

$$12.66\text{ m}$$

Now, when we calculate the exact answer, 4.22 x 3 can be written as 422/100 x 3/1. When I multiply 422 x 3, I get 1266 in my numerator. That answer is not reasonable; I have to think about my place value. 100 x 1 gives me a denominator of 100. So 1266/100 can be written as 12.66 meters.

Nice work! You just used the same set of information to answer lots of different types of questions.

Let's Try it (Slide 7-8): Now let's work together to solve problems involving decimals. We're going to work on this page together, step-by-step. Remember we want to pay close attention to the place value of each digit as we work, and we can always use a drawing and estimation to help make sure our answers make sense.

WARM WELCOME

Today we will solve problems involving decimals.

Let's Talk:

What's important to keep in mind when we add, subtract, or multiply with decimals?

7.2

9.09

$4.59

6.000

$0.50

.001

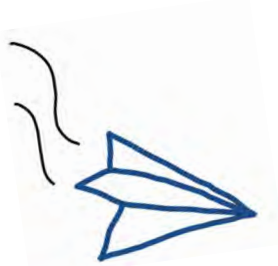
1

Let's Think:

Three friends measured how far they could throw their paper airplanes.

STUDENT	DISTANCE (m)
Jada	8
Terrell	4.095
Lucy	4.22

Did Terrell or Lucy's plane fly the greatest distance? By how much?

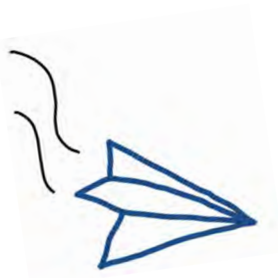


Let's Think:

Three friends measured how far they could throw their paper airplanes.

STUDENT	DISTANCE (m)
Jada	8
Terrell	4.095
Lucy	4.22

What was the combined distance of all three planes?

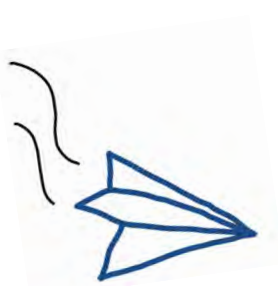


Let's Think:

Three friends measured how far they could throw their paper airplanes.

STUDENT	DISTANCE (m)
Jada	8
Terrell	4.095
Lucy	4.22

Lucy's uncle made a plane that flew *three times* as far as Lucy's plane. How far did Lucy's uncle's plane fly?



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Let's Try It:

Let's solve problems involving decimals!

Name ______________________ G6 Lesson 4.7 Let's Try It

At a movie theater, popcorn costs $4.80, a soda costs $3.09, and candy costs $1.25.

1. Estimate about how much each item costs.
   - POPCORN: __________
   - SODA: __________
   - CANDY: __________

2. Estimate the cost of buying 4 sodas. Then find the actual cost.

3. Exactly how much would it cost to buy one of each item? Show or explain how you know.

4. Liz wants to buy a soda and a candy. Her estimate is shown below. Is her estimate reasonable? What is the exact cost of buying a soda and a candy?

$3.09 is about $4.

$1.25 is about $2.

So, my total should be about $6.00.

Use the quadrilateral shown here to answer the following questions.

5. Write a number sentence that could be used to find the perimeter of the polygon.

6. Find the perimeter of the polygon.

7. An artist wants to draw a quadrilateral that has a perimeter that is two times the perimeter of the figure shown here. What is the perimeter of the artist's quadrilateral?

Larry and Tierra both tried to solve the problem below. Their work is shown.

"A large loaf of bread weighs 3.5 pounds. How much would two loaves of bread weigh?"

LARRY

$3.5 \times 2 = 70$

TIERRA

$\frac{35}{10} \cdot \frac{2}{1} = \frac{70}{10} = 7.0$

8. Whose answer is most reasonable?

9. How could the person whose answer is NOT reasonable correct their work?

On your Own:

Name ______________________ G6 Lesson 4.7 Independent Work

1. A fruit stand sells bananas for $0.90, pineapples for $3.85, and coconuts for $2.

a. Estimate the cost of buying 2 bananas, 2 pineapples, and 1 coconut.

b. Calculate the actual cost of buying those items.

2. Tiffanie's bag of blueberries weighs 0.097 kilograms. Kate's bag of blueberries weighs 0.2 kilograms.

Whose bag of blueberries is heavier? How much heavier?

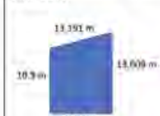
3. Marquez has a goal to run 10 miles. He tracked the distance he ran each day this week.

Monday	1.09 miles
Tuesday	2.5 miles
Wednesday	0.95 miles
Thursday	4 miles
Friday	2.44 miles

A. Did he meet his goal?

B. How many more miles will Marquez have to run this week if he changes his goal to 15 miles?

4. Cristal is remodeling her living room, and she measured the length of each wall. She estimated the perimeter of the room to be 40 meters. Is her estimate reasonable? What is the exact perimeter?



At a movie theater, popcorn costs $4.80, a soda costs $3.09, and candy costs $1.25.

1. Estimate about how much each item costs.
   - POPCORN: ____________
   - SODA: ____________
   - CANDY: ____________
2. Estimate the cost of buying 4 sodas. Then find the actual cost.
3. Exactly how much would it cost to buy one of each item? Show or explain how you know.
4. Liz wants to buy a soda and a candy. Her estimate is shown below. Is her estimate reasonable? What is the exact cost of buying a soda and a candy?

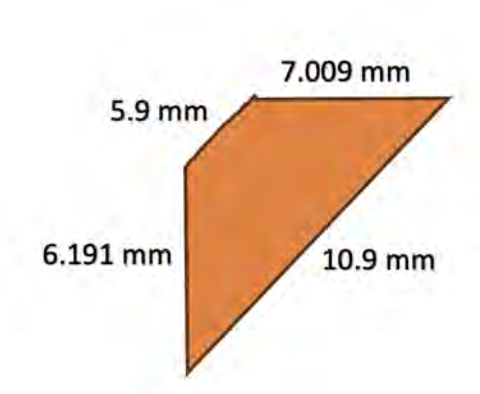
$3.09 is about $4. $1.25 is about $2. So, my total should be about $6.00.

____

____

____

Use the quadrilateral shown here to answer the following questions.



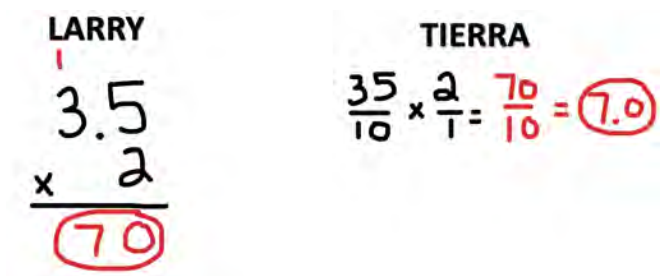
5. Write a number sentence that could be used to find the perimeter of the polygon.

6. Find the perimeter of the polygon.

7. An artist wants to draw a quadrilateral that has a perimeter that is two times the perimeter of the figure shown here. What is the perimeter of the artist's quadrilateral?

Larry and Tierra both tried to solve the problem below. Their work is shown.

"A large loaf of bread weighs 3.5 pounds. How much would two loaves of bread weigh?"



8. Whose answer is most reasonable?

9. How could the person whose answer is NOT reasonable correct their work?

1. A fruit stand sells bananas for \$0.90, pineapples for \$3.85, and coconuts for \$2. a. Estimate the cost of buying 2 bananas, 2 pineapples, and 1 coconut. b. Calculate the actual cost of buying those items.	**2. Tiffanie's bag of blueberries weighs 0.087 kilograms. Kate's bag of blueberries weighs 0.2 kilograms.** Whose bag of blueberries is heavier? How much heavier?

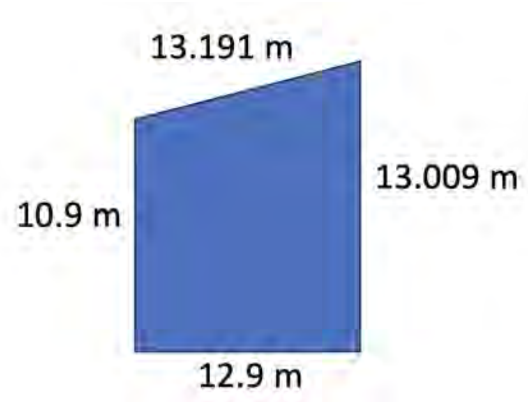
3. Marquez has a goal to run 10 miles. He tracked the distance he ran each day this week.

Monday	1.09 miles
Tuesday	2.5 miles
Wednesday	0.95 miles
Thursday	4 miles
Friday	2.44 miles

A. Did he meet his goal?

B. How many more miles will Marquez have to run this week if he changes his goal to 15 miles?

4. Cristal is remodeling her living room, and she measured the length of each wall. She estimated the perimeter of the room to be 40 meters. Is her estimate reasonable? What is the exact perimeter?



Name KEY

At a movie theater, popcorn costs $4.80, a soda costs $3.09, and candy costs $1.25.

1. Estimate about how much each item costs.

- POPCORN: $5
- SODA: $3
- CANDY: $1

$4.80 \approx 5$
$3.09 \approx 3$
$1.25 \approx 1$

2. Estimate the cost of buying 4 sodas. Then find the actual cost.

ESTIMATE $\underbrace{3+3+3+3}_{\$12}$ OR 3×4 $12

ACTUAL
3.09
3.09
3.09
+ 3.09
12.36

OR $\frac{309}{100} \times 3 = \frac{1236}{100}$ $12.36

3. Exactly how much would it cost to buy one of each item? Show or explain how you know.

$\underbrace{\boxed{4.80}\boxed{3.09}\boxed{1.25}}_{?}$

4.80
3.09
+ 1.25
9.14

$9.14

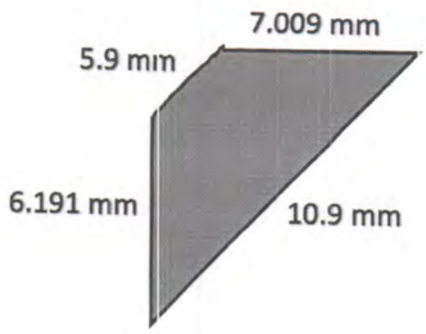
4. Liz wants to buy a soda and a candy. Her estimate is shown below. Is her estimate reasonable? What is the exact cost of buying a soda and a candy?

$3.09 is about $4.
$1.25 is about $2.
So, my total should be about $6.00.

3.09
+ 1.25
$4.34 ← exact

Her estimate is too high. $3.09 is closer to 3, and $1.25 is closer to 1. A better estimate would be about $4.

Use the quadrilateral shown here to answer the following questions.



5. Write a number sentence that could be used to find the perimeter of the polygon.

7.009 + 10.9 + 5.9 + 6.191 = ?

6. Find the perimeter of the polygon.

$$\begin{array}{r} 10.900 \\ 7.009 \\ 6.191 \\ +\ 5.900 \\ \hline 30.000 \end{array}$$

30 mm

7. An artist wants to draw a quadrilateral that has a perimeter that is two times the perimeter of the figure shown here. What is the perimeter of the artist's quadrilateral?

30.000 × 2 = ?

30 × 2 = 60 mm

Larry and Tierra both tried to solve the problem below. Their work is shown.

"A large loaf of bread weighs 3.5 pounds. How much would two loaves of bread weigh?"

LARRY	TIERRA
$3.5 \times 2 = 70$	$\frac{35}{10} \times \frac{2}{1} = \frac{70}{10} = 7.0$

way too heavy! →

8. Whose answer is most reasonable? TIERRA

9. How could the person whose answer is NOT reasonable correct their work?

Larry forgot about his decimal in his answer. 35 × 2 is 70, but 35 tenths × 2 would be 70 tenths or 7.0.

Name KEY

1. A fruit stand sells bananas for $0.90, pineapples for $3.85, and coconuts for $2.

a. Estimate the cost of buying 2 bananas, 2 pineapples, and 1 coconut.

$0.90 + 0.90 + 3.85 + 3.85 + 2$

$\downarrow$

$1 + 1 + 4 + 4 + 2$

$12

b. Calculate the actual cost of buying those items.

$$\begin{array}{r} \overset{3\;\;1}{0.90} \\ 0.90 \\ 3.85 \\ 3.85 \\ +\ 2.00 \\ \hline 11.50 \end{array}$$

$\boxed{\$11.50}$

2. Tiffanie's bag of blueberries weighs 0.087 kilograms. Kate's bag of blueberries weighs 0.2 kilograms.

Whose bag of blueberries is heavier? How much heavier?

		0	.	0	8	7	T
		0	.	2			K

Kate's bag is heavier.

$$\begin{array}{r} 0.\overset{1}{\cancel{2}}\overset{9}{\cancel{\overset{10}{0}}}\overset{10}{\cancel{0}} \\ -\ 0.087 \\ \hline 0.113 \end{array}$$

It is 0.113 kg heavier.

3. **Marquez has a goal to run 10 miles. He tracked the distance he ran each day this week.**

Monday	1.09 miles
Tuesday	2.5 miles
Wednesday	0.95 miles
Thursday	4 miles
Friday	2.44 miles

?

A. Did he meet his goal?

$$\begin{array}{r} 1.09 \\ 2.50 \\ 0.95 \\ 4.00 \\ +\,2.44 \\ \hline 10.98 \end{array}$$

miles

Yes, he did!

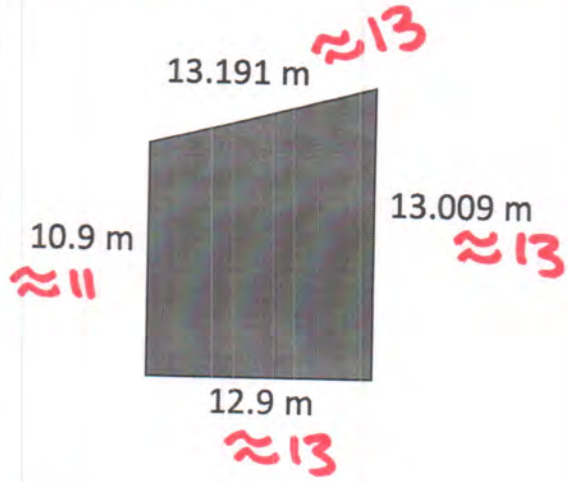
B. How many more miles will Marquez have to run this week if he changes his goal to 15 miles?

$$\underbrace{\boxed{10.98}\boxed{\ ?\ }}_{15}$$

$$\begin{array}{r} 15.00 \\ -\,10.98 \\ \hline 4.02 \end{array}$$

4.02 miles

4. **Cristal is remodeling her living room, and she measured the length of each wall. She estimated the perimeter of the room to be 40 meters. Is her estimate reasonable? What is the exact perimeter?**



$$\begin{array}{r} 13 \\ 13 \\ 13 \\ +\,11 \\ \hline 50 \end{array}$$

← my estimate

Her estimate is too low.

$$\begin{array}{r} 13.191 \\ 13.009 \\ 12.900 \\ +\,10.900 \\ \hline 50.000 \end{array}$$

50 m

G6 U4 Lesson 8

Use different methods to find the product of decimals

CITYTUTOR DC

G6 U4 Lesson 8 - Students will use different methods to find the product of decimals.

Warm Welcome (Slide 1): Tutor choice.

Frame the Learning/Connect to Prior Learning (Slide 2): We've been working with decimals for several lessons. Today, our focus is going to be specifically on multiplying decimals. We're going to explore all the different strategies we can use to arrive at a product of two decimal numbers. By the end of our time together, you'll be able to look at a multiplication problem and decide for yourself what method makes the most sense for you.

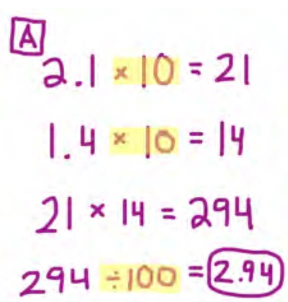
Let's Talk (Slide 3): Before we jump in ourselves, we'll take a moment to compare and contrast some methods. There are a lot of ways to think about multiplying decimals. Let's look at how three students multiplied 2.1 x 1.4. Look at these three examples. Every student showed correct work in a different way. **Do any of these strategies look familiar to you?** Possible Student Answers, Key Points:

- I multiplied by changing my decimals into fractions in 5th grade. (NOTE: This is often how students first explore decimal multiplication in 5th grade)
- Student C's work kind of looks like the multiplication algorithm.

Take a moment and look at each work sample. **What do you notice is the same? What is different?** Possible Student Answers, Key Points:

- They all use the same digits. I see 21 and 14 and 294 in all of them.
- They all have the same final answer.
- Student B used fractions.
- Student C wrote the multiplication vertically.
- Student A used friendly, or easier, numbers.
- Students A and C changed their factors so they were not decimals.

Let's Think (Slide 4): Great things to notice. I want us to look closer at each one to make sense of why every student's thinking works.

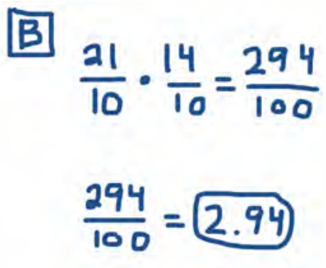


Let's start with Student A. I notice she started by changing 2.1 and 1.4 into whole numbers by multiplying each by a power of ten. 2.1 x 10 shifts each digit to make 21, and 1.4 x 10 shifts each digit to make 14. Then all she had to do was multiply 21 x 14 any way she wanted, and that got her to 294. But 294 is way too big of a product if we're only multiplying 2.1 by 1.4. If I'm estimating, 2.1 is close to 2 and 1.4 is close to 1, so our answer should be about 2 x 1. So as their last step, they divided by 100 *(highlight)* to put their answer back in decimal form. That makes sense because they multiplied one factor x10 *(highlight)* and another factor x10 *(highlight)*, so they needed to "undo" that to put their answer back in the right place value. To undo x10 and x10, they divided by 100, since 10x10 is 100. Kind of cool!

So, how would you describe Student A's strategy in your own words? Possible Student Answers, Key Points:

- They changed their factors into whole numbers by multiplying by a power of 10. Then they multiplied the whole numbers, but they had to divide by a power of 10 to put their answer back in the proper place value.
- They used a power of ten to make the numbers easier to multiply, then they turned the numbers back into decimals.

Let's Think (Slide 5): Now, let's check out Student B. This strategy might look familiar from 5th grade. It looks like they used fractions.

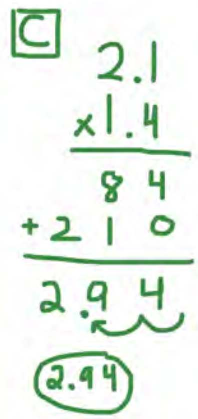


Student B wrote 2.1 as 21/10, because 2.1 is 21 in the tenths place . They then wrote 1.4 as 14/10, because 1.4 is 14 in the tenths place. Then they multiplied across their numerator and denominator to make 294/100. Lastly, they wrote 294/100 back in decimal form. 294/100 is the number 294 ending in the hundredths place, which is 2.94.

How would you describe Student B's work in your own words? Possible Student Answers, Key Points:

- They changed their factors into fractions to make them easy to multiply. They multiplied across their fractions, and then put their fraction answer back in decimal form.
- They made their numbers easier to work with by converting them to fractions.

Let's Think (Slide 5): Last but not least, check out Student C.

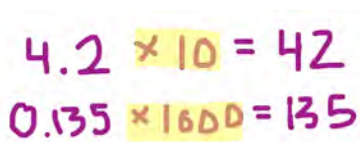


They stacked their numbers like people do when using the standard multiplication algorithm. They multiplied, remembering to annex the zero before multiplying by the second digit, and then added their partial products. **Look closely at what they did last. Why do you think they did that?** Possible Student Answers, Key Points:

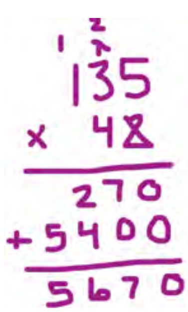
- It looks like they scooped or hopped their decimal two place values in, because their first factor had 1 decimal place value and their second factor had 1 decimal place value.
- It's kind of like how Student A multiplied 21 by 14, but then had to divide by 100 to make sure the product's digits were in the proper place value.

Nice. So we saw a strategy involving converting factors to whole numbers, a strategy involving converting factors into fractions, and a strategy that looks similar to the standard algorithm with special attention to the decimal placement. Let's try out all three of these strategies for ourselves and see what methods we find most helpful.

Let's Think (Slide 7): We're going to multiply 4.2 x 0.135 using each method. Be ready to help me out.



Let's try Strategy A, where we change our decimals into whole numbers. I can start by changing 4.2 into 42. I can multiply by 10, because I only have to shift each digit one place value. I can change 0.135 into 135 by multiplying by 1,000, because I have to shift each digit three place values. I want to remember what I multiplied, or how many place values I shifted, because at the end I will need to put my answer BACK into the proper place value.



Now, let's multiply 135 x 42. We 5670.

$5670 \div 10 = 567$

$567 \div 1000 = 0.567$

That is way too big; we were only multiplying 4.2 x 0.135, so our answer should be much smaller. So we have to divide by the powers of 10 we multiplied by earlier. If we multiplied by 10 and then by 1,000 to get friendlier numbers, we can divide by 10 and then by 1000 or we can just divide by 10,000 all at once. If we divide by 10 and then by 1000 *(write as you narrate)*, our digits shift back into place and our product is 0.567. Nicely done.

$$\frac{42}{10} \times \frac{135}{1000} = \frac{5670}{10000}$$

Now let's try Strategy B, where we change our decimals into fractions. What would 4.2 be as a fraction? 42/10! What would 0.135 be as a fraction? 135/1000! Cool, let's multiply across. Do we *really* need to multiply 42 by 135? No, we already did it with Strategy A. It's 5670! So multiplying across our fractions gives us 5,670 over 10,000. All we have left to do is write this in decimal form. I can think of 5670/10000 as the digits 5670 ending in the ten thousandths place, which is four place values to the right of the decimal (tenths, hundredths, thousandths, ten thousandths). Our final product is 0.5670 which is the same as what we got in Strategy A.

Ready for our final strategy? Strategy C was the one where we write our multiplication vertically. Let's set that up, even though we already know the final product *(write vertical multiplication similar to example here)*.

$$\begin{array}{r} {\scriptstyle 2} \\ {\scriptstyle 1\ \ 1\ \ } \\ 0.135 \\ \times\quad 4.2 \\ \hline 0270 \\ +05400 \\ \hline 0.5670 \\ \boxed{0.567} \end{array}$$

We're going to multiply and, in a way, kind of ignore the decimal for now. We're just multiplying the digits as if we were multiplying whole numbers *(multiply with the student's help)*. Our product looks like 05670, but we need to remember to place the decimal in our answer. I know we had three decimal place values in 0.135 and one decimal place value in 4.2, so we can shift our decimal in 4 place values *(show with arrow)*. **Why does shifting the decimal four times make sense in this problem?** Possible Student Answers, Key Points:

- It's like in Strategy A when we ended up with 5670, but divided by 100 and by 10 to put our answer back in the correct place value.
- It's like in Strategy B when we had 5670/10000, but needed to write it in decimal form.
- If I multiply thousandths by tenths, my answer should be in the ten-thousandths place.

We just practiced each strategy and saw that a lot of the multiplication of digits feels similar, but how we represent our factors in each method varies somewhat. What strategies do you most connect with and why?

Let's Try it (Slide 8-9): Now let's work together to use different methods to find the product of decimals. Whether we rewrite our decimals as fractions, rewrite our decimals as whole numbers, or multiply our numbers vertically similar to the standard algorithm, we want to keep a close eye on the place value of our products. Estimation can come in handy before and after multiplying to help make sure our products are reasonable.

WARM WELCOME

Today we will use different methods to find the product of decimals.

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Let's Talk:

There are a lot of ways to think about multiplying decimals. Let's look at how three students multiplied 2.1 x 1.4.

A

$2.1 \times 10 = 21$

$1.4 \times 10 = 14$

$21 \times 14 = 294$

$294 \div 100 = \boxed{2.94}$

B

$\frac{21}{10} \cdot \frac{14}{10} = \frac{294}{100}$

$\frac{294}{100} = \boxed{2.94}$

C

$$\begin{array}{r} 2.1 \\ \times 1.4 \\ \hline 84 \\ +210 \\ \hline 2.94 \end{array}$$

2.94

Let's Think:

Let's look closely at how this student solved.

A

$2.1 \times 10 = 21$

$1.4 \times 10 = 14$

$21 \times 14 = 294$

$294 \div 100 = \boxed{2.94}$

Let's Think:

Let's look closely at how this student solved.

B

$$\frac{21}{10} \cdot \frac{14}{10} = \frac{294}{100}$$

$$\frac{294}{100} = 2.94$$

Let's Think:

Let's look closely at how this student solved.

C

$$\begin{array}{r} 2.1 \\ \times 1.4 \\ \hline 84 \\ +210 \\ \hline 2.94 \end{array}$$

2.94

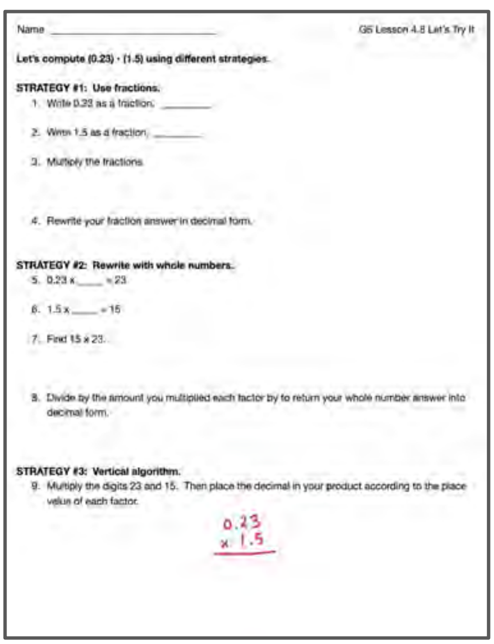
Let's Think:

Let's try each strategy!

Let's try Strategy A…	Let's try Strategy B…	Let's try Strategy C…
(4.2)(0.135)	(4.2)(0.135)	(4.2)(0.135)

Let's Try It:

Let's use different methods to find the product of decimals!


Name ______________________ G5 Lesson 4.8 Let's Try It

Let's compute (0.23) · (1.5) using different strategies.

STRATEGY #1: Use fractions.

1. Write 0.23 as a fraction. ________
2. Write 1.5 as a fraction. ________
3. Multiply the fractions.
4. Rewrite your fraction answer in decimal form.

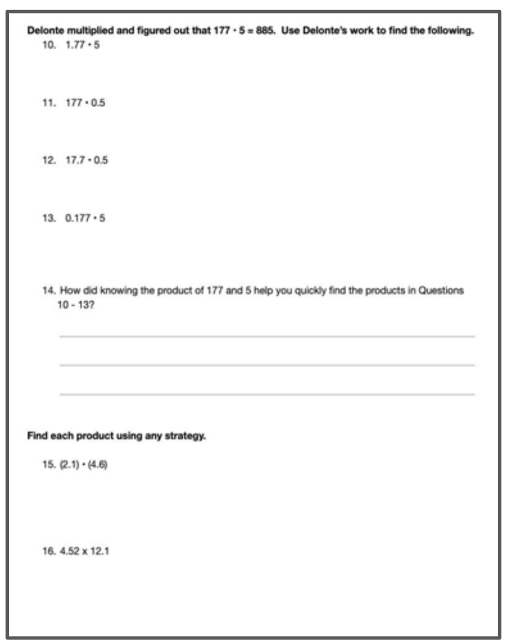
STRATEGY #2: Rewrite with whole numbers.

5. 0.23 x _____ = 23
6. 1.5 x _____ = 15
7. Find 15 x 23.
8. Divide by the amount you multiplied each factor by to return your whole number answer into decimal form.

STRATEGY #3: Vertical algorithm.

9. Multiply the digits 23 and 15. Then place the decimal in your product according to the place value of each factor.

$$\begin{array}{r} 0.23 \\ \times\ 1.5 \\ \hline \end{array}$$

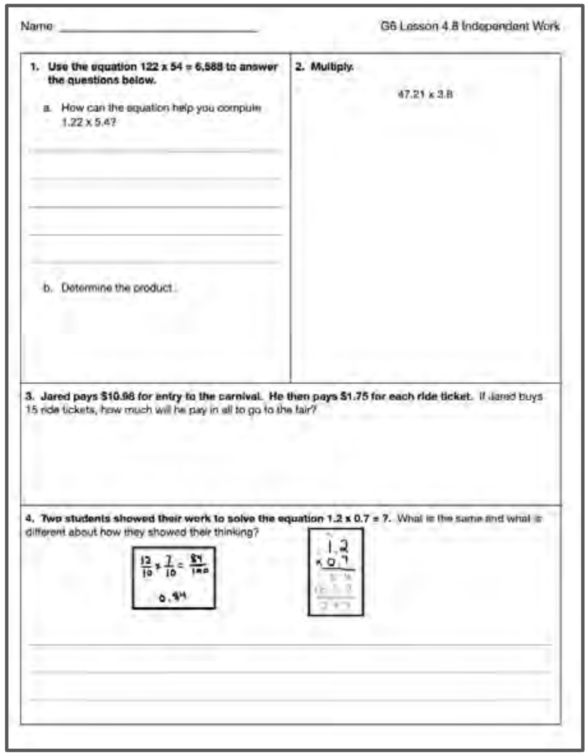

Delonte multiplied and figured out that 177 · 5 = 885. Use Delonte's work to find the following.

10. 1.77 · 5
11. 177 · 0.5
12. 17.7 · 0.5
13. 0.177 · 5
14. How did knowing the product of 177 and 5 help you quickly find the products in Questions 10 - 13?

Find each product using any strategy.

15. (2.1) · (4.6)
16. 4.52 x 12.1

On your Own:


Name: ______________________ G6 Lesson 4.8 Independent Work

1. Use the equation 122 x 54 = 6,588 to answer the questions below.

a. How can the equation help you compute 1.22 x 5.4?

b. Determine the product.

2. Multiply.

47.21 x 3.8

3. Jared pays $10.98 for entry to the carnival. He then pays $1.75 for each ride ticket. If Jared buys 15 ride tickets, how much will he pay in all to go to the fair?

4. Two students showed their work to solve the equation 1.2 x 0.7 = ?. What is the same and what is different about how they showed their thinking?

$\frac{12}{10} \times \frac{7}{10} = \frac{84}{100}$

0.84

Name ________________________________

Let’s compute (0.23) • (1.5) using different strategies.

STRATEGY #1: Use fractions.

1. Write 0.23 as a fraction. __________

2. Write 1.5 as a fraction. __________

3. Multiply the fractions.

4. Rewrite your fraction answer in decimal form.

STRATEGY #2: Rewrite with whole numbers.

5. 0.23 x _____ = 23

6. 1.5 x _____ = 15

7. Find 15 x 23.

8. Divide by the amount you multiplied each factor by to return your whole number answer into decimal form.

STRATEGY #3: Vertical algorithm.

9. Multiply the digits 23 and 15. Then place the decimal in your product according to the place value of each factor.

$$\begin{array}{r} 0.23 \\ \times\ 1.5 \\ \hline \end{array}$$

Delonte multiplied and figured out that 177 • 5 = 885. Use Delonte's work to find the following.

10. 1.77 • 5

11. 177 • 0.5

12. 17.7 • 0.5

13. 0.177 • 5

14. How did knowing the product of 177 and 5 help you quickly find the products in Questions 10 - 13?

Find each product using any strategy.

15. (2.1) • (4.6)

16. 4.52 x 12.1

1. Use the equation 122 x 54 = 6,588 to answer the questions below.

a. How can the equation help you compute 1.22 x 5.4?

____

____

____

____

____

b. Determine the product.

2. Multiply.

47.21 x 3.8

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$$\frac{12}{10} \times \frac{7}{10} = \frac{84}{100}$$

0.84

$$\begin{array}{r} 1.2 \\ \times\ 0.7 \\ \hline 84 \\ +000 \\ \hline 0.84 \end{array}$$

____

____

____

Name KE-1

Let's compute (0.23) · (1.5) using different strategies.

STRATEGY #1: Use fractions.

1. Write 0.23 as a fraction. $\frac{23}{100}$

2. Write 1.5 as a fraction. $\frac{15}{10}$

3. Multiply the fractions.

$$\frac{23}{100} \times \frac{15}{10} = \frac{345}{1000}$$

$$\begin{array}{r} 23 \\ \times 15 \\ \hline 115 \\ 230 \\ \hline 345 \end{array}$$

4. Rewrite your fraction answer in decimal form.

0.345

STRATEGY #2: Rewrite with whole numbers.

5. 0.23 x 100 = 23

6. 1.5 x 10 = 15

7. Find 15 x 23.

345

8. Divide by the amount you multiplied each factor by to return your whole number answer into decimal form.

345 ÷ 1000 = 0.345

digits shift 3 place values

STRATEGY #3: Vertical algorithm.

9. Multiply the digits 23 and 15. Then place the decimal in your product according to the place value of each factor.

$$\begin{array}{r} 0.23 \\ \times 1.5 \\ \hline 115 \\ 0230 \\ \hline 0.345 \end{array}$$

0.345

Delonte multiplied and figured out that 177 • 5 = 885. Use Delonte's work to find the following.

10. 1.77 • 5

$$\begin{array}{r} 177 \\ \times\ 5 \\ \hline 885 \end{array}$$

8.85

11. 177 • 0.5

885, 88.5

12. 17.7 • 0.5

885, 8.85

13. 0.177 • 5

885, 0.885

14. How did knowing the product of 177 and 5 help you quickly find the products in Questions 10 - 13?

The digits in each product were 885. I just had to keep track of each factors decimal place values to know where to put the decimal in the product.

Find each product using any strategy.

15. (2.1) • (4.6)

$\frac{21}{10} \times \frac{46}{10} = \frac{966}{100}$

9.66

$$\begin{array}{r} 21 \\ \times\ 46 \\ \hline 126 \\ +840 \\ \hline 966 \end{array}$$

16. 4.52 x 12.1

$$\begin{array}{r} 452 \\ \times\ 12.1 \\ \hline 502 \\ 9040 \\ +45200 \\ \hline 54742 \end{array}$$

54.742

1. Use the equation 122 x 54 = 6,588 to answer the questions below.

a. How can the equation help you compute 1.22 x 5.4?

I'll use the digits in the product (6588) and shift the decimal in 3 place values.

b. Determine the product.

6588

6.588

2. Multiply.

47.21 x 3.8

$$\begin{array}{r} 47.21 \\ \times\ 3.8 \\ \hline 37568 \\ +141630 \\ \hline 179198 \end{array}$$

179.198

3. Jared pays $10.98 for entry to the carnival. He then pays $1.75 for each ride ticket. If Jared buys 15 ride tickets, how much will he pay in all to go to the fair?

10.98 + (1.75 x 15)
entry tickets

$$\begin{array}{r} 1.75 \\ \times\ 15 \\ \hline 875 \\ 1750 \\ \hline 26.25 \end{array}$$

$$\begin{array}{r} 10.98 \\ +26.25 \\ \hline 37.23 \end{array}$$

$37.23

4. Two students showed their work to solve the equation 1.2 x 0.7 = ?. What is the same and what is different about how they showed their thinking?

$\frac{12}{10} \times \frac{7}{10} = \frac{84}{100}$

0.84

$$\begin{array}{r} 1.2 \\ \times\ 0.7 \\ \hline 84 \\ +000 \\ \hline 0.84 \end{array}$$

One student rewrote each factor as fractions, and the other used the algorithm. They each ended up with the same product.

G6 U4 Lesson 9

Use area diagrams to represent and justify how to find the product of two decimals

G6 U4 Lesson 9 - Students will use area diagrams to represent and justify how to find the product of two decimals

Warm Welcome (Slide 1): Tutor choice.

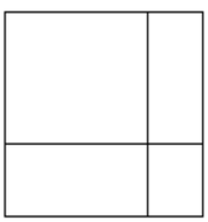
Frame the Learning/Connect to Prior Learning (Slide 2): Think back to our previous lesson. We looked at a variety of strategies to help us multiply decimals. Today, we're going to keep thinking about multiplying with decimals, but we're going to focus on a strategy you've probably seen before with whole numbers: The area model or area diagram!

Let's Talk (Slide 3): Before we dive into decimals, let's look at this fourth grader's work. **They were multiplying 36 x 25. How did this student find the product of 36 x 25?** Possible Student Answers, Key Points:

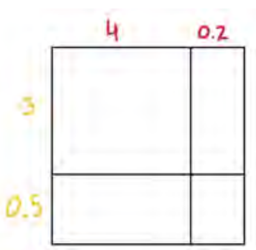
- They broke their numbers up into easier pieces and multiplied the parts. Then they added those parts together to find their answer.
- They used an area model and expanded form. They wrote 36 as 30 + 6 and 25 as 20 + 5, so they could find partial products.

This is an example of an area model or area diagram. We can use them to break apart numbers into expanded form so that we have "friendlier" parts to multiply with. I can't multiply 36 x 25 all at once in my head very quickly, but I can definitely multiply 30 x 20, and 6 x 20, and 30 x 5, and 6 x 5. That's a snap! We can do the same method to help us multiply decimals in parts. Let's explore!

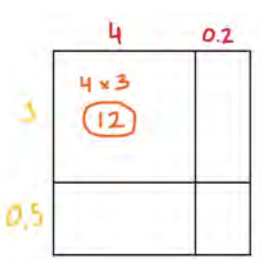
Let's Think (Slide 4): This problem is asking us to use an area diagram to find the product of 4.2 x 3.5. Just like we saw with the whole numbers, we can break these decimal numbers apart and multiply those parts carefully in an area model.



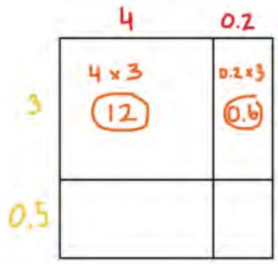
I notice each factor has TWO digits, so I'm going to draw a 2 by 2 area model to start with *(sketch an area model similar to example)*.



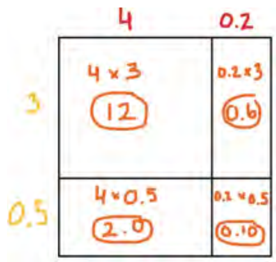
Now I need to break my numbers into expanded form. I know 4.2 has 4 ones and 2 tenths. So I could write it as 4 + 0.2 in expanded form. How could we write 3.5 in expanded form? It has 3 ones and 5 tenths, so we could write it as 3 + 0.5. Excellent. Let's label our area diagram with our expanded factors. Now we have friendly numbers that we can use to multiply efficiently.



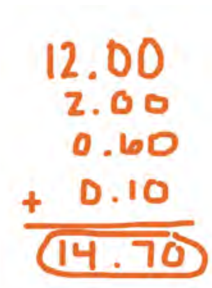
Let's start with the upper left box. *(Point our outline as you talk)* I see 4 and 3 are labeled on the sides of that part, so 4 x 3 is 12. I'll put a 12 in that box *(write 12)*.



Look at the upper right box. I see it is labeled with 0.2, and if I look across the area model, the other side would be 3. Hm, what is 0.2 x 3? *I know 3 groups of 2 tenths would make 6 tenths. So we can put 0.6 in that box.*



Nice. Now let's look at the bottom boxes. On the bottom left I see 4 and 0.5 are being multiplied. I know 4 x 0.5 is 4 groups of 5 tenths, so that's 20 tenths or 2.0. Or I could picture fractions in my head. 4/1 x 5/10 would make 20/10 if I multiply across. 20/10 is 2.0 or 2 wholes. What do we need to multiply in the last box? What would the product be? We need to multiply 0.2 x 0.5. So, 2/10 x 5/10 = 10/100 or 0.10, or I can think of it as 2 x 5 = 10, and 10ths x 10ths = 100ths. 10 hundredths is 0.10.



The area model made it so that our multiplication could mostly be done in our heads. Writing each factor in expanded form, made it so that we were multiplying easier parts of each number rather than the entire decimal number all at once. We just had to slow down a little bit when we were multiplying decimal parts to make sure our place value was accurate. Now all we have left to do is add. Let's go ahead and add our partial products, making sure you are adding like units like we've practiced in previous lessons. We can check our answers when you're finished. *(wait and then check/correct as needed)* Adding all four partial products together gives us a sum of 14.70 or 14.7. Nice work!

Let's Think (Slide 5): Before we jump into practicing, take a look at how another student solved the same problem. **What is the same and what is different about our strategies?** Possible Student Answers, Key Points:

- We both used an area model.
- We both multiplied parts together and then added.
- This student multiplied everything all at once using the algorithm.
- We both got the same answer.

Look closely at our partial products and the numbers the other student added. **Do you see any evidence of our partial product strategy in what this student did?** Possible Student Answers, Key Points:

- The student added 210 and 1260. The 210 is similar to our 2.10 from multiplying 4.2 x 0.5, and the 1260 is similar to our 12.60 from multiplying 4.2 x 3.

Good observations! The student multiplied 42 x 5 to make 210, and then 42 x 30 to make 1260. We kept our decimals in place for the area model, but we also see similar partial products from when we multiplied 4.2 x 0.5 across the bottom and 4.2 x 3 across the top row of our area diagram.

That's interesting. Even though the strategies can appear quite different, both strategies still involve multiplying in parts and adding those parts together.

Let's Try it (Slide 6-7): Now let's work together to use area diagrams to represent and justify how to find the product of two decimals. We've explored lots of ways to think about decimal multiplication. When we use an area diagram, we break out decimal numbers up into more manageable pieces to multiply similar to how we first learned to multiply whole numbers in 3rd and 4th grade. Let's practice how this looks on some more problems.

WARM WELCOME

Today we will use area diagrams to represent and justify how to find the product of two decimals.

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Let's Talk:

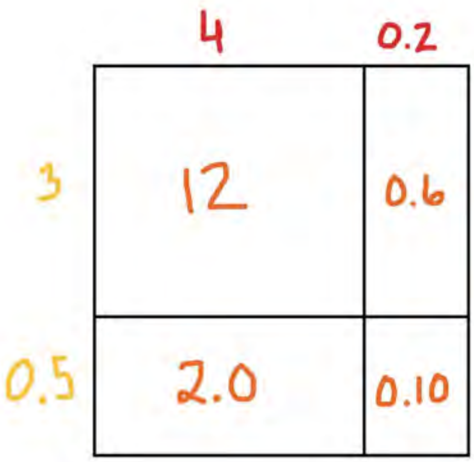
How did this student find the product of 36 x 25?

Let's Think:

Use an area diagram to find the product of 4.2 x 3.5.

Let's Think:

Use an area diagram to find the product of 4.2 x 3.5.



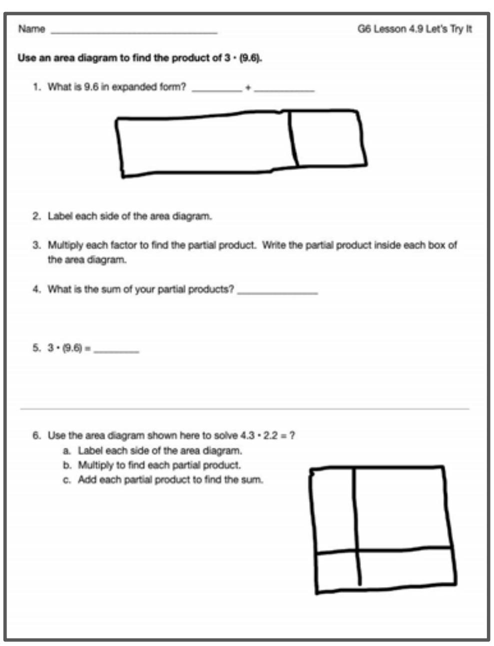
$$\begin{array}{r} 12.00 \\ 2.00 \\ 0.60 \\ +\ 0.10 \\ \hline 14.70 \end{array}$$

$$\begin{array}{r} 4.2 \\ \times\ 3.5 \\ \hline 210 \\ +1260 \\ \hline 14.70 \end{array}$$

14.70

Let's Try It:

Let's use area diagrams to represent and justify how to find the product of two decimals!

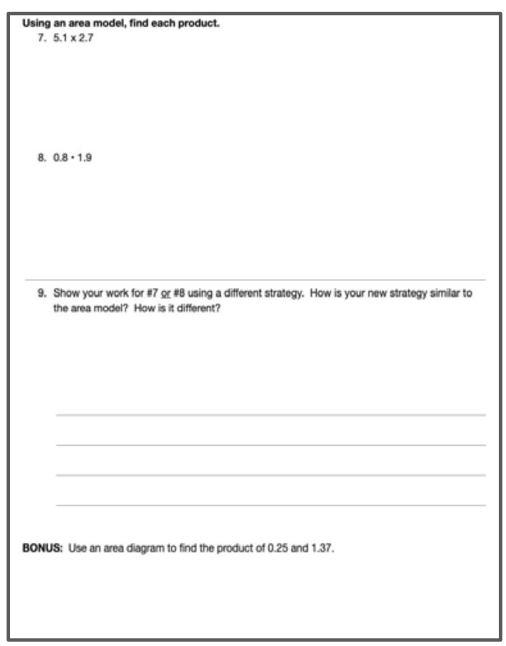


Name ______________________ G6 Lesson 4.9 Let's Try It

Use an area diagram to find the product of 3 • (9.6).

1. What is 9.6 in expanded form? ________ + ________
2. Label each side of the area diagram.
3. Multiply each factor to find the partial product. Write the partial product inside each box of the area diagram.
4. What is the sum of your partial products? ____________
5. 3 • (9.6) = _______

6. Use the area diagram shown here to solve 4.3 • 2.2 = ?
   a. Label each side of the area diagram.
   b. Multiply to find each partial product.
   c. Add each partial product to find the sum.



Using an area model, find each product.

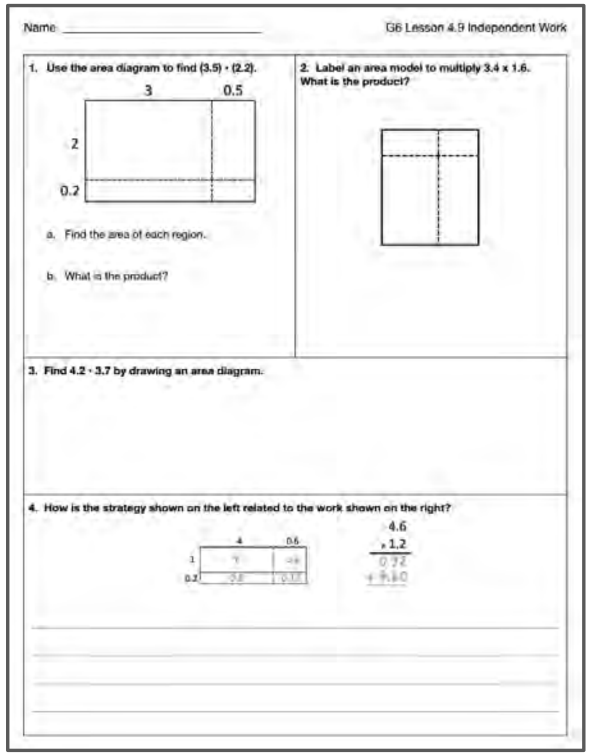
7. 5.1 x 2.7

8. 0.8 • 1.9

9. Show your work for #7 or #8 using a different strategy. How is your new strategy similar to the area model? How is it different?

BONUS: Use an area diagram to find the product of 0.25 and 1.37.

On your Own:


Name ______________________ G6 Lesson 4.9 Independent Work

1. **Use the area diagram to find (3.5) · (2.2).**

   3 0.5

   2

   0.2

   a. Find the area of each region.

   b. What is the product?

2. **Label an area model to multiply 3.4 x 1.6. What is the product?**

3. **Find 4.2 · 3.7 by drawing an area diagram.**

4. **How is the strategy shown on the left related to the work shown on the right?**

   4 0.6

   1

   0.2

   4.6

   x 1.2

Name _______________________________

Use an area diagram to find the product of 3 • (9.6).

1. What is 9.6 in expanded form? _________ + ___________

2. Label each side of the area diagram.

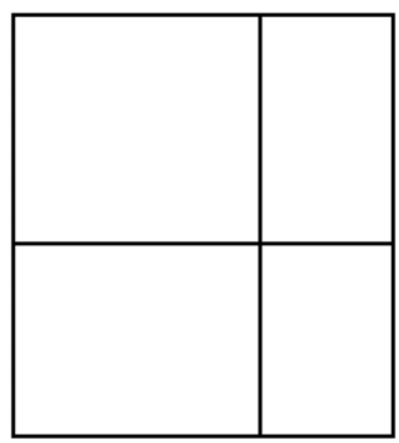
3. Multiply each factor to find the partial product. Write the partial product inside each box of the area diagram.

4. What is the sum of your partial products? _______________

5. 3 • (9.6) = ________

---

6. Use the area diagram shown here to solve 4.3 • 2.2 = ?
   a. Label each side of the area diagram.
   b. Multiply to find each partial product.
   c. Add each partial product to find the sum.



Using an area model, find each product.

7. 5.1 x 2.7

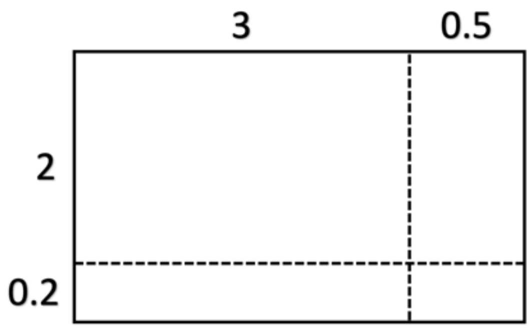
8. 0.8 • 1.9

9. Show your work for #7 or #8 using a different strategy. How is your new strategy similar to the area model? How is it different?

BONUS: Use an area diagram to find the product of 0.25 and 1.37.

Name ______________________________

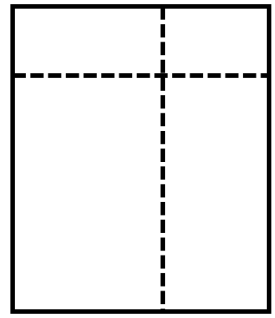
1. Use the area diagram to find (3.5) • (2.2).



a. Find the area of each region.

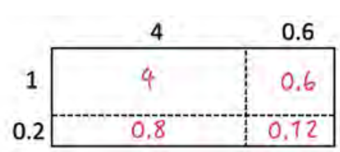
b. What is the product?

2. Label an area model to multiply 3.4 x 1.6. What is the product?



3. Find 4.2 • 3.7 by drawing an area diagram.

4. How is the strategy shown on the left related to the work shown on the right?



$$\begin{array}{r} 4.6 \\ \times\ 1.2 \\ \hline 0.92 \\ +\ 4.60 \\ \hline \end{array}$$

____

____

____

____

Name KEY

Use an area diagram to find the product of 3 • (9.6).

1. What is 9.6 in expanded form? 9 + 0.5

	9	0.5
3	27 (3×9)	1.5 (3×0.5)

2. Label each side of the area diagram. ✓

3. Multiply each factor to find the partial product. Write the partial product inside each box of the area diagram.

4. What is the sum of your partial products? 28.5

$$\begin{array}{r} 27.0 \\ +\ 1.5 \\ \hline 28.5 \end{array}$$

5. 3 • (9.6) = 28.5

---

6. Use the area diagram shown here to solve 4.3 • 2.2 = ?
   a. Label each side of the area diagram. ✓
   b. Multiply to find each partial product.
   c. Add each partial product to find the sum.

	4	0.3
2	8	0.6
0.2	0.8	0.06

$$\begin{array}{r} {}^{1} \\ 8.00 \\ 0.80 \\ 0.60 \\ +\ 0.06 \\ \hline 9.46 \end{array}$$

Using an area model, find each product.

7. 5.1 x 2.7

	2	0.7
5	10	3.5
0.1	0.2	0.07

$$\begin{array}{r} 10.00 \\ 3.50 \\ 0.20 \\ +\,0.07 \\ \hline 13.77 \end{array}$$

8. 0.8 • 1.9

	1	0.9
0.8	0.8	0.72

$$\begin{array}{r} 0.80 \\ +\,0.72 \\ \hline 1.52 \end{array}$$

---

9. Show your work for #7 <u>or</u> #8 using a different strategy. How is your new strategy similar to the area model? How is it different?

$$\begin{array}{r} \overset{7}{1.9} \\ \times\ \ .8 \\ \hline 152 \end{array}$$

1.52

I used the algorithm. I got the same final product, but I multiplied each factor at once rather than in parts.

BONUS: Use an area diagram to find the product of 0.25 and 1.37.

	1	0.3	0.07
0.2	0.2	0.06	0.014
0.05	0.05	0.015	0.0035

$$\begin{array}{r} 0.2000 \\ 0.0500 \\ 0.0600 \\ 0.0150 \\ 0.0140 \\ +\,0.0035 \\ \hline 0.3425 \end{array}$$

0.3425

Name KEY

1. **Use the area diagram to find (3.5) · (2.2).**

	3	0.5
2	6	1
0.2	0.6	0.1

a. Find the area of each region.

b. What is the product?

6 + 1 + 0.6 + 0.1

7 + 0.7

7.7

2. **Label an area model to multiply 3.4 x 1.6. What is the product?**

	1	0.6
0.4	0.4	0.24
3	3	1.8

$$\begin{array}{r} 3.00 \\ 1.80 \\ 0.40 \\ +\ 0.24 \\ \hline 5.44 \end{array}$$

5.44

3. **Find 4.2 · 3.7 by drawing an area diagram.**

	4	0.2
3	12	0.6
0.7	2.8	0.14

$$\begin{array}{r} 12.00 \\ 2.80 \\ 0.60 \\ +\ 0.14 \\ \hline 15.54 \end{array}$$

15.54

4. **How is the strategy shown on the left related to the work shown on the right?**

	4	0.6
1	4	0.6
0.2	0.8	0.12

$$\begin{array}{r} 4.6 \\ \times\ 1.2 \\ \hline 0.92 \\ +\ 4.60 \\ \hline \end{array}$$

Both show the same factors and product. The area model breaks each factor into expanded form to multiply in parts. The algorithm keeps each factor intact and multiplies one place value at a time.

G6 U4 Lesson 10

Use the partial quotients method and the place value chart to divide

G6 U4 Lesson 10 - Students will use the partial quotients method and the place value chart to divide

Warm Welcome (Slide 1): Tutor choice.

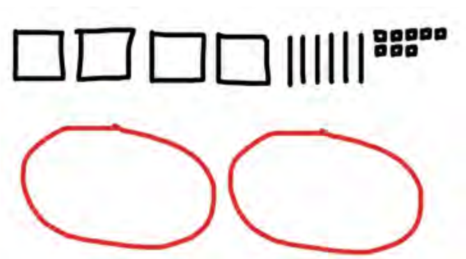
Frame the Learning/Connect to Prior Learning (Slide 2): In the next few lessons, we're going to pivot from talking about decimal multiplication to learning lots about decimal division. Before we get to decimals, today is going to refresh us on a couple ways we can think about whole number division. It's likely you've seen a lot of this in 4th and 5th grade, so today is a great chance to refresh and build our skills.

Let's Talk (Slide 3): In your own words, **what would you say is the same or different about multiplication and division?** You don't need to evaluate the expressions on the slide, but you're welcome to use them to help you explain your thinking. Possible Student Answers, Key Points:

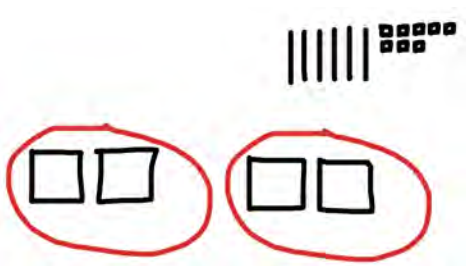
- They're opposites.
- Multiplication is like repeated addition. The bigger the number we're multiplying by, the more equal groups we have. Division is like taking away equal groups; we want to know how many of a number goes into another number.
- 36 times 12 we could think of as 36 groups of 12. Whereas 36 divided by 12 we could think of as how many groups of 12 fit into 36, or 12 groups of what number fit into 36.
- If we multiply 36 times 12, we'll get a bigger number than 36. If we divide 36 by 12, we'll get a smaller number than 36.

You named some great ideas. Let's now refresh ourselves on how we can represent division using place value models and the partial quotients method.

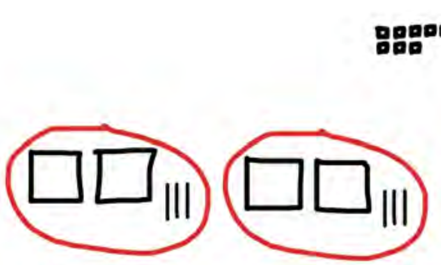
Let's Think (Slide 4): This question wants us to divide 468 by 2 using a place value model and partial quotients. As a reminder, the number we're dividing is called our DIVIDEND (468). The number we're dividing by is our divisor (2). The answer we get is our QUOTIENT.



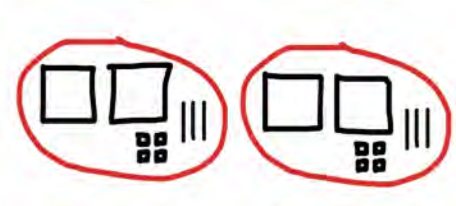
We can think of this problem as wanting us to split 468 into 2 equal groups. Let's start by modeling the dividend, since that's what we're going to have to split up. I'll model 4 hundreds with large squares, 6 tens with rods, and 8 ones with small squares. Then I'll draw two circles/ovals as my groups. Now all we have to do is share everything evenly.



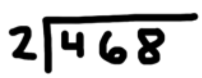
Let's start in the biggest place value. I have 4 hundreds. If I share them between 2 groups, how many should I put in each group? 2! Let's do that.



Great, now let's move onto the tens. I have 6 tens. If I split them between 2 groups, how many should I put in each group? 3! Let's show that.

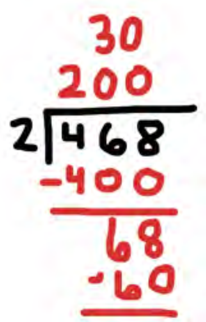


And then what do you think I'm going to do last? We can split the 8 ones into 2 groups. So there should be 4 in each group. Let's show that. So now I can see we have 2 hundreds, 3 tens, and 4 ones in each group. So 468 divided by 2 is 234. We did it!

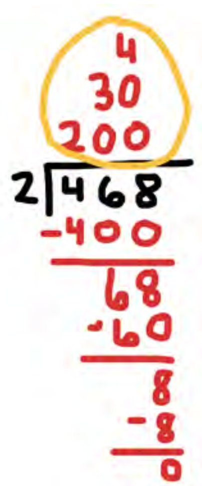


We can show what we did using partial quotients, too. To do that, we set up our division using a fancy thing called a vinculum. You might call it a division bar, and that's okay. Our divisor goes outside the bar and our dividend goes inside.

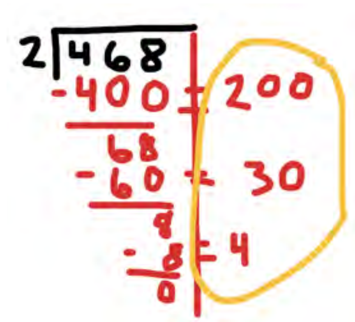
What did we do first in our model? We took the 4 hundred and put 2 hundred in each group. We show that in our partial quotients method like this *(write it out like example shown here))*. We use the top of the division bar to show what went into each group, and then we subtract beneath our dividend to keep track of what was leftover in our model/dividend.



468 take away the 400 that we shared evenly leaves us with 68 left to put into groups. We then took our 6 tens or 60, and split it into 2 groups. That meant we had 30 in each group, so I'll write 30 up above and take away the 60 that we split into groups. We're left with 8 ones in our dividend. What did we do next? *We split the 8 ones into the 2 groups, so we put 4 in each group!*

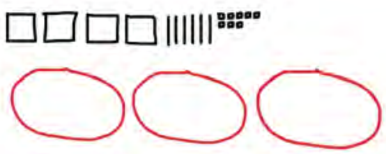


Correct, so I'll take away the 8 we shared and put 4 up top to show that 4 ones went into each group. Our quotient appears up top above the division bar in parts. That's why this method is called partial quotients. So, 200 + 30 + 4, means our quotient is 234.



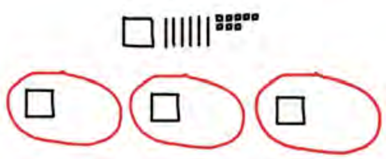
Depending on how you've learned this previously, you may have also seen your quotient written to the side like this *(show or write out an example).* Either way of showing the partial quotients is accurate, so do what you feel most comfortable with.

Let's Think (Slide 5): We just used a model and partial quotients to solve a whole number division problem. Let's look at one more example together that has a unique twist.



This wants us to take 468 and divide it into THREE groups. Let's start with a model, since we already modeled 468. We can use the same model, but we'll need 3 groups this time. Once again, we'll start with the greatest place value. But wait…what is the issue we run into if we try to split 4 hundred into 3 groups? Possible Student Answers, Key Points:

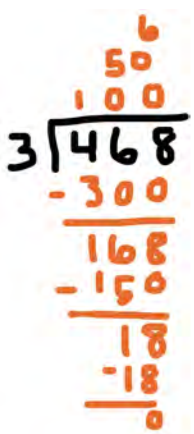
- 4 hundreds can't be split neatly into 3 groups.
- We will have a leftover or extra hundred



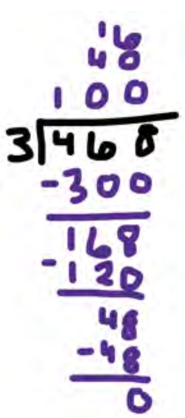
You're right. Let's split up what we can *(put 1 hundred in each group)*. We're left with 1 hundred. I can't split this evenly between 3 groups, so I'm going to break this hundred into tens. How many tens can I make with 1 hundred? 10 tens!

Great, let's cross out this hundred and rewrite it as ten tens rods. Now, how many tens do we have in all? 16! Let's share the tens three ways. Hm, this means we'll have 5 tens in each group, but I have 1 ten left over.

What do you think I'll need to do, since I can't split this ten into a group evenly/fairly? Break it into 10 ones, so it can be split up fairly. Good idea. Let's show that. Now we have 18 ones. Can we split 18 ones up evenly? I think we can! I can put 6 into each group. Let me show that in my model. How much do we have in each group now? 1 hundred, 5 tens, and 6 ones. 156! We have 156 in each group. So 468 divided into 3 groups is 156.



Let's think about what this can look like using a partial quotients method. We write 468 inside our division bar, and 3 outside. We first took 300 and split 100 into each group. I'll write 100 in our partial quotients, and take away the 300 that we split up. That leaves us with 168. Then we had 15 tens, so we put 5 tens or 50 in each group. I'll write 50 in our partial quotients, and take away the 150 that we split up. That left us with 18. I'll write 6 in our partial quotients, and if I take away 18 from our dividend, we are left with nothing to split up. Our quotient is 156, which matches what we showed in our model.



Before we jump into practicing, I want to point out that there are MANY ways to divide using partial quotients. Just because you divide out in certain parts, doesn't mean everyone will. For example, maybe I'm splitting 468 into 3 groups and I start by putting 100 in each group. That leaves me with 168 in my dividend. But I think, hm, I know 3 x 40 is 120, so I could put 40 in each group and take away 120 from my dividend. That leaves me with 48, and I know 3 x 16 is 48. I can put 16 as a partial quotient, and I take away 48 from my dividend. You'll notice I still ended up with 156 as my quotient, but I worked with different partial quotients.

Use the relationships you know and what stands out to you to make your partial quotients as efficient as possible. As a general rule, the bigger the partial quotients you're able to pull out, the more efficiently you'll be able to solve any division problem.

Let's Try it (Slide 6-7): Now let's work together to use the partial quotients method and place value charts to divide. Similar to how we can break apart numbers to help us multiply, we can also break apart our dividends to help us divide in easier parts. We'll break our dividends up into parts that make sense to use, and then bring those parts together to arrive at our final quotient. Let's go!

WARM WELCOME

Today we will use the partial quotients method and the place value chart to divide.

Let's Talk:

What's the same or different about multiplication and division?

$36 \cdot 12$

$36 \div 12$

Let's Think:

Divide using a place value model and using partial quotients.

$468 \div 2$

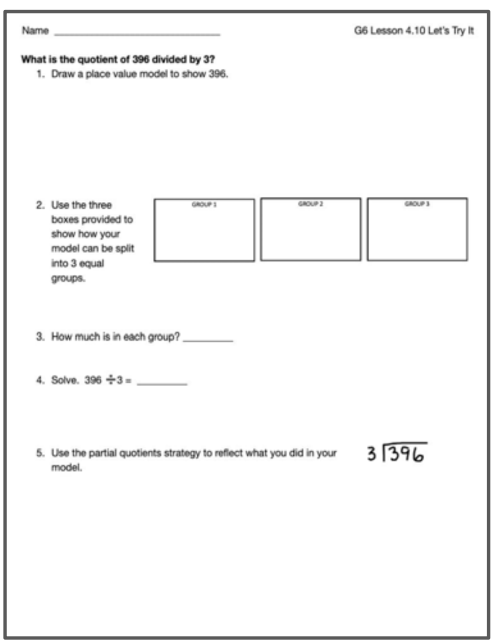
Let's Think:

Divide using a place value model and using partial quotients.

$468 \div 3$

Let's Try It:

Let's use the partial quotients method and the place value chart to divide!



Name ______________________ G6 Lesson 4.10 Let's Try It

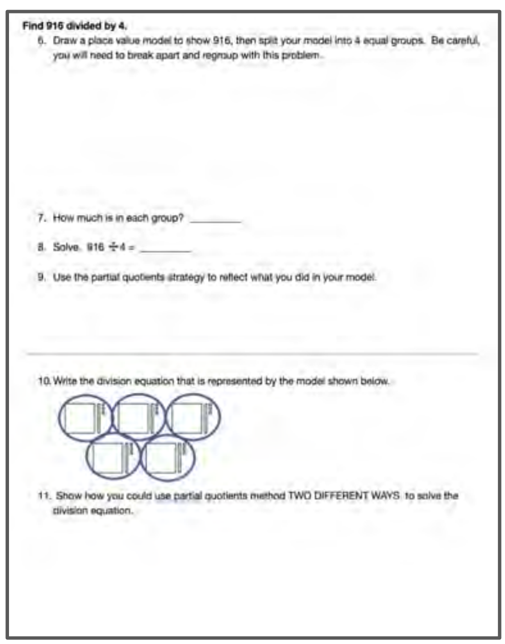
What is the quotient of 396 divided by 3?

1. Draw a place value model to show 396.
2. Use the three boxes provided to show how your model can be split into 3 equal groups.

GROUP 1	GROUP 2	GROUP 3

3. How much is in each group? ________
4. Solve. $396 \div 3 =$ ________
5. Use the partial quotients strategy to reflect what you did in your model.

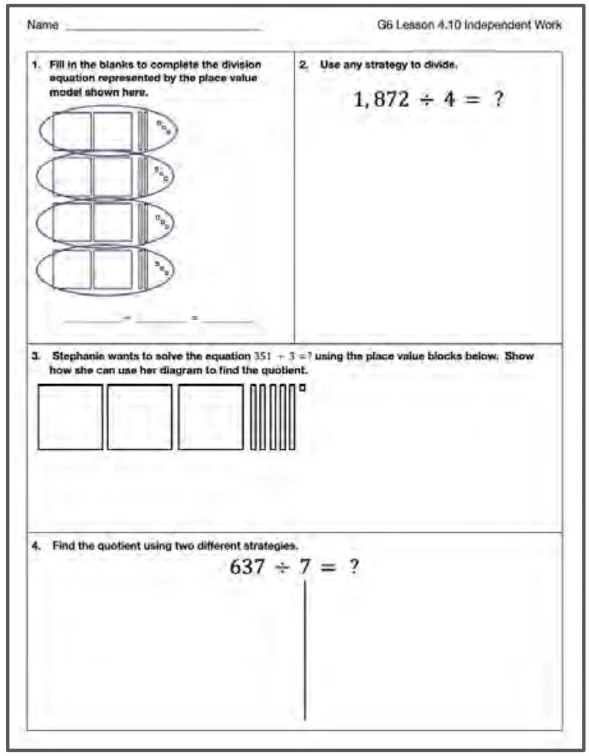
$3\overline{)396}$



Find 916 divided by 4.

6. Draw a place value model to show 916, then split your model into 4 equal groups. Be careful, you will need to break apart and regroup with this problem.
7. How much is in each group? ________
8. Solve. $916 \div 4 =$ ________
9. Use the partial quotients strategy to reflect what you did in your model.
10. Write the division equation that is represented by the model shown below.
11. Show how you could use partial quotients method TWO DIFFERENT WAYS to solve the division equation.

On your Own:


Name ______________ G6 Lesson 4.10 Independent Work

1. Fill in the blanks to complete the division equation represented by the place value model shown here.

   ______ ÷ ______ = ______

2. Use any strategy to divide.

   $1,872 \div 4 = ?$

3. Stephanie wants to solve the equation $351 \div 3 = ?$ using the place value blocks below. Show how she can use her diagram to find the quotient.

4. Find the quotient using two different strategies.

   $637 \div 7 = ?$

What is the quotient of 396 divided by 3?

1. Draw a place value model to show 396.

2. Use the three boxes provided to show how your model can be split into 3 equal groups.

GROUP 1	GROUP 2	GROUP 3

3. How much is in each group? _________

4. Solve. 396 ÷ 3 = _________

5. Use the partial quotients strategy to reflect what you did in your model.

$3\overline{)396}$

Find 916 divided by 4.

6. Draw a place value model to show 916, then split your model into 4 equal groups. Be careful, you will need to break apart and regroup with this problem.

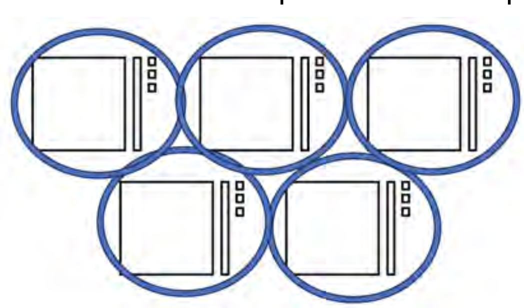
7. How much is in each group? __________

8. Solve. 916 ÷ 4 = __________

9. Use the partial quotients strategy to reflect what you did in your model.

---

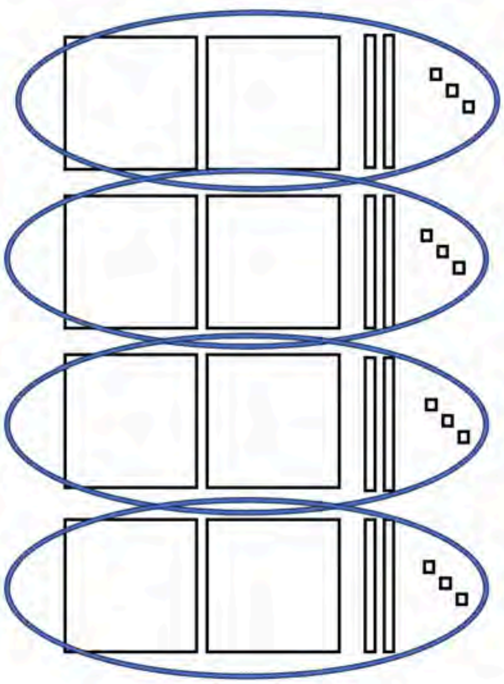
10. Write the division equation that is represented by the model shown below.



11. Show how you could use partial quotients method TWO DIFFERENT WAYS to solve the division equation.

Name ______________________________

1. Fill in the blanks to complete the division equation represented by the place value model shown here.

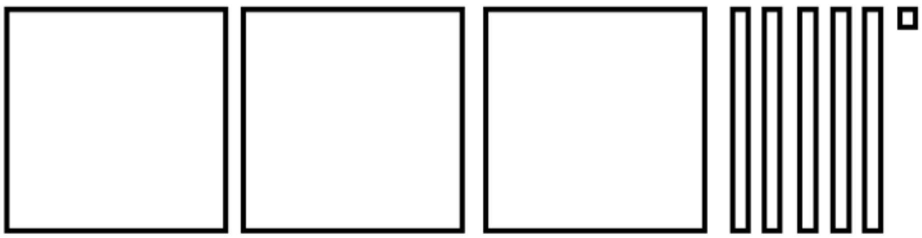


_________ ÷ _________ = _________

2. Use any strategy to divide.

$$1,872 \div 4 = ?$$

3. **Stephanie wants to solve the equation $351 \div 3 = ?$ using the place value blocks below. Show how she can use her diagram to find the quotient.**



4. **Find the quotient using two different strategies.**

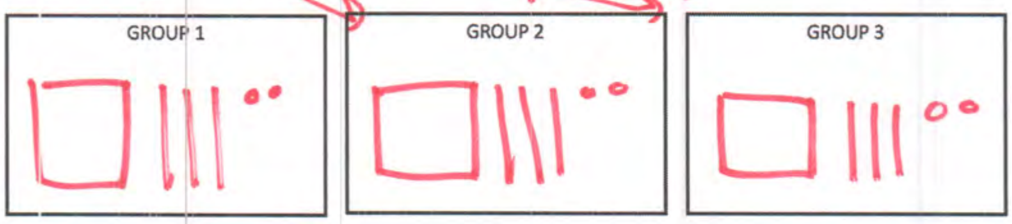
$$637 \div 7 = ?$$

Name KEY

What is the quotient of 396 divided by 3?

1. Draw a place value model to show 396.

2. Use the three boxes provided to show how your model can be split into 3 equal groups.



3. How much is in each group? 132

4. Solve. 396 ÷ 3 = 132

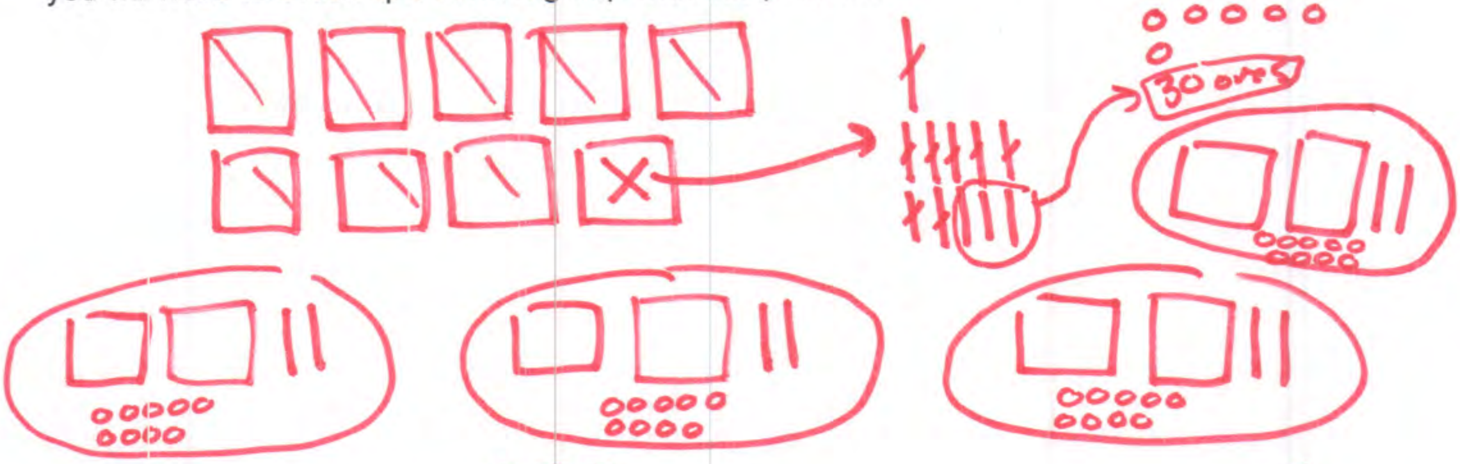
5. Use the partial quotients strategy to reflect what you did in your model.

132

```
   2
  30
 100
3)396
 -300
   96
  -90
    6
   -6
    0
```

Find 916 divided by 4.

6. Draw a place value model to show 916, then split your model into 4 equal groups. Be careful, you will need to break apart and regroup with this problem.



7. How much is in each group? 229

8. Solve. 916 ÷ 4 = 229

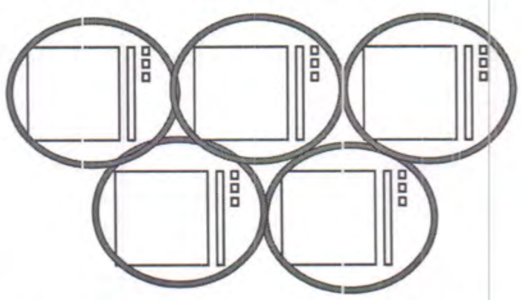
9. Use the partial quotients strategy to reflect what you did in your model.

$$\begin{array}{r} 9 \\ 20 \\ 200 \\ 4\overline{)916} \\ -800 \\ \hline 116 \\ -80 \\ \hline 36 \\ -36 \\ \hline 0 \end{array}$$

229

---

10. Write the division equation that is represented by the model shown below.



$$\begin{array}{r} 500 \\ +\ 50 \\ +\ 15 \\ \hline 565 \end{array}$$

565 ÷ 5 = 113
total groups in each group

565÷5=113

11. Show how you could use partial quotients method TWO DIFFERENT WAYS to solve the division equation.

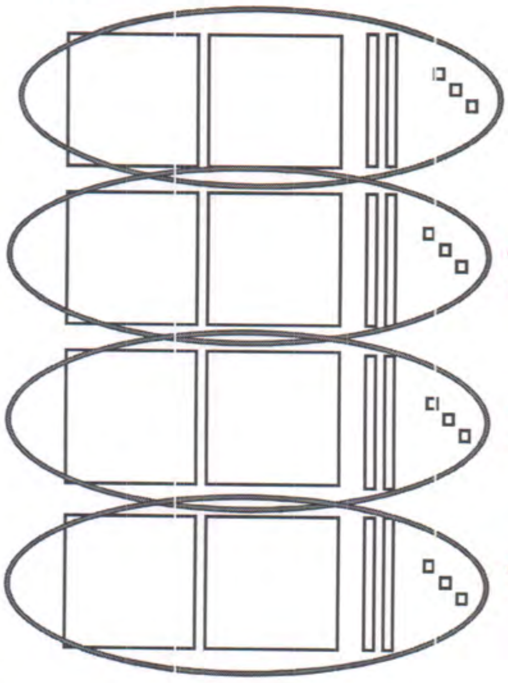
$$\begin{array}{r} 3 \\ 10 \\ 100 \\ 5\overline{)565} \\ -500 \\ \hline 65 \\ -50 \\ \hline 15 \\ -15 \\ \hline 0 \end{array} = 113$$

$$\begin{array}{rl} 5\overline{)565} & \\ -500 & = 100 \\ \hline 65 & \\ -65 & = 13 \\ \hline 0 & \end{array}$$

113

Name KEY

1. **Fill in the blanks to complete the division equation represented by the place value model shown here.**



223

223

223

223

892 ÷ 4 = 223

total groups

2. **Use any strategy to divide.**

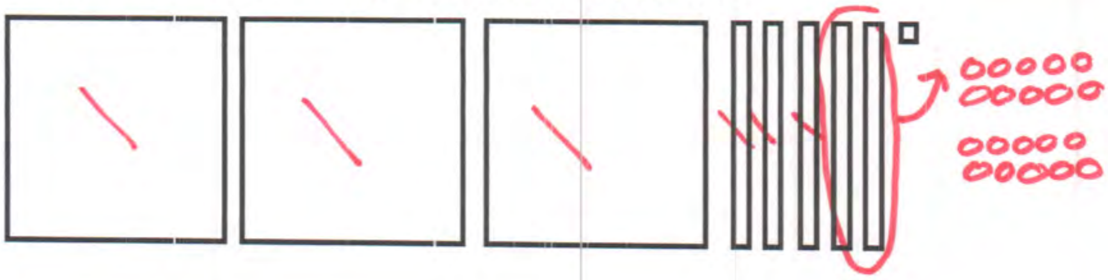
$$1,872 \div 4 = \ ?$$

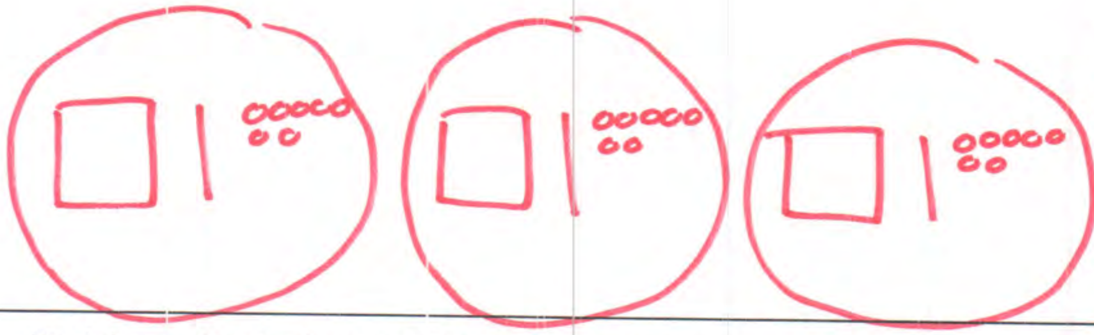
8
60
400

4 | 1872
−1600
272
−240
32
−32
0

468

3. **Stephanie wants to solve the equation $351 \div 3 = ?$ using the place value blocks below. Show how she can use her diagram to find the quotient.**





117

4. **Find the quotient using two different strategies.**

$$637 \div 7 = ?$$

$$\begin{array}{r} 1 \\ 90 \\ 7\overline{)637} \\ -630 \\ \hline 7 \\ -7 \\ \hline 0 \end{array}$$

91

$$\begin{array}{r} 1 \\ 80 \\ 10 \\ 7\overline{)637} \\ -70 \\ \hline 567 \\ -560 \\ \hline 7 \\ -7 \\ \hline 0 \end{array}$$

91

G6 U4 Lesson 11

Use the long division method to divide

G6 U4 Lesson 11 - Students will use the long division method to divide

Warm Welcome (Slide 1): Tutor choice.

Frame the Learning/Connect to Prior Learning (Slide 2): Last time we were together, we refreshed on how we can use place value models and partial quotients to solve division problems. Today, we're going to look at one more common strategy people use to divide. You may have heard of it before; it's called long division. Today we'll see how it is an efficient way to divide, and we'll explore how it connects to other strategies we're familiar with.

Let's Talk (Slide 3): Take a look at this problem that we solved using partial quotients during our previous lesson. **In your own words, can you walk me through how we used partial quotients to arrive at our answer?** Possible Student Answers, Key Points:

- We thought about splitting 468 into 3 groups. We knew we could take 300 and put 100 in each group, so we wrote 100 as one partial quotient and subtracted the 300 we split up from our dividend. That left us with 168. We knew we could take 150 and put 50 in each group. 50 went in our partial quotients, and we took away the 150 from our dividend. That left us with 18, and 18 split into 3 groups is 6.
- Then we added our partial quotients to get our full quotient. 100 + 50 + 6 is 156.
- We could do it differently but this was the fastest way!

Great explanation. Keep that in the back of your mind as we look at the same problem using LONG DIVISION.

Let's Think (Slide 4): Here we see our partial quotients on the left in orange. We're going to look at the work in blue that shows long division, step-by-step. As I clarify what this person did, I want you thinking about any similarities or differences you notice between our partial quotients method and this person's long division method. To start with, the student set up the division so he could perform vertical, up/down, calculations. Notice any connections between the strategies so far? Long division starts the same way as partial quotients.

Let's Think (Slide 5): Now let's look at what the student did next. Next, the student knew that there are 3 groups of 1 that can go into 4. The student wrote 1 above the 4 and subtracted 3 from the 4, leaving 1. Then he brought down the 6 tens from 468 which leaves 16 (*point as you narrate*). **What connections do you see now?** Possible Student Answers, Key Points:

- We both have 1 in the hundreds place of our quotients.
- The 3 he subtracted from the 4 represents 3 hundred. In the partial quotients method we did the same thing, but we wrote it out as 300.
- The thinking is similar. In partial quotients, it seems like we're thinking of the full numbers (300, 100, etc) but with long division, we're working more with digits and intentionally putting them in their corresponding place value as we work (ex. the 1 really means 100, so I put it in the hundreds place of my quotient)

Let's Think (Slide 6): Now we have the next thing that this student did. Let's look closely to understand what's happening here. So, there were 16 left (*point to 16*) and it looks like this student knew that there are 3 groups of 5 in 16, so he wrote 5 at the top and subtracted 15 from 16, which left us with a remainder of 1.

Let's Think (Slide 7): And now, the very last step that the student took! Let's look closely, he brought down the 8 ones from 468 and wrote it next to the 1. This made 18. There are 3 groups of 6 in 18, so he wrote 6 at the top and subtracted 18, leaving 0. **Now that we've seen each step of his long division, what do you notice is the same/different?** Possible Student Answers, Key Points:

- He got the same answer, but he wrote it all at once instead of in parts. It's like he was building it step by step.

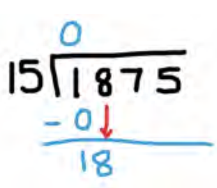
- We both started by thinking about the biggest place value first.
- Both show the quotient up top and the dividend on the bottom. As we worked through both methods, we kept subtracting out the parts we'd already divided so we could keep track of what's left in our dividend.

Those are all great things to notice. In partial quotients, we can divide out any "chunks" that make sense to us until we're left with nothing in our dividend to split up. And remember in partial quotient we can do it lots of different ways–smaller chunks or bigger chunks. But in long division, we work systematically left to right from digit to digit. We subtract out as large a group as possible in each step. We also don't write out the full numbers we're using, instead relying on the precise place value of each digit to show its value.

Let's Think (Slide 8): Let's try this out together. We're dividing 1875 by 15. This divisor is 2-digits. Let's start by looking at what we already know how to do, the partial quotients method! Take a close look at what this student did with the partial quotients method in green. **How did that student get their quotient?** Possible Student Answers, Key Points:

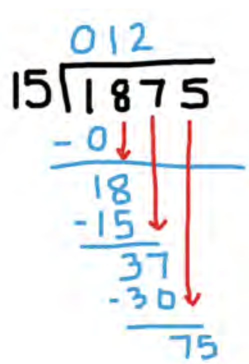
- They thought of splitting 1875 into 15 groups. 15 groups of 100 makes 1500, so they put 100 in their partial quotients and took away 1500 from the dividend. Then they took out 15 groups of 10 and then 15 groups of 10 again, subtracting 150 from the dividend each time. Then they were left with 75. 15 groups of 5 is 75, so they added 5 to the quotient. Their answer would be 125.

That's right, in the partial quotient method, they pulled out quotients they knew in a way that made sense to them. With long division, we're going to work systematically from left to right. Let's start.

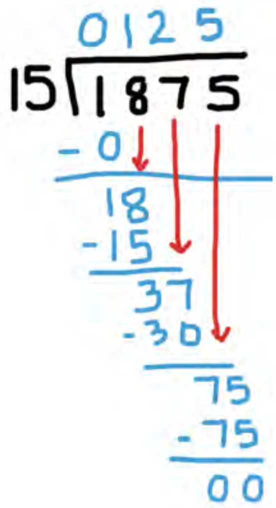


Our first digit in the dividend is 1. I can't fit 15 into 1, so I'm going to start by writing a 0 in my quotient. I'm going to make sure I write it above the 1 so that it represents 0 thousands, since the 1 represents 1 thousand in this problem. I'll subtract 0 from 1, which remains 1. And then I'll bring down my next digit, 8, so it's next to the 1. Now we'll think about 18.

So I have 18 now, let me think…15 groups of what would get me close to 18, or how many 15s can I fit into 18? 15 groups of 1! That's right, I can fit 15 into 18 one time! Let's write 1 in my quotient directly next to the 0, so that it is neatly in the hundreds place. 15 groups of 1 would be 15, so I'm going to subtract that from the 18 in our dividend. 18 - 15 leaves us with 3, and then we'll pull down the next digit. We'll place the 7 next to the 3. Now we'll think about 37.



Okay, so we're at 27 and we want to think about how we can use 15 to get close to 37, it might not fit exactly though! So, 15 groups of what would get me close to 37? 15 groups of 2! That's right, 15 groups of 1 would be too small and 15 groups of 3 would be too big, because that would be 45. 15 groups of 2 gets us as close as possible to 37. Let's put 2 in our quotient, directly next to the 0 and the 1. So, 15 groups of 2 or 15x2 is 30, so we'll take that out of our dividend. And, 37 - 30 leaves us with 7. And we'll pull down our final digit, 5. So now we're looking at 75.



So, we've got 75 left. Let's think about 15 groups of what gets us to 75 OR how many times can 15 go into 75, it might not be exact though? 15 groups of 5! Nice! Let's slide 5 next to the rest of our quotient, and take out the 75 from our dividend. We're left with 0, so we don't have any remainder. What's our final quotient? 125! That's right, we see that from the 0 thousands, 1 hundred, 2 tens, and 5 ones.

Excellent! We just used long division to find our quotient. We didn't work in whatever pieces we wanted to, like the partial quotients example did. Instead, we worked one digit at a time from left to right, placing our digits carefully in our quotient, and then subtracting from our dividend before moving to the next digit.

Let's keep practicing so that this new method becomes more familiar over time. Practice makes perfect.

Let's Try it (Slide 6-7): Now let's work together to use the long division method to divide. Remember, when we use the long division method, we go digit by digit from left to right thinking about how many times our divisor can go into that digit based on its place value. We want to be extra careful about making sure each digit we write is in the correct place value. As we get used to this method, we can continue to use models and partial quotients to double-check our thinking. Let's go for it!

WARM WELCOME

Today we will use the long division method to divide.

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Let's Talk:

In your own words, explain how we used the partial quotients method to divide 468 by 3 in our previous lesson.

$$\begin{array}{r} 6 \\ 50 \\ 100 \\ 3\overline{)468} \\ -300 \\ \hline 168 \\ -150 \\ \hline 18 \\ -18 \\ \hline 0 \end{array}$$

Let's Think:

Let's look at the same problem solved using what is called "long division."

PARTIAL QUOTIENTS METHOD

$$\begin{array}{r} 6 \\ 50 \\ 100 \\ 3\overline{)468} \\ -300 \\ \hline 168 \\ -150 \\ \hline 18 \\ -18 \\ \hline 0 \end{array}$$

LONG DIVISION METHOD

$$3\overline{)468}$$

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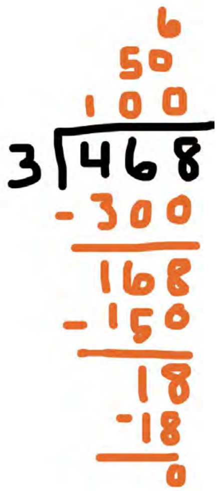
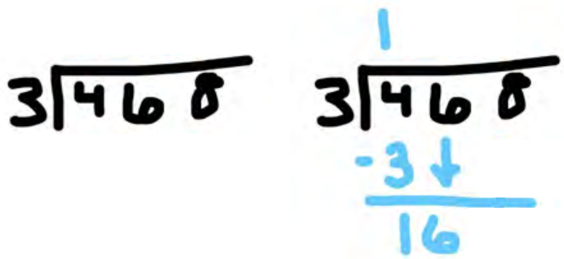
Let's Think:

Let's look at the same problem solved using what is called "long division."

PARTIAL QUOTIENTS METHOD



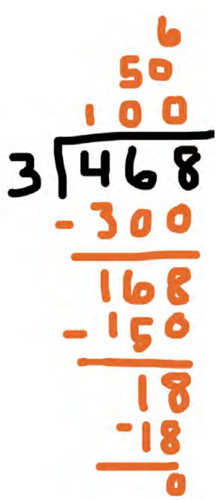
LONG DIVISION METHOD



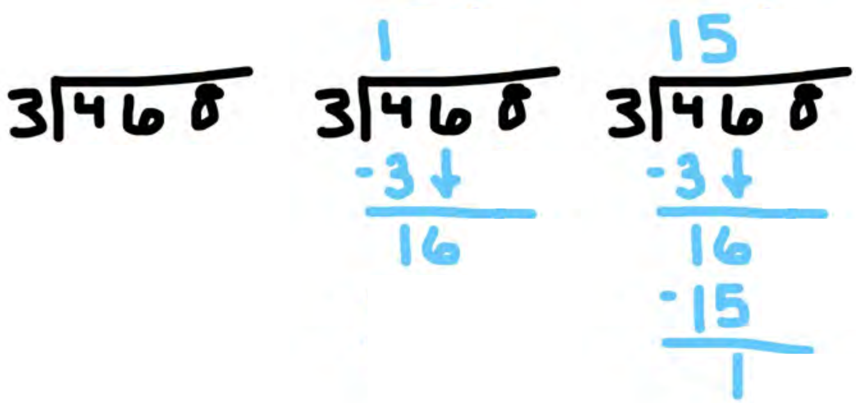
Let's Think:

Let's look at the same problem solved using what is called "long division."

PARTIAL QUOTIENTS METHOD



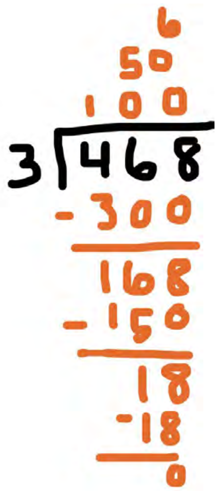
LONG DIVISION METHOD



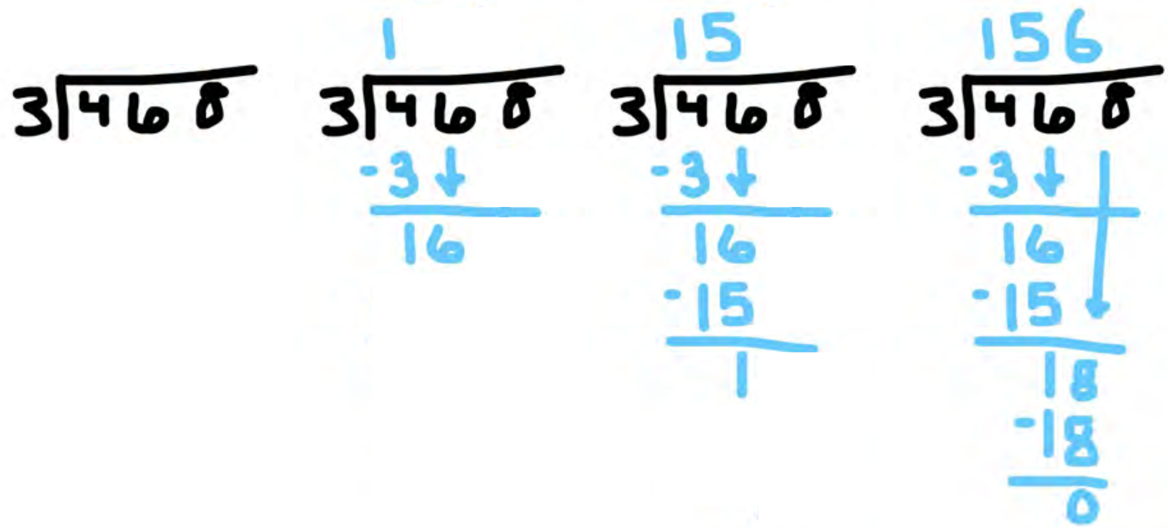
Let's Think:

Let's look at the same problem solved using what is called "long division."

PARTIAL QUOTIENTS METHOD



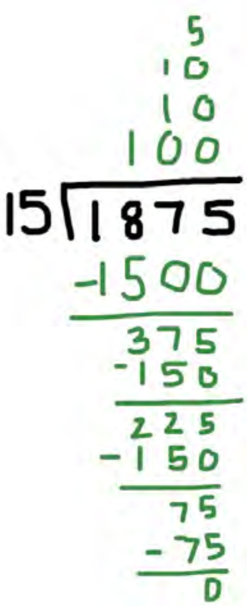
LONG DIVISION METHOD



Let's Think:

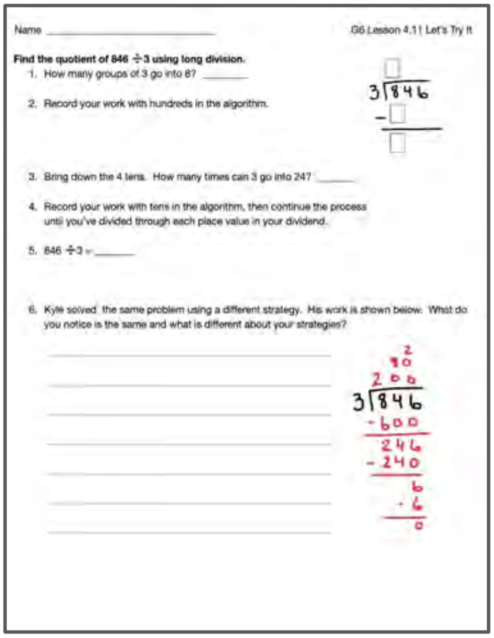
Let's try long division together.

1875 ÷ 15



Let's Try It:

Let's use the long division method to divide!



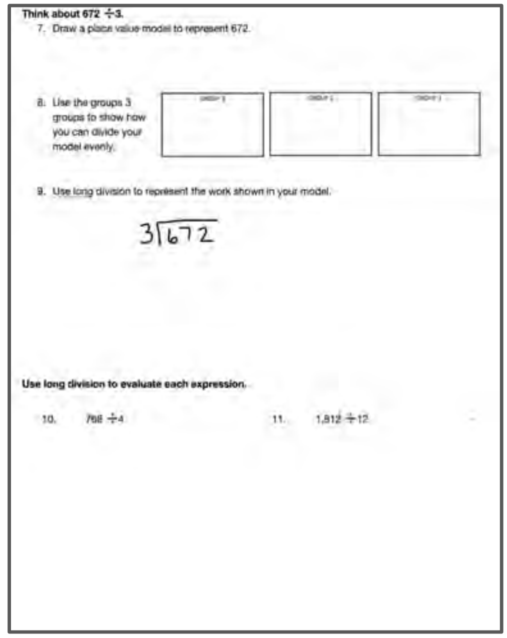
Name ______________________ G6 Lesson 4.1 | Let's Try It

Find the quotient of 846 ÷ 3 using long division.

1. How many groups of 3 go into 8? ______
2. Record your work with hundreds in the algorithm.
3. Bring down the 4 tens. How many times can 3 go into 24? ______
4. Record your work with tens in the algorithm, then continue the process until you've divided through each place value in your dividend.
5. 846 ÷ 3 = ______
6. Kyle solved the same problem using a different strategy. His work is shown below. What do you notice is the same and what is different about your strategies?

$3\overline{)846}$

2
80
200
3)846
-600
246
-240
6
-6
0



Think about 672 ÷ 3.

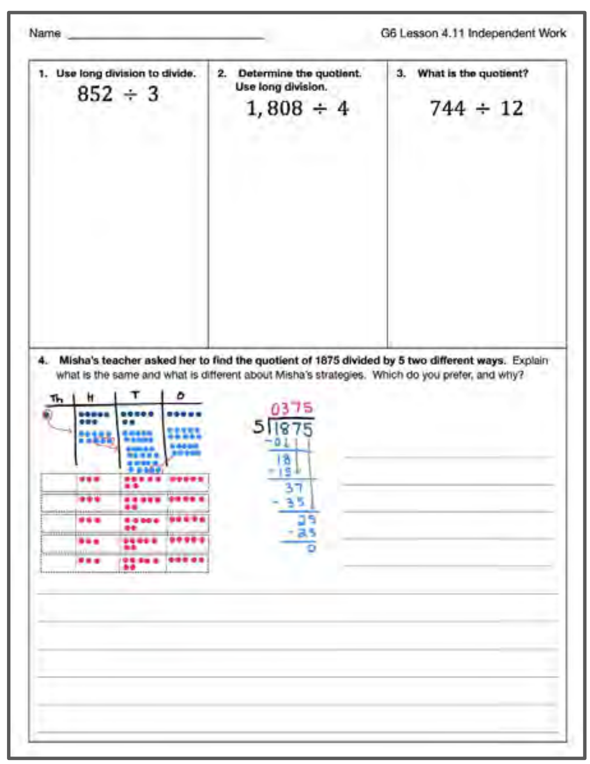
7. Draw a place value model to represent 672.
8. Use the groups 3 groups to show how you can divide your model evenly.
9. Use long division to represent the work shown in your model.

$3\overline{)672}$

Use long division to evaluate each expression.

10. 768 ÷ 4
11. 1,812 ÷ 12

On your Own:



Name ______________________ G6 Lesson 4.11 Independent Work

1. Use long division to divide.	2. Determine the quotient. Use long division.	3. What is the quotient?
852 ÷ 3	1,808 ÷ 4	744 ÷ 12

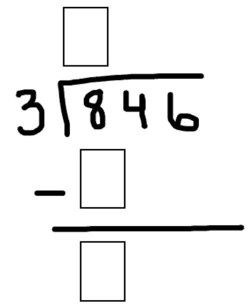
4. **Misha's teacher asked her to find the quotient of 1875 divided by 5 two different ways.** Explain what is the same and what is different about Misha's strategies. Which do you prefer, and why?

Th | H | T | O

0375
5)1875
-0
18
-15
37
-35
25
-25
0

Name ______________________________

Find the quotient of 846 ÷ 3 using long division.



1. How many groups of 3 go into 8? ________

2. Record your work with hundreds in the algorithm.

3. Bring down the 4 tens. How many times can 3 go into 24? _______

4. Record your work with tens in the algorithm, then continue the process until you've divided through each place value in your dividend.

5. 846 ÷ 3 = ________

6. Kyle solved the same problem using a different strategy. His work is shown below. What do you notice is the same and what is different about your strategies?

____

____

____

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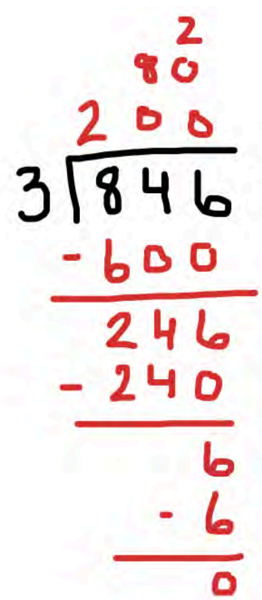
____

____

____



Think about 672 ÷ 3.

7. Draw a place value model to represent 672.

8. Use the groups 3 groups to show how you can divide your model evenly.

GROUP 1	GROUP 2	GROUP 3

9. Use long division to represent the work shown in your model.

$$3\overline{)672}$$

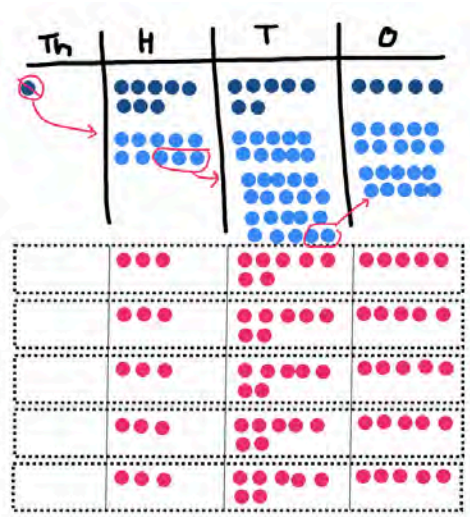
Use long division to evaluate each expression.

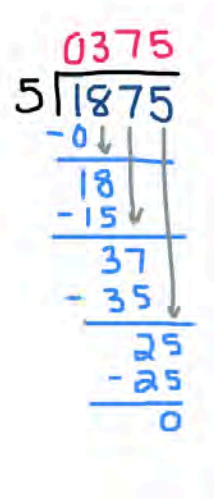
10. 768 ÷ 4

11. 1,812 ÷ 12

1. Use long division to divide. $852 \div 3$	**2. Determine the quotient. Use long division.** $1{,}808 \div 4$	**3. What is the quotient?** $744 \div 12$

4. Misha's teacher asked her to find the quotient of 1875 divided by 5 two different ways. Explain what is the same and what is different about Misha's strategies. Which do you prefer, and why?





____

____

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____

____

____

____

____

Name KEY

Find the quotient of 846 ÷ 3 using long division.

1. How many groups of 3 go into 8? 2
2. Record your work with hundreds in the algorithm. ✓

$\boxed{2}82$
$3\overline{)846}$
$-\boxed{6}$
$\boxed{2}4$
-24
06

3. Bring down the 4 tens. How many times can 3 go into 24? 8
4. Record your work with tens in the algorithm, then continue the process until you've divided through each place value in your dividend. ✓
5. 846 ÷ 3 = 282

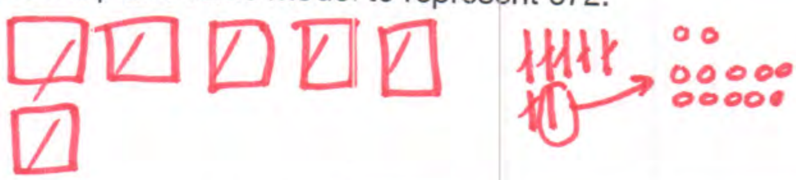
6. Kyle solved the same problem using a different strategy. His work is shown below. What do you notice is the same and what is different about your strategies?

Kyle used vertical calculations and arrived at the same quotient. Instead of using long division, Kyle used partial quotients and divided in pieces that made sense to him.

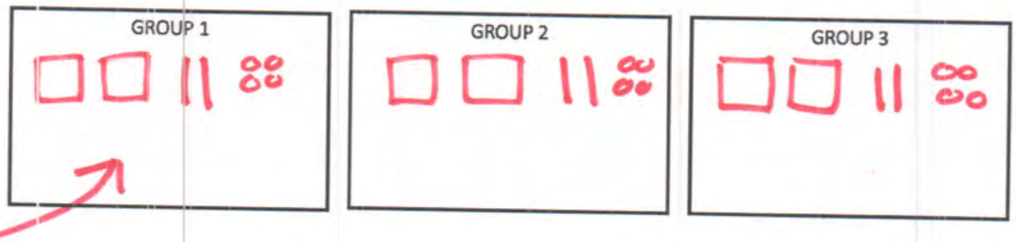
2
80
200
$3\overline{)846}$
-600
246
-240
6
-6
0

Think about 672 ÷ 3.

7. Draw a place value model to represent 672.



8. Use the groups 3 groups to show how you can divide your model evenly.



224

9. Use long division to represent the work shown in your model.

224

3) 672
-6
07
-06
12
-12
0

Use long division to evaluate each expression.

10. 768 ÷ 4

192

4) 768
-4
36
-36
08
-08
0

11. 1,812 ÷ 12

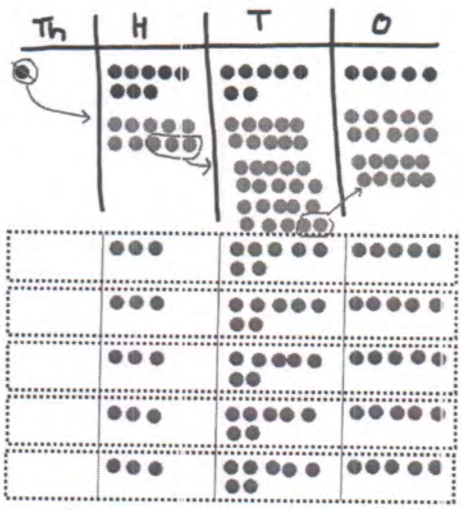
151

12) 1812
-12
61
-60
12
-12
0

Name KEY

1. Use long division to divide. $852 \div 3$ 284 3)852 -6 25 -24 12 -12 0	**2. Determine the quotient. Use long division.** $1,808 \div 4$ 452 4)1808 -16 20 -20 08 -8 0	**3. What is the quotient?** $744 \div 12$ 62 12)744 -72 24 -24 0 62

4. Misha's teacher asked her to find the quotient of 1875 divided by 5 two different ways. Explain what is the same and what is different about Misha's strategies. Which do you prefer, and why?



0375
5)1875
-0
18
-15
37
-35
25
-25
0

They both show the same dividend, divisor, and quotient. I like the algorithm because it is more efficient than a place value model. Both show we could not share any thousands, and that we can make 3 groups of 5 hundreds out of 18 hundred. In both cases we see 7 groups 5 tens can be made with 37 tens, and then 5 groups of 5 can be made of 25.

G6 U4 Lesson 12

Use long division to divide whole numbers that result in a quotient with a decimal

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G6 U4 Lesson 12 - Students will use long division to divide whole numbers that result in a quotient with a decimal

Warm Welcome (Slide 1): Tutor choice.

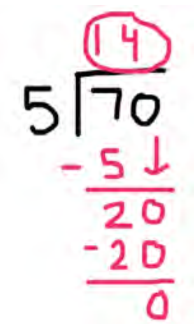
Frame the Learning/Connect to Prior Learning (Slide 2): Last lesson, we were introduced to the long division algorithm, where we went digit by digit to find our quotient. Today, we'll continue practicing this important skill, but we're going to see problems where we have a remainder that we'll write as a decimal in our quotient. We'll see what that looks like in a moment…

Let's Talk (Slide 3): Look at the numbers shown here. What do you notice about them? Possible Student Answers, Key Points:

- Some are whole numbers and some are decimals.
- The second number in each pair just adds on some zeros.
- Even though some have decimals, they are equivalent, for example 72 is the same as 72.0.

Yes, each of these pairs shows two equivalent numbers. Putting a zero after the decimal on a number does not change the value of that number. This is going to come in handy a bit later today. You'll see why in a moment!

Let's Think (Slide 4): Look here, we're being asked to use long division for two problems. Since we practiced this yesterday, help me with the first one (*write as students explain or walk students through it if they need extra help*).

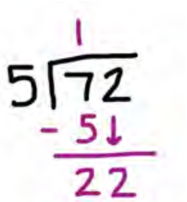


So, we're starting on the left. We see that 5 groups of 1 go into 7, or we can make 5 go into 7 1 time. We can write a 1 in our quotient, then we'll subtract 5 in the dividend. 7 - 5 is 2. We bring down our last digit, 0. 5 groups of 4 go into 20. 4 will go in our quotient, and we subtract 20. We end up with 0 in our dividend. The answer is 14. Great. 70 divided by 5 is 14. And, how did we know we were finished solving? We didn't have a remainder. We were left with 0! That's right, we knew that we were done dividing because we were left with 0, we didn't have anything leftover, in other words there was no remainder!

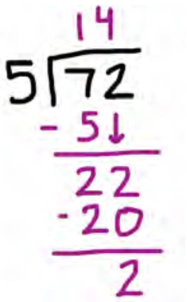
Let's look at the next problem, it says 72 divided by 5. **What do you notice/wonder?** Possible Student Answers, Key Points:

- I notice it looks similar to our last one, but with 72 instead of 70.
- I wonder if 5 goes into 72.
- I notice 5 doesn't go into 72 evenly.

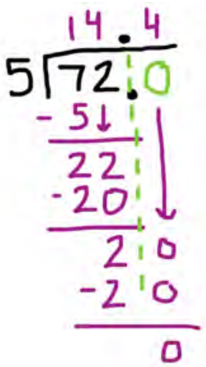
Good noticings. I agree, I noticed that we're dividing 72, which is close to 70 by 5 and we're thinking that 5 isn't going to go into 72 evenly. That's okay, we're going to see this happen a lot today. Let me show you the easy way we will approach this issue when we see it.



I'm going to start the same way we just did. We're starting on the left side, 5 groups of 1 go into 7. I put 1 in my quotient, and subtract 5 in my dividend. That leaves me with 2, and then I'll pull down my next digit, 2.



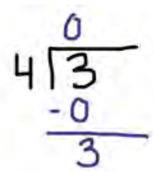
Now we're working with 22, so 5 groups of 4 go into 22, so I'll write 4 in the quotient and subtract 20 in the dividend. I'm left with 2. We *could* say the answer is 14 remainder 2 (14 R2), but in 6th grade we want to be able to write our answers in decimal form. So let's think…



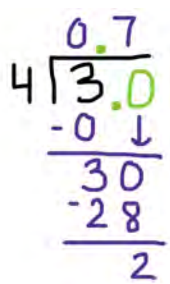
We talked earlier about how we can write 72 as 72.0 and it won't change the value. So if I add a decimal and a 0 to my quotient like this, I can keep doing long division. I can now bring down that 0, so we have 20 in our dividend. 5 groups of 4 make 20. When I annexed my zero, you'll notice I also put a decimal in my quotient so I know that last 4 is 4 TENTHS, not 4 ones.

Today, if we end up with a remainder, all we need to do is think of an equivalent form of our dividend. We can put a decimal on it, annex a zero and keep dividing. It's as simple as that. Let's look at one more.

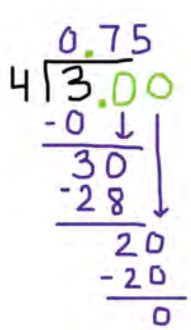
Let's Think (Slide 5): This question says 3 divided by 4. Hmm, can we even do that? Let's try. Usually my bigger number is my dividend, but in this case 4 is my divisor and 3 is my dividend. I'll set up my long division algorithm accordingly.



I already feel kind of stuck, because 4 cannot go into 3. 3 is smaller than 4. *(Write 0 in quotient, subtract 0 to show a remainder of 3)* But I know I can rewrite my dividend as an equivalent number. That's right, 3 is the same as 3.0, so let me put a decimal in my dividend and annex a zero. Don't forget to put a decimal in your quotient too. Can I keep dividing now? Yes! Okay, follow along with me.



Let's bring the 0 down. We have 30 in the dividend. 4 groups of 7 go into 30. So write 7 in your quotient and subtract 28 from 30. We have a remainder of 2.



Uh-oh. Another remainder? That's okay! I can annex another 0. 3 is the same as 3.0 or 3.00. Let's annex and see if we can keep going. Bring the 0 down. We have 20 in the dividend. 4 groups of 5 go into 20. So write 5 in your quotient and subtract 20 from 20. I think we're done! So, 3 divided by 4 is 0.75. In that problem we had to annex zeros a couple times in order to continue dividing.

And you know what? That makes sense because I know that ¾ is the same as 0.75!

Let's Try it (Slide 6-7): Now let's work together to divide whole numbers that result in a quotient with a decimal. In previous years when we have divided, we've thought of any leftovers as a remainder. Today we saw that we can continue dividing even if our whole numbers don't divide neatly by thinking of our remainder as a decimal. Today when we see that we're "stuck" in our division, we'll put in a decimal and continue dividing into the tenths, hundredths, and thousandths places if need be. Are you ready?

WARM WELCOME

Today we will use long division to divide whole numbers that result in a quotient with a decimal.

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Let's Talk:

What do you notice about the numbers shown here?

72	5	899	1.2
72.0	5.00	899.000	1.20

Let's Think:

Use long division to find each quotient.

$5\overline{)70}$ $\qquad$ $5\overline{)72}$

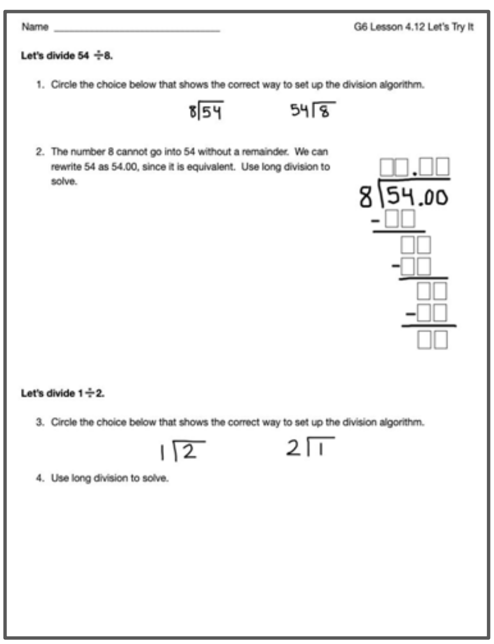
Let's Think:

Let's think about one more example.

$$3 \div 4$$

Let's Try It:

Let's use long division to divide whole numbers that result in a quotient with a decimal!


Name ____________________ G6 Lesson 4.12 Let's Try It

Let's divide 54 ÷ 8.

1. Circle the choice below that shows the correct way to set up the division algorithm.

8⟌54   54⟌8

2. The number 8 cannot go into 54 without a remainder. We can rewrite 54 as 54.00, since it is equivalent. Use long division to solve.

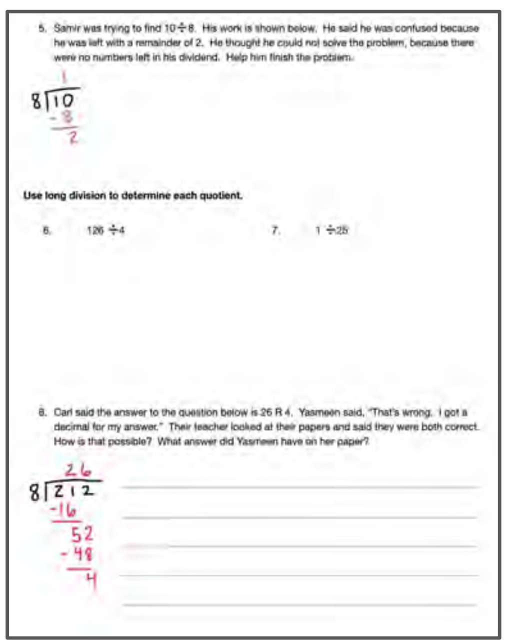
8⟌54.00

Let's divide 1 ÷ 2.

3. Circle the choice below that shows the correct way to set up the division algorithm.

1⟌2   2⟌1

4. Use long division to solve.


5. Samir was trying to find 10 ÷ 8. His work is shown below. He said he was confused because he was left with a remainder of 2. He thought he could not solve the problem, because there were no numbers left in his dividend. Help him finish the problem.

8⟌10, 1, −8, 2

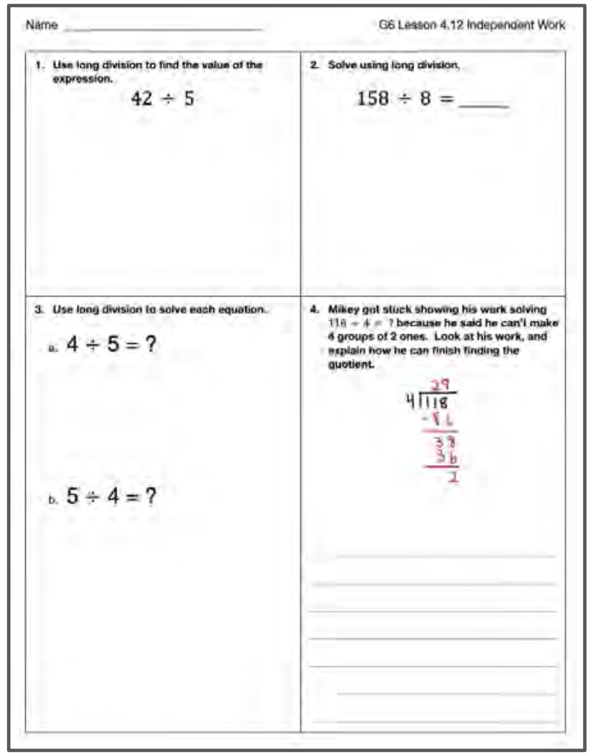
Use long division to determine each quotient.

6. 126 ÷ 4   7. 1 ÷ 25

8. Carl said the answer to the question below is 26 R 4. Yasmeen said, "That's wrong. I got a decimal for my answer." Their teacher looked at their papers and said they were both correct. How is that possible? What answer did Yasmeen have on her paper?

8⟌212, 26, −16, 52, −48, 4

On your Own:



Name ____________________ G6 Lesson 4.12 Independent Work

1. Use long division to find the value of the expression.

$42 \div 5$

2. Solve using long division.

$158 \div 8 =$ _____

3. Use long division to solve each equation.

a. $4 \div 5 = ?$

b. $5 \div 4 = ?$

4. Mikey got stuck showing his work solving $118 \div 4 = ?$ because he said he can't make 4 groups of 2 ones. Look at his work, and explain how he can finish finding the quotient.

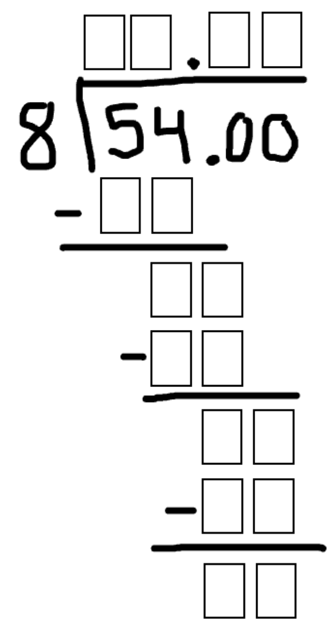
29
4)118
-8
38
36
2

Let's divide 54 ÷ 8.

1. Circle the choice below that shows the correct way to set up the division algorithm.

$8\overline{)54}$ $\qquad\qquad$ $54\overline{)8}$

2. The number 8 cannot go into 54 without a remainder. We can rewrite 54 as 54.00, since it is equivalent. Use long division to solve.



Let's divide 1 ÷ 2.

3. Circle the choice below that shows the correct way to set up the division algorithm.

$1\overline{)2}$ $\qquad\qquad$ $2\overline{)1}$

4. Use long division to solve.

5. Samir was trying to find 10 ÷ 8. His work is shown below. He said he was confused because he was left with a remainder of 2. He thought he could not solve the problem, because there were no numbers left in his dividend. Help him finish the problem.

$$\begin{array}{r} 1 \\ 8\overline{)10} \\ -8 \\ \hline 2 \end{array}$$

Use long division to determine each quotient.

6. 126 ÷ 4

7. 1 ÷ 25

8. Carl said the answer to the question below is 26 R 4. Yasmeen said, “That’s wrong. I got a decimal for my answer.” Their teacher looked at their papers and said they were both correct. How is that possible? What answer did Yasmeen have on her paper?

$$\begin{array}{r} 26 \\ 8\overline{)212} \\ -16 \\ \hline 52 \\ -48 \\ \hline 4 \end{array}$$

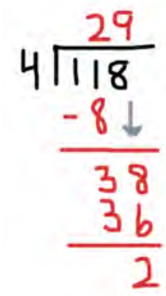
1. Use long division to find the value of the expression. $42 \div 5$	**2. Solve using long division.** $158 \div 8 = \_\_\_\_\_$

3. **Use long division to solve each equation.**

a. $4 \div 5 = ?$

b. $5 \div 4 = ?$

4. **Mikey got stuck showing his work solving** $118 \div 4 = ?$ **because he said he can't make 4 groups of 2 ones. Look at his work, and explain how he can finish finding the quotient.**



Name KEY

Let's divide 54 ÷ 8.

1. Circle the choice below that shows the correct way to set up the division algorithm.

$8\overline{)54}$ $\qquad\qquad$ $54\overline{)8}$

2. The number 8 cannot go into 54 without a remainder. We can rewrite 54 as 54.00, since it is equivalent. Use long division to solve.

$$\begin{array}{r} \boxed{0}\boxed{6}.\boxed{7}\boxed{5} \\ 8\overline{)54.00} \\ -\boxed{4}\boxed{8} \\ \hline \boxed{6}\boxed{0} \\ -\boxed{5}\boxed{6} \\ \hline \boxed{4}\boxed{0} \\ -\boxed{4}\boxed{0} \\ \hline \boxed{0}\boxed{0} \end{array}$$

Let's divide 1 ÷ 2.

3. Circle the choice below that shows the correct way to set up the division algorithm.

$1\overline{)2}$ $\qquad\qquad$ $2\overline{)1}$

4. Use long division to solve.

$$\begin{array}{r} 0.5 \\ 2\overline{)1.0} \\ -1\,0 \\ \hline 0 \end{array}$$

0.5

5. Samir was trying to find 10 ÷ 8. His work is shown below. He said he was confused because he was left with a remainder of 2. He thought he could not solve the problem, because there were no numbers left in his dividend. Help him finish the problem.

```
   1.25
8 )10.00
  -8
   20
  -16
    40
   -40
     0
```

1.25

Use long division to determine each quotient.

6. 126 ÷ 4

```
   31.5
4 )126.0
  -12
    06
    04
    20
   -20
     0
```

31.5

7. 1 ÷ 25

```
    0.04
25 )1.00
   -1 00
       0
```

0.04

8. Carl said the answer to the question below is 26 R 4. Yasmeen said, "That's wrong. I got a decimal for my answer." Their teacher looked at their papers and said they were both correct. How is that possible? What answer did Yasmeen have on her paper?

```
   26.5
8 )212.0
  -16
    52
   -48
     40
    -40
      0
```

Carl wrote his answer as 26 R 4, but Yasmeen annexed a zero to continue dividing (see my example). She got 26.5 as her quotient.

Name KEY

1. **Use long division to find the value of the expression.**

$$42 \div 5$$

$$
\begin{array}{r}
8.4 \\
5 \overline{)42.0} \\
-40 \\
\hline
2\,0 \\
-2\,0 \\
\hline
0
\end{array}
$$

8.4

2. **Solve using long division.**

$$158 \div 8 = \_\_\_\_\_$$

$$
\begin{array}{r}
19.75 \\
8 \overline{)158.00} \\
-8 \\
\hline
78 \\
72 \\
\hline
6\,0 \\
-5\,6 \\
\hline
40 \\
-40 \\
\hline
0
\end{array}
$$

19.75

3. Use long division to solve each equation.

a. $4 \div 5 = ?$

$$\begin{array}{r} 0.8 \\ 5\,\overline{)\,4.0} \\ -4\,0 \\ \hline 0 \end{array}$$

0.8

b. $5 \div 4 = ?$

$$\begin{array}{r} 1.25 \\ 4\,\overline{)\,5.00} \\ -4 \\ \hline 10 \\ -8 \\ \hline 20 \\ -20 \\ \hline 0 \end{array}$$

1.25

4. Mikey got stuck showing his work solving $118 \div 4 = ?$ because he said he can't make 4 groups of 2 ones. Look at his work, and explain how he can finish finding the quotient.

$$\begin{array}{r} 29.5 \\ 4\,\overline{)\,118.0} \\ -8 \\ \hline 38 \\ 36 \\ \hline 20 \\ -20 \\ \hline 0 \end{array}$$

He can think of 118 as 118.0, so he can continue dividing his quotient up into groups of 4. If he does that, the 2 can be thought of as 20, which can be divided neatly by 4.

G6 U4 Lesson 13

Divide decimals by whole numbers

G6 U4 Lesson 13 - Students will divide decimals by whole numbers

Warm Welcome (Slide 1): Tutor choice.

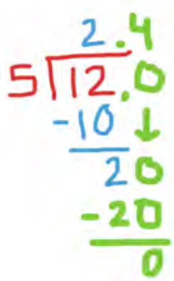
Frame the Learning/Connect to Prior Learning (Slide 2): Over the past several lessons, we've been honing our division skills. Today's aim is to divide decimals by whole numbers. This sounds like a new objective, but think back to our previous lesson. In many of our problems, we had to rewrite our dividend as a decimal, for example we converted 5 to 5.00 to help us divide. So, in a way, we've already seen how we can divide with decimals and today is an opportunity to dig a little deeper and finetune our decimal division.

Let's Talk (Slide 3): Speaking of our last lesson, this slide shows a division problem. The person who was trying to solve it claims they got stuck and they want our help. **Take a look at what they've done so far. Describe what you see.** Possible Student Answers, Key Points:

- It looks like long division. They know 5 groups of 2 go into 12.
- They wrote the 2 in their quotient, and took away 10 from their dividend.
- They were left with a remainder of 2, and then they got stuck.

Based on what we did in our last lesson, can you think of what they could do next to finish solving and get a decimal answer? Possible Student Answers, Key Points:

- They could add a decimal to make it 12.0 and 2.0.
- They could write 12 as 12.0, so they can continue dividing.
- 12.0 means the same thing as 12, but it helps us because we can now think about the tenths place.

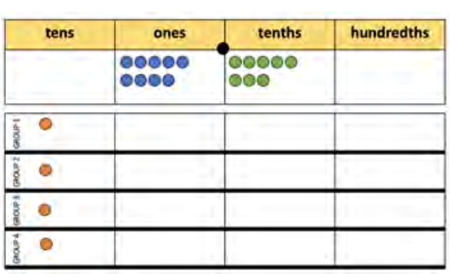


Excellent. Let's finish this for them. We annex a zero and put our decimal in to make 12.0. Bring the 0 down in our dividend, so now we're thinking of 20. 5 groups of 4 go into 20, so our 4 goes in the quotient and we subtract 20 in the dividend. Our quotient is 2.4! Let's pause here. When turned 12 into 12.0 to help us finish this problem, we made a decimal number. Did our process change? Did we have to change how we approached our long division? Possible Student Answers, Key Points:

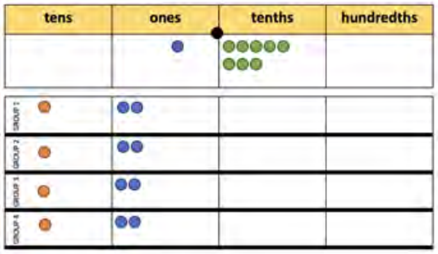
- No, it's the same steps, just with a new place value!
- When we made 12 into the decimal 12.0, we just kept doing the long division steps we're used to. The math didn't change; we just thought of our dividend a bit differently.

Aha! So dividing a decimal by a whole number, really isn't any different than dividing with all whole numbers. We just have to keep a slightly closer eye on our place value and the placement of our decimal. Let's look at a problem together so I can prove it to you.

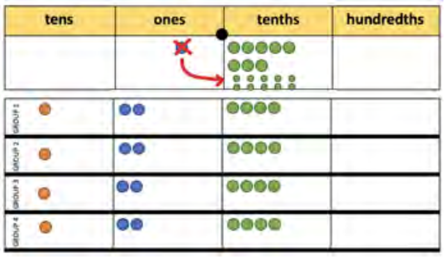
Let's Think (Slide 4): This slide wants us to divide 49.8 by 4 using a model and then long division. Let's start with the model. This model doesn't use squares and rods like we've seen. It just uses different colored discs or circles in each place value. It's just a little simpler to look at.



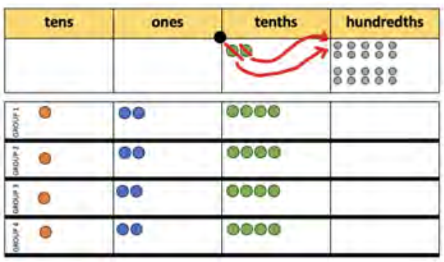
The model shows 4 tens, 9 ones, and 8 tenths. That's 49.8. They want us to split this up evenly into 4 groups, which they show here in rows. Let's start in the biggest place value. Can I split 4 tens up evenly? *Yes, put 1 in each group!* *(Model as you narrate. If you have colored chips or counters, that would work even better than drawing a model, because you can physically manipulate the counters.)* Okay, we have 4 tens in each group.



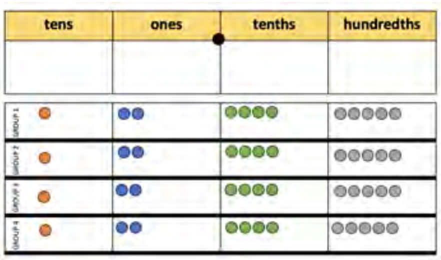
Now let's look at the tens. How could I split up 9 tens? *Put 2 in each group!* When I put 2 in each group, I will have 1 left over. I can't share that evenly into 4 groups. I'll need to break it apart or regroup it into 10 tenths. Let's show that.



Now how many tenths do we have in all? 18! Sharing those evenly means that each group gets 4 (*put 4 in each group*). Now I have 2 tenths left over, because I can't split them into 4 groups. What do you think I'll need to do with those 2 tenths? Regroup them or break them apart! That's right, we have to take our two tenths and break them into hundredths.

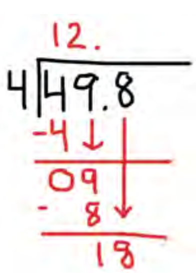


Let's break up 2 tenths. Each tenth can be broken up into 10 hundredths. So 2 tenths can be regrouped into 20 hundredths. Now we we can split those into our 4 groups. How many can I put in each group? 4 groups of 5 makes 20.



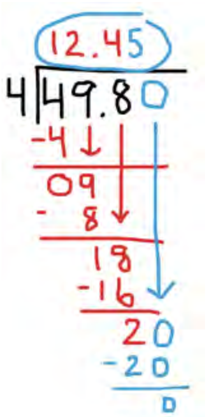
So how much was in each group? I see 1 ten, 2 ones, 4 tenths, and 5 hundredths. That's 12.45. We just divided decimals using a model.

Now let's think about how we can use the same ideas to solve the same problem with long division. Do you think we'll get the same answer if we use long division? Let's give it a shot. I'll get us started. Be ready to help me along. 4 groups of 1 go into 4, so I'll put a 1 in our quotient and subtract 4 in the dividend. We saw this step in our model when we put 1 in each group and were left with no more hundreds. Now, we dropped down the 9 and we have 9 left.



I know I can make 4 groups of 2 with 9. We saw this in our model when we put 2 ones in each group and had 1 one left over in our chart. I'll put a 2 in our quotient, then take away 8 from our dividend. We have 1 left, just like when we modeled. Bring down the 8, so that we can keep going. Okay now we have 18.

So, 4 groups of 4 can go into 18. Let’s put a 4 in our quotient and subtract 16 in our dividend. And look, we saw this in our model when we regrouped the extra 1 to make 1 tenth. That left us with the 18 tenths that we split into 4 groups. After we put 4 in each group, we were left with 2 extra tenths. So since we’re left with just 2, it can feel like we’re done or we’re stuck.



But we know that we can annex a zero to keep going. This is like when we regrouped those 2 leftover tenths to make 20 hundredths. Look, when we annexed the zero in our long division and dropped it down, we make a 20. And, 4 groups of 5 make 20, so our 5 goes into the hundredths place in our quotient. We have zero left so we’re done! So 49.8 divided by 4 is 12.45.

We just used long division and arrived at the same answer!

How were our two strategies to divide decimals the same or different? Possible Student Answers, Key Points:

- We got the same answer. They both show splitting 49.8 into 4 equal groups.
- The model involved us having to physically regroup. We could actually see the splitting. It took a little longer.
- The long division is more efficient, but requires us to be extra careful with our decimal placement and place value.

Those are all wonderful reflections on our two strategies! You might prefer one strategy more than the other. You also might find that you prefer a different strategy depending on the problem you’re given. As we work more, you’re welcome to use the strategy that works best for you at the moment.

Let’s Try it (Slide 5-6): Now let’s work together to divide decimals by whole numbers. Our work will look just the same as when we divide with whole numbers, we just need to pay close attention to the decimal in our dividend and quotient. We can use models or long division to show our thinking today. We’ll work carefully to ensure that the digits in our quotient are in the correct place value when all is said and done. You can do this!

WARM WELCOME

Today we will divide decimals by whole numbers.

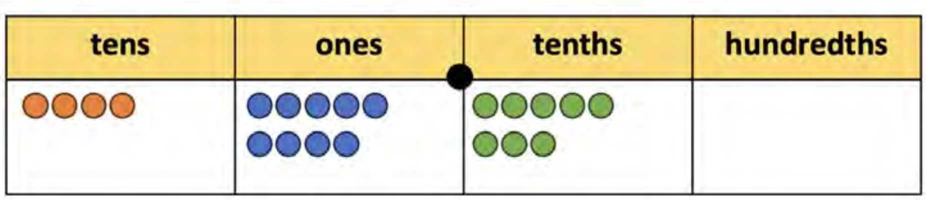
Let's Talk:

Help! I'm stuck! How can I finish my work?

$$\begin{array}{r} 2 \\ 5\overline{)12} \\ -10 \\ \hline 2 \end{array}$$

Let's Think:

Divide 49.8 by 4. Use a model and use long division.



GROUP 1				
GROUP 2				
GROUP 3				
GROUP 4				

Let's Try It:

Let's divide decimals by whole numbers!

Name ____________________ G6 Lesson 4.13 Let's Try It

Consider the equation 72.4 ÷ 5 = ?

1. Draw a place value model to show 72.4.

tens	ones	tenths	hundredths

2. Split the tens evenly into the 5 groups. Regroup any remaining tens into the ones place.
3. Split the ones evenly into the 5 groups. Regroup any remaining ones into the tenths place.
4. Split the tenths evenly into the 5 groups. Regroup any remaining tenths into the hundredths place.
5. Split the hundredths evenly into 5 groups.
6. How much is in each group?
   _____ tens
   _____ ones
   _____ tenths
   _____ hundredths
7. Solve. 72.4 ÷ 5 = __________
8. Use long division to show how you can arrive at the same quotient.

$5\overline{)72.4}$

Use any strategy to divide.

9. 0.8 ÷ 5

10. 46.5 ÷ 3

11. Use any strategy to find 72 divided by 3. Then use any strategy to find 7.2 divided by 3. What do you notice about your work?

On your Own:

Name ____________________ G6 Lesson 4.13 Independent Work

1. **Use long division to find the value of the expression.**

$$37.5 \div 3$$

2. **Solve using long division.**

$$0.6 \div 4 = \_\_\_\_\_$$

3. **Matthew and Dejanae are trying to find** 1 ÷ 4. Matthew said he will rewrite the problem as 1.0 ÷ 4. Dejanae said she will rewrite the problem as 1.00 ÷ 4. Whose strategy do you agree with? What is the quotient?

Name ______________________________ G6 U4 Lesson 13 - Let's Try It

Consider the equation 72.4 ÷ 5 = ?

1. Draw a place value model to show 72.4.

tens	ones	tenths	hundredths

2. Split the tens evenly into the 5 groups. Regroup any remaining tens into the ones place.

GROUP 1			
GROUP 2			
GROUP 3			
GROUP 4			
GROUP 5			

3. Split the ones evenly into the 5 groups. Regroup any remaining ones into the tenths place.

4. Split the tenths evenly into the 5 groups. Regroup any remaining tenths into the hundredths place.

5. Split the hundredths evenly into 5 groups.

6. How much is in each group?
   ______ tens
   ______ ones
   ______ tenths
   ______ hundredths

7. Solve. 72.4 ÷ 5 = ____________

8. Use long division to show how you can arrive at the same quotient.

$5\overline{)72.4}$

Use any strategy to divide.

9. $0.8 \div 5$

10. $46.5 \div 3$

11. Use any strategy to find 72 divided by 3. Then use any strategy to find 7.2 divided by 3. What do you notice about your work?

1. Use long division to find the value of the expression.

$$37.5 \div 3$$

2. Solve using long division.

$$0.6 \div 4 = \_\_\_\_\_$$

3. Matthew and Dejanae are trying to find $1 \div 4$. Matthew said he will rewrite the problem as $1.0 \div 4$. Dejanae said she will rewrite the problem as $1.00 \div 4$. Whose strategy do you agree with? What is the quotient?

Name KEY

Consider the equation 72.4 ÷ 5 = ?

1. Draw a place value model to show 72.4. ✓

2. Split the tens evenly into the 5 groups. Regroup any remaining tens into the ones place.

3. Split the ones evenly into the 5 groups. Regroup any remaining ones into the tenths place.

	tens	ones	tenths	hundredths
GROUP 1	0	0000	0000	00000 000
GROUP 2	0	0000	0000	00000 000
GROUP 3	0	0000	0000	00000 000
GROUP 4	0	0000	0000	00000 000
GROUP 5	0	0000	0000	00000 000

4. Split the tenths evenly into the 5 groups. Regroup any remaining tenths into the hundredths place.

5. Split the hundredths evenly into 5 groups.

6. How much is in each group?
   1 tens
   4 ones
   4 tenths
   8 hundredths

7. Solve. 72.4 ÷ 5 = 14.48

8. Use long division to show how you can arrive at the same quotient.

14.48

```
   14.48
5)72.40
 -5
  22
 -20
   24
  -20
    40
   -40
     0
```

Use any strategy to divide.

9. $0.8 \div 5$

0.16
5 | 0.80
-0 5
30
-30
0

0.16

10. $46.5 \div 3$

15.5
3 | 46.5
-3
16
-15
15
-15
0

15.5

11. Use any strategy to find 72 divided by 3. Then use any strategy to find 7.2 divided by 3. What do you notice about your work?

24
3 | 72
-6
12
-12
0

2.4
3 | 7.2
-6
12
-12
0

It is the same work in every way except the place value in our dividend and quotient. The second problem is just 72 <u>tenths</u> split 3 ways, so the quotient isn't 24 ... it's 24 <u>tenths</u>.

Name KEY

1. Use long division to find the value of the expression.

$$37.5 \div 3$$

$$\begin{array}{r} 12.5 \\ 3\overline{)37.5} \\ -3\downarrow \\ \hline 07 \\ -06\downarrow \\ \hline 15 \\ -15 \\ \hline 0 \end{array}$$

12.5

2. Solve using long division.

$$0.6 \div 4 = \_\_\_\_$$

$$\begin{array}{r} 0.15 \\ 4\overline{)0.60} \\ -\ 4\downarrow \\ \hline 20 \\ -20 \\ \hline 0 \end{array}$$

0.15

3. Matthew and Dejanae are trying to find $1 \div 4$. Matthew said he will rewrite the problem as $1.0 \div 4$. Dejanae said she will rewrite the problem as $1.00 \div 4$. Whose strategy do you agree with? What is the quotient?

$$\begin{array}{r} 0.25 \\ 4\overline{)1.00} \\ -08 \\ \hline 20 \\ -20 \\ \hline 0 \end{array}$$

$$4\overline{)1.0}$$

I would use Dejanae's strategy. Both students know they can annex zeroes, but in this case, Matthew's dividend would need to annex an additional zero. 4 could not go into 1.0 (10 tenths) as is; it'd be easier to think of 1 as 1.00 (100 hundredths), since 4 goes into 100.

G6 U4 Lesson 14

Divide decimals by decimal divisors

G6 U4 Lesson 14 - Students will divide with decimal divisors

Warm Welcome (Slide 1): Tutor choice.

Frame the Learning/Connect to Prior Learning (Slide 2): We've been working on division with decimals for the past several days, and we've arrived at our final lesson. We've already learned how to divide whole numbers, we saw what happens when we have decimal quotients, we explored dividing a decimal by a whole number, and today we will see how to tackle problems that involve a decimal divisor. Let's begin.

Let's Talk (Slide 3): Take a peek at the two division problems on this slide. **Without trying to solve them, what do you notice? What do you wonder?** Possible Student Answers, Key Points:

- I notice they involve the same digits. I notice they're set up as if we'd use long division. I notice some decimal numbers and some whole numbers.
- I wonder if they're the same problem. I wonder what the quotient would be.

Those are all great ideas. I want you to picture in your mind for a moment. Can you picture a model of 24.8? I'm picturing 2 tens, 4 ones, 8 hundredths, right? Now, can you picture dividing that or splitting it into 4 equal groups? Sure! We've been doing that for the past couple lessons. We could take our pieces and split them evenly into 4 groups, regrouping if necessary.

Now. Picture the problem on the right. Can you picture a model of 2.48 in your mind? I'm picturing 2 wholes, 4 tenths, 8 hundredths. See it? Now, what if I told you to split it into…0.4 groups. Can you picture that? Not really right? It's hard to think about 4 tenths of a group. What would that look like? How would I share things in 0.4 of a group–that's not even a whole group? It's difficult to think about divisors as decimals because it's hard to imagine groups that aren't whole numbers.

Well don't worry! Today, when we see divisors that are decimals, we're going to REWRITE our division to make it easier to think about and solve. Let me show you what I mean.

Let's Think (Slide 4): Think back to 3rd, 4th, and 5th grade for a second. If I gave you a fraction, like ½ *(write ½)*, and I multiplied the numerator and denominator by the same number…let's say 10 *(show that like in example)*. What happens? We'd get 10/20! We'd get an equivalent fraction!

$$\frac{1}{2} \times \frac{10}{10} = \frac{10}{20}$$

(NOTE: If students don't mention that the fractions are equivalent, consider drawing a picture of ½ and of 10/20 using the same-sized bar to emphasize that the pieces look different, but they are still equivalent values.)

We can use this thinking to help make tricky-seeming division problems, much more manageable. Let's look at a few division problems and rewrite them to make them easier to solve..

$$\frac{48.84}{0.4}$$

Read this problem with me, 48.84 divided by 0.4. A problem like 48.84 divided by 0.4 can seem hard to grasp at first. 48.84…split into 0.4 groups…hmm, not the simplest problem to think about because the divisor is not a whole number of groups. But, we can fix that. If I think of 48.84 divided by 0.4 as a fraction, it would look like this *(write it)*.

$$\frac{48.84}{0.4} \times \frac{10}{10} = \frac{488.4}{4}$$

If I multiply both numbers by 10, each digit in my numerator and each digit in my denominator will shift over to the next place value up *(show this)*. Look! This division expression is equivalent just like ½ and 2/10, but now I can think of my problem as 488.4 divided by 4, or 488.4 divided into 4 groups. That's much easier to wrap my head around. Notice, I chose to multiply by 10, because I saw that if the 4 in my divisor shifted up one place value, it'd be a nice easy whole number.

Look at the next example. It wants us to divide 52.7 by 0.63. Once again, this is not the easiest division problem to think about as is. If I can make the denominator, 0.63, into a whole number like 63, then we can much more efficiently tackle this problem.

$$\frac{52.7}{0.63} \times \frac{100}{100} = \frac{5270}{63}$$

$$5270 \div 63$$

Let's write our division as a fraction (write 52.7/0.63). If I multiplied both numbers by 10, I get 527 over 6.3. That's not helpful because my divisor is still a decimal, 6.3, which means it's still hard to imagine our groups. I need to shift each digit TWO place values in this problem. So I need to actually multiply each number by 100 *(cross out the x10 example, write out the x100 example as shown)*. Now we have a whole number for our divisor. We could simply divide 5270 by 63.

$$\frac{9}{0.005} \times \frac{1000}{1000} = \frac{9000}{5}$$

$$9000 \div 5$$

Look at the next example. Yikes! The divisor is a decimal, 0.005. Let's rewrite this as an easier problem. What does this equation look like as a fraction? 9/0.005! Nice. If we want to make that divisor a whole number, we're going to have to shift everything over 3 place values. What do you think I can multiply by to shift our digits 3 place values? 1000/1000! Let's do it! Now our equivalent division expression reads 9,000 divided by 5. Much easier!

$$\frac{2.4}{1.2} \times \frac{10}{10} = \frac{24}{12}$$

$$24 \div 12$$

Try the last one here. Don't evaluate it, just rewrite it as an easier, equivalent division expression. *(Give student time to work).* Great. We multiplied both numbers by 10. Each digit shifted up one place value, and we ended up with an equivalent division expression of 24 divided by 12.

Now, in your own words, how could you describe what we just did in each expression and why we did it? Possible Student Answers, Key Points:

- We wanted to make easier division expressions that were equivalent to the original ones. To do that, we wanted to get a whole number divisor.
- We used powers of 10 (10, 100, 1000) to help us. We multiplied each number by the same power of 10 so that the divisor became a whole number.
- Then we wrote an equivalent division expression that would be simpler to solve.

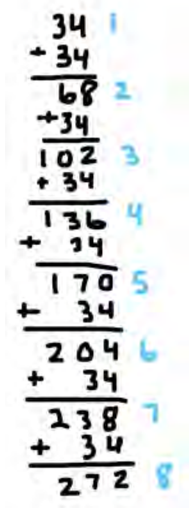
Let's Think (Slide 5): Let's try one more together. This time, we'll actually do the division.

This question wants us to divide 9.248 by 3.4. Our divisor is not a whole number, so we'll want to rewrite this to make our lives easier. How can I rewrite this? We can multiply by 10/10 so that our divisor becomes 34. Our dividend's digits would shift up to become 92.48.

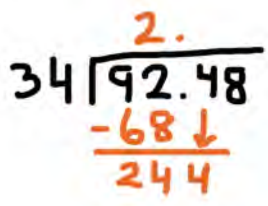
$$\frac{9.248}{3.4} \times \frac{10}{10} = \frac{92.48}{34}$$

$$92.48 \div 34 = ?$$

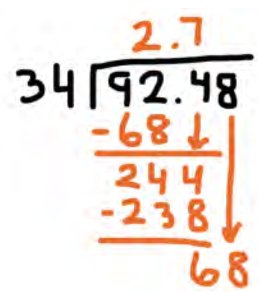
So our rewritten division equation is now 92.48 divided by 34 equals something. Let's set up our division algorithm so we can do our vertical calculations.



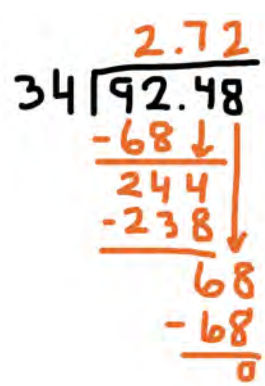
Now wait, one thing I notice is that this divisor is not a number that I know in my head super well. So, let's list out some multiples of 34 using repeated addition so that we can use them as we go through our long division. *(Write out a list repeatedly adding 34. As you go, label each new multiple with how many 34s it represents. See example.)* This feels a little tedious, but when we have a divisor that we don't know multiples of by heart, it will save us time in the long run.



Okay, so I need to think…34 groups of what goes into 92? Or how many 34s can go into 92. Look at our list. I see 2 groups of 34 can go into 92 without going over. *So, we*'ll write 2 in our quotient, and take away 68 in our dividend. Now remember, we have to make sure that we write the decimal up in our quotient to make sure we don't lose track.



We can now think about 244. 34 groups of what goes into 244? Or, another way to think of that is, how many 34s can go into 244? 7! This is why doing our multiples of 24 can be helpful! Yeah, 7! We'll put 7 in our quotient, and subtract 238 in our dividend.



Once we bring down our 8, all we have left to worry about dividing from is 68. Can you help me finish? So, 34 goes into 68 two times. I can see that from our list. So we write 2 in the quotient and when we subtract 68 in the dividend, we have nothing left. Our quotient is 2.72! Great work! As you can probably tell, the long division today is no different than we've been doing the past several lessons. Our main job today will be to carefully rewrite any tricky division expressions that have decimal divisors into equivalent division expressions with whole number divisors. Once that's handled, we can start on our long division steps easily.

Let's Try it (Slide 6-7): Now let's work together to divide with decimal divisors. When we have a decimal divisor, we will write an equivalent division expression by adjusting the place value of the digits in the dividend and the divisor to make a whole-number divisor. We will multiply by powers of 10 to do this in a snap. This makes thinking about splitting into groups much easier. Let's carefully rewrite our division problems to make our math more manageable. Let's keep at it!

WARM WELCOME

Today we will divide with decimal divisors.

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Let's Talk:

What do you notice? What do you wonder?

$4\overline{)24.8}$ $\qquad$ $0.4\overline{)2.48}$

Let's Think:

Let's rewrite some division equations to make them easier to think about.

$48.84 \div 0.4$

$52.7 \div 0.63$

$9 \div 0.005$

$2.4 \div 1.2$

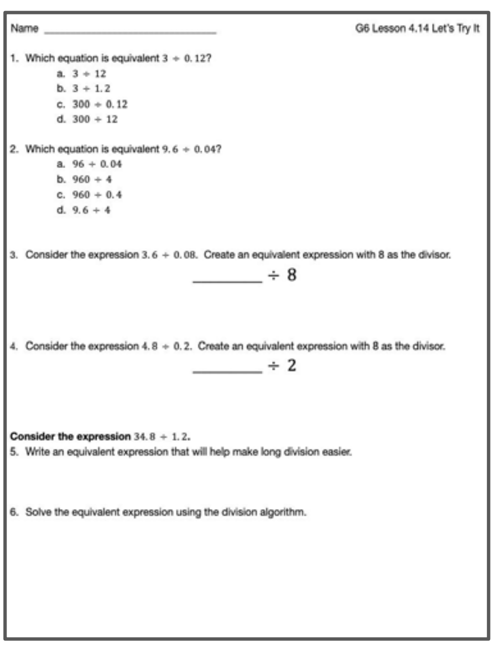
Let's Think:

Let's try dividing now!

$$9.248 \div 3.4$$

Let's Try It:

Let's divide with decimal divisors!



Name ____________________ G6 Lesson 4.14 Let's Try It

1. Which equation is equivalent $3 \div 0.12$?
   - a. $3 \div 12$
   - b. $3 \div 1.2$
   - c. $300 \div 0.12$
   - d. $300 \div 12$
2. Which equation is equivalent $9.6 \div 0.04$?
   - a. $96 \div 0.04$
   - b. $960 \div 4$
   - c. $960 \div 0.4$
   - d. $9.6 \div 4$
3. Consider the expression $3.6 \div 0.08$. Create an equivalent expression with 8 as the divisor.

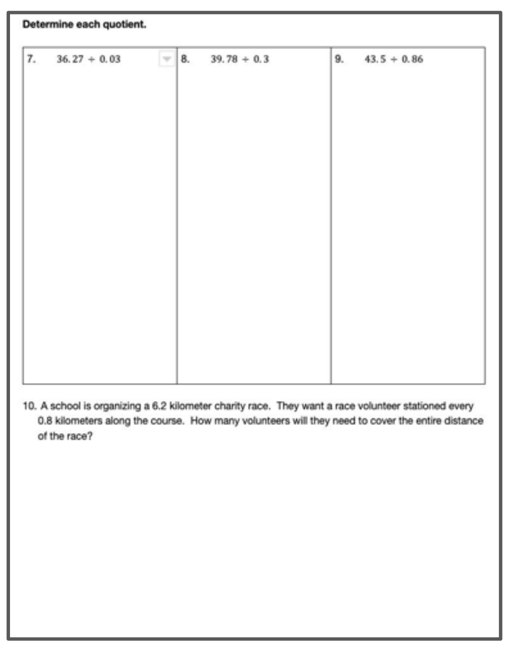
   ________ $\div\ 8$

4. Consider the expression $4.8 \div 0.2$. Create an equivalent expression with 8 as the divisor.

   ________ $\div\ 2$

Consider the expression $34.8 \div 1.2$.

5. Write an equivalent expression that will help make long division easier.
6. Solve the equivalent expression using the division algorithm.

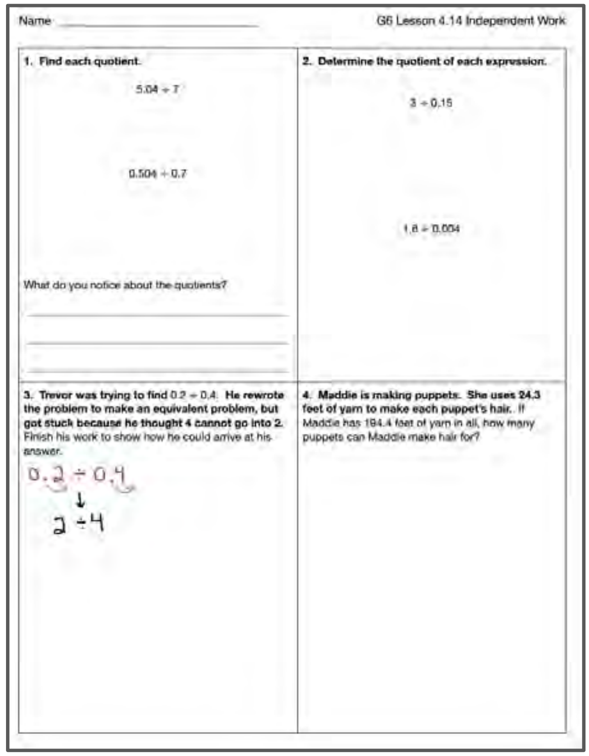


Determine each quotient.

7. $36.27 \div 0.03$	8. $39.78 \div 0.3$	9. $43.5 \div 0.86$

10. A school is organizing a 6.2 kilometer charity race. They want a race volunteer stationed every 0.8 kilometers along the course. How many volunteers will they need to cover the entire distance of the race?

On your Own:


Name ____________________ G6 Lesson 4.14 Independent Work

1. Find each quotient.

$5.04 \div 7$

$0.504 \div 0.7$

What do you notice about the quotients?

2. Determine the quotient of each expression.

$3 \div 0.15$

$1.8 \div 0.004$

3. Trevor was trying to find $0.2 \div 0.4$. **He rewrote the problem to make an equivalent problem, but got stuck because he thought 4 cannot go into 2.** Finish his work to show how he could arrive at his answer.

$0.2 \div 0.4$

$\downarrow$

$2 \div 4$

4. Maddie is making puppets. She uses 24.3 feet of yarn to make each puppet's hair. If Maddie has 194.4 feet of yarn in all, how many puppets can Maddie make hair for?

1. Which equation is equivalent $3 \div 0.12$?
   a. $3 \div 12$
   b. $3 \div 1.2$
   c. $300 \div 0.12$
   d. $300 \div 12$

2. Which equation is equivalent $9.6 \div 0.04$?
   a. $96 \div 0.04$
   b. $960 \div 4$
   c. $960 \div 0.4$
   d. $9.6 \div 4$

3. Consider the expression $3.6 \div 0.08$. Create an equivalent expression with 8 as the divisor.

$$\_\_\_\_\_\_\_\_\_\_ \div 8$$

4. Consider the expression $4.8 \div 0.2$. Create an equivalent expression with 8 as the divisor.

$$\_\_\_\_\_\_\_\_\_\_ \div 2$$

Consider the expression $34.8 \div 1.2$**.**

5. Write an equivalent expression that will help make long division easier.

6. Solve the equivalent expression using the division algorithm.

Determine each quotient.

7. $36.27 \div 0.03$	8. $39.78 \div 0.3$	9. $12 \div 0.004$

10. A school is organizing a 6.2 kilometer charity race. They want a race volunteer stationed every 0.8 kilometers along the course. How many volunteers will they need to cover the entire distance of the race?

1. Find each quotient.	2. Determine the quotient of each expression.
5.04 ÷ 7	**3 ÷ 0.15**
0.504 ÷ 0.7	**1.8 ÷ 0.004**
What do you notice about the quotients? ______________________________ ______________________________ ______________________________ ______________________________ ______________________________ ______________________________	

3. Trevor was trying to find 0.2 ÷ 0.4. **He rewrote the problem to make an equivalent problem, but got stuck because he thought 4 cannot go into 2.** Finish his work to show how he could arrive at his answer.

$$0.2 \div 0.4$$

$$\downarrow$$

$$2 \div 4$$

4. Maddie is making puppets. She uses 24.3 feet of yarn to make each puppet's hair. If Maddie has 194.4 feet of yarn in all, how many puppets can Maddie make hair for?

Name KEY

1. Which equation is equivalent $3 \div 0.12$?
   a. $3 \div 12$
   b. $3 \div 1.2$
   c. $300 \div 0.12$
   d. $300 \div 12$

$\frac{3}{0.12} \times \frac{100}{100} = \frac{300}{12}$

2. Which equation is equivalent $9.6 \div 0.04$?
   a. $96 \div 0.04$
   b. $960 \div 4$
   c. $960 \div 0.4$
   d. $9.6 \div 4$

$\frac{9.6}{0.04} \times \frac{100}{100} = \frac{960}{4}$

3. Consider the expression $3.6 \div 0.08$. Create an equivalent expression with 8 as the divisor.

$\frac{3.6}{0.08} \times \frac{100}{100} = \frac{360}{8}$

360 $\div 8$

4. Consider the expression $4.8 \div 0.2$. Create an equivalent expression with 8 as the divisor.

$\frac{4.8}{0.2} \times \frac{10}{10} = \frac{48}{2}$

48 $\div 2$

Consider the expression $34.8 \div 1.2$.

5. Write an equivalent expression that will help make long division easier.

$\frac{34.8}{1.2} \times \frac{10}{10} = \frac{348}{12}$

$348 \div 12$

6. Solve the equivalent expression using the division algorithm.

$$\begin{array}{r} 29 \\ 12 \overline{)348} \\ -24\downarrow \\ \hline 108 \\ -108 \\ \hline 0 \end{array}$$

29

Determine each quotient.

7. $36.27 \div 0.03$	8. $39.78 \div 0.3$	9. $12 \div 0.004$
$\frac{36.27}{0.03} \times \frac{100}{100} = \frac{3627}{3}$ $3627 \div 3 = 1209$ $-3,\ 06,\ -06,\ 02,\ -00,\ 27,\ -27,\ 0$ 1,209	$\frac{39.78}{0.3} \times \frac{10}{10} = \frac{397.8}{3}$ $397.8 \div 3 = 132.6$ $-3,\ 09,\ -09,\ 07,\ -06,\ 18,\ -18,\ 0$ 132.6	$\frac{12}{0.004} \times \frac{1000}{1000} = \frac{12000}{4}$ $12000 \div 4$ 12 thousand $\div 4 = 3$ thousand 3000

10. A school is organizing a 6.2 kilometer charity race. They want a race volunteer stationed every 0.8 kilometers along the course. How many volunteers will they need to cover the entire distance of the race?

$6.2 \div 0.8$

$\frac{6.2}{0.8} \times \frac{10}{10} = \frac{62}{8}$

$62.00 \div 8 = 7.75$

$-56,\ 60,\ -56,\ 40,\ -40,\ 0$

They need 7.75 volunteers, which means they will need 8 volunteers to be safe.

Name KEY

1. Find each quotient.

$5.04 \div 7$

$$\begin{array}{r} 7.2 \\ 7\overline{)50.4} \\ -49\downarrow \\ \hline 14 \\ -14 \\ \hline 0 \end{array}$$

7.2

$0.504 \div 0.7$

$$\frac{0.504}{0.7} \times \frac{10}{10} = \frac{5.04}{7}$$

$$\begin{array}{r} 0.72 \\ 7\overline{)5.04} \\ -49\downarrow \\ \hline 14 \\ -14 \\ \hline 0 \end{array}$$

0.72

What do you notice about the quotients?

The digits are the same, but their place values are different.

2. Determine the quotient of each expression.

$3 \div 0.15$

$$\frac{3}{0.15} \times \frac{100}{100} = \frac{300}{15}$$

$$\begin{array}{r} 20 \\ 15\overline{)300} \\ -30\downarrow \\ \hline 00 \\ -00 \\ \hline 0 \end{array}$$

20

$1.8 \div 0.004$

$$\frac{1.8}{0.004} \times \frac{1000}{1000} = \frac{1800}{4}$$

$$\begin{array}{r} 450 \\ 4\overline{)1800} \\ -16\downarrow \\ \hline 20 \\ -20\downarrow \\ \hline 00 \\ -00 \\ \hline 0 \end{array}$$

450

3. **Trevor was trying to find** 0.2 ÷ 0.4. **He rewrote the problem to make an equivalent problem, but got stuck because he thought 4 cannot go into 2.** Finish his work to show how he could arrive at his answer.

$0.2 \div 0.4$

$\downarrow$

$2 \div 4$ ← he is correct so far

$\frac{2}{4} \rightarrow 4\overline{)2.0}$ = 0.5

$$\begin{array}{r} 0.5 \\ 4\overline{)2.0} \\ -2.0 \\ \hline 0 \end{array}$$

0.5

4. **Maddie is making puppets. She uses 24.3 feet of yarn to make each puppet's hair.** If Maddie has 194.4 feet of yarn in all, how many puppets can Maddie make hair for?

$\underset{\text{total}}{194.4} \div \underset{\text{per piece}}{24.3}$

$\frac{194.4}{24.3} \times \frac{10}{10} = \frac{1944}{243}$

$$\begin{array}{r} 8 \\ 243\overline{)1944} \\ -1944 \\ \hline 0 \end{array}$$

Guess and check...

$$\begin{array}{r} 243 \\ \times\ 5 \\ \hline 1015 \end{array} \quad \begin{array}{r} 243 \\ \times\ 7 \\ \hline 1701 \end{array} \quad \begin{array}{r} 243 \\ \times\ 8 \\ \hline 1944 \end{array}$$

8 puppets

G6 U4 Lesson 15

Find the greatest common factor of two numbers

CITYTUTOR DC

G6 U4 Lesson 15 - Students will find the greatest common factor of two numbers.

Warm Welcome (Slide 1): Tutor choice.

Frame the Learning/Connect to Prior Learning (Slide 2): We've been working with decimals for the past several lessons. Today we're switching gears to start thinking about factors and multiples, specifically greatest common factors and least common multiples. Today, we'll focus on finding the greatest common factor of two numbers. Before we do that…

Let's Talk (Slide 3): Take a look at the fraction pairs you see here. **Take a second and then tell me: Do you notice anything? What stands out to you?** Possible Student Answers, Key Points:

- The fractions all look different.
- The fractions all have different numerators and denominators.
- Each color shows equivalent fractions.
- The colors show a fraction and then another fraction in simplest form.

Great noticings! Although we won't be working directly with fractions today, you've likely already thought about common factors when you simplified fractions in 5th grade. For example, if I gave you the fraction 4/6 and asked for it in simplest form, you would probably pause and think "Hmm, is there a number or FACTOR that goes into both 4 and 6 that I can divide or FACTOR out of each?" Can you think of one? 2! Yeah, 2 is a factor that goes into 4 and 6. In fact, it's the greatest common factor! If we simplify 4/6 by dividing both the numerator and denominator by 2, we end up with an equivalent fraction of ⅔.

And we do the same thing with simplifying 3/30. We can look for a common factor. So, is there a number or FACTOR that goes into both 3 and 30? Yes, 3! Very good so when we divide both the numerator and denominator by 3, we get 1/10!

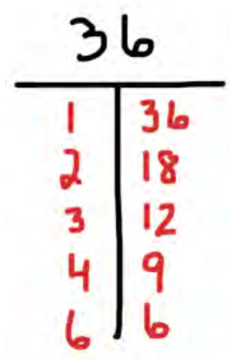
And finally, let's look at 6/12. There are a few common factors here but we want to greatest common factor. We know that 2 and 3 both go into 6 and 12 but 6 is also a common factor. So if we divide the numerator and the denominator by 6 we get ½!

Nice! It looks like you've already experienced finding the greatest common factor without even knowing it. We'll use similar thinking as we tackle today's problems. Let's dive in.

Let's Think (Slide 4): Today, our goal will be to look at two numbers and determine what their greatest common factor is. Be aware, sometimes mathematicians abbreviate "greatest common factor" and just say GCF. Our first pair of numbers is 36 and 48. The question asks what is the greatest common factor. **Hmm…do you know any factors of 36 and 48 off the top of your head?** Possible Student Answers, Key Points:

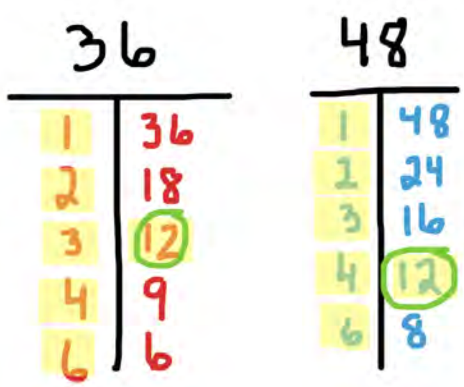
- 2, 12, 4…
- They both have 12 in common.
- Note: Often students own certain factor relationships fluently. This is helpful in the long run, but we want to make sure they have a systematic way to find the GCF for number pairs that might not automatically come to them. If the student jumps quickly to the correct GCF, do not confirm the answer and instead say something like "Hm, you think it's 12. Let's see if we can be 100% certain by showing all our thinking…"

We know that mathematicians are systematic, they do this carefully and efficiently. So, in order to find the GREATEST common factor, we have to first find all the COMMON factors. In order to find the COMMON factors, we have to find all the factors of each number. It is helpful to do this in an organized list or a table so that we don't accidentally forget factors.

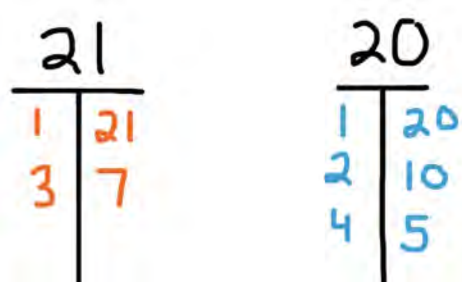


Let's make a t-chart to show the factors for 36 *(complete table as you narrate)*. I know 1 x 36 is 36, so I can start by putting 1 and 36 in my organized chart. I know 2 goes into 36 because 36 is an even number. Hm, 2 times what gives me 36? How could I figure that out if it's not a fact I know by heart? You could divide 36 by 2 on your paper! You could skip count by 2s until you get to 36. Yes! We have several strategies to find missing factors, so do what works best for you in the moment. So 2 and 18 are factors. 3 and 12 are factors, because 3 x 12 is 36. I know 4 x 9 is 36, so 4 and 9 are factors. Is 5 a factor of 36? No, nothing times 5 will make 36. So then I think our last factor pair is 6 x 6, so let's add those factors to our chart.

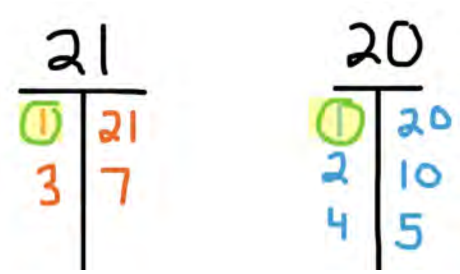
We now have all the factors of 36. Now let's do the same thing for 48. Let's go number by number systematically to make sure we're catching all of our factors. *(Complete t-chart with help from students starting with 1 and 48).*



Now that we have all the factors listed out, we just have to look carefully for all the factors they have in common to help us find the GREATEST COMMON FACTOR. Let's be systematic again, so we don't miss anything. Let's go factor-by-factor and highlight or circle any that they have in common. Do they both 1 as a factor? Yes! Do they both have 2 as a factor? Yes! Do they both have 3 as a factor? Yes! Do they both have 4 as a factor? Yes! Do they both have 6 as a factor? Yes! I don't see 7 on either list, so that's not a factor of either number. What about 8? Hm, that's a factor of 48 but not 36. *(Keep going until you've checked every factor with the student)*. So our common factors are 1, 2, 3, 4, 6, and 12. Based on that, what do you think the GREATEST common factor is? 36! Nice! We found all the factors of each number, highlighted each COMMON factor, and then we were able to quickly spot the greatest common factor or GCF.

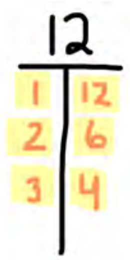


Let's try another one *(create t-chart while narrating)*. The next one wants us to find the GCF of 21 and 20. Let's start by finding all the factors. I know 1 x 21 makes 21, so 1 and 21 are easy first factors. Can you think of any other factors that make 21? 3 and 7! Yeah, 3 and 7. And that's it for factors of 21. 2 would not work, 4 doesn't go into 21, 5 doesn't go into 21…there are no more factors. Make a t-chart and see if you can find all the factors of 20 and then we can check our factor list. Now we see all our factors.



Okay, we listed all of our factors, now let's look carefully to find which factors do they have in common. It looks like only 1 *(highlight or circle)*. So if the only factor they have in common is 1, what do you think the GREATEST common factor is? 1! Correct! Sometimes the greatest common factor of two numbers will just be 1, and that's totally fine. This happens when the two numbers have no other common factors.

Let’s try our last one. We’re going to find the GCF of 12 and 24. If you feel comfortable, go ahead and make your list of factors for 12 and another list of factors for 24. We’ll check our t-charts when you’re ready. *(Let student work on t-charts, supporting as necessary, then compare with correct work)*



These are all the possible factors of 12 and 24. What are the COMMON factors you see? 1, 2, 3, 4, 6, 12. So based on that list, what would you say the GREATEST common factor is? 12. Correct! The biggest number that can go into 12 and 24 is 12. Sometimes our GCF is actually one of our numbers. This happens when one of the two numbers is a factor of the other. What would you say to somebody who said 24 was the GCF because it’s the biggest factor in our t-charts? Possible Student Answers, Key Points:

- 24 is a factor, but it’s not a common factor of 12 and 24.
- 24 does not go into 12. It is only a factor of 24.

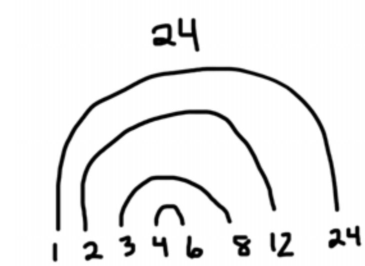
So today when we were asked to find the GCF what did we do each time? Possible Student Answers, Key Points:

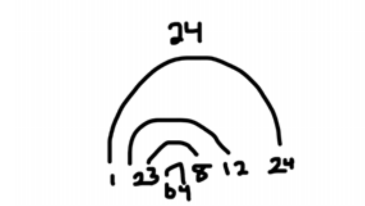
- We made an organized list/chart of every factor for each number. Then we identified which factors the numbers had in common. From there, we selected the greatest of those common factors. That’s the greatest common factor, or GCF.

And we saw that a GCF is sometimes just a regular old factor, but sometimes can be 1 if the numbers have nothing else in common AND it can be one of the numbers if one of the numbers is a factor of the other. We’ll want to keep a careful eye out for similar examples as we work more.

Let’s Try it (Slide 4): Now let’s work together to find the greatest common factor of two numbers. We’ll want to make sure we are finding all the factors of each number in an organized way, identifying which factors our numbers have in common, and then carefully identifying the *greatest* common factor.

NOTE: Some students may be familiar with “factor rainbows” from earlier grades (see first example below). This is a valid way to find factors, but is limiting. It can quickly get messy (see second example) if students don’t have enough space and requires students to predict how many factors they’re going to have in a given number. The t-chart is a more flexible way to build out factor pairs, so encourage students to use them rather than rainbows.





WARM WELCOME

Today we will find the greatest common factor of two numbers.

Let's Talk:

What do you notice about the fractions?

$\frac{4}{6}$ $\frac{2}{3}$ $\frac{3}{30}$ $\frac{1}{10}$

$\frac{6}{12}$ $\frac{1}{2}$

Let's Think:

What is the greatest common factor of each number pair?

36 and 48	21 and 20	12 and 24

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Let's Try It:

Let's find the greatest common factor of two numbers!

Name ______________________ G6 Lesson 4.15 Let's Try It

Let's find the greatest common factor of 32 and 40.

1. Make a list or a table to show all the factors of 32.

2. Make a list or a table to show all the factors of 40.

3. What factors do 32 and 40 have in common?

4. Which of the common factors is the GREATEST common factor? __________

Let's find the greatest common factor of 18 and 36.

5. List all the common factors.

6. Which common factor is the GCF? __________

7. What is the greatest common factor of 13 and 14?

8. Find the GCF of 100 and 72.

Do you AGREE or DISAGREE with each student below (#9 - 11)? Justify your reasoning.

9. Veronica said that the greatest common factor of 14 and 28 is 7.

10. Darius said that there is not a GCF for the numbers 4 and 15.

11. Arielle said that the GCF of two numbers can never be one of the two numbers.

BONUS QUESTION: Determine the GCF of 30, 42, and 72.

On your Own:

Name ______________________ G6 Lesson 4.15 Independent Work

1. Find all the factors of 24 and 16. Then, identify the <u>greatest</u> common factor.

2. Norah said the greatest common factor of 50 and 10 is 5. Do you agree or disagree? Explain.

3. What is the greatest common factor of 48 and 60? Show your reasoning.

4. Choose the statement that is true.

A. The GCF of 4 and 8 is 2.
B. The GCF of 12 and 30 is 12.
C. The GCF of 45 and 60 is 15.
D. The GCF of 24 and 64 is 4.

Let's find the greatest common factor of 32 and 40.

1. Make a list or a table to show all the factors of 32.

2. Make a list or a table to show all the factors of 40.

3. What factors do 32 and 40 have in common?

____

4. Which of the common factors is the GREATEST common factor? _____________

Let's find the greatest common factor of 18 and 36.

5. List all the common factors.

____

6. Which common factor is the GCF? _____________

---

7. What is the greatest common factor of 13 and 14?

8. Find the GCF of 100 and 72.

Do you AGREE or DISAGREE with each student below (#9 - 11)? Justify your reasoning.

9. Veronica said that the greatest common factor of 14 and 28 is 7.

10. Darius said that there is not a GCF for the numbers 4 and 15.

11. Arielle said that the GCF of two numbers can never be one of the two numbers.

BONUS QUESTION: Determine the GCF of 30, 42, and 72.

1. Find all the factors of 24 and 16. Then, identify the <u>greatest</u> common factor.	**2. Norah said the greatest common factor of 50 and 10 is 5.** Do you agree or disagree? Explain.

3. Find the GCF of each pair of numbers.

15 and 17

9 and 27

3. What is the greatest common factor of 48 and 60? Show your reasoning.

4. Choose the statement that is true.

A. The GCF of 4 and 8 is 2.
B. The GCF of 12 and 30 is 12.
C. The GCF of 45 and 60 is 15.
D. The GCF of 24 and 64 is 4.

Name KEY

G6 Lesson 4.15 Let's Try It

Let's find the greatest common factor of 32 and 40.

1. Make a list or a table to show all the factors of 32.

32	
1	32
2	16
4	8

2. Make a list or a table to show all the factors of 40.

40	
1	40
2	20
4	10
5	8

3. What factors do 32 and 40 have in common?

1, 2, 4, 8

4. Which of the common factors is the GREATEST common factor? 8

Let's find the greatest common factor of 18 and 36.

18	
1	18
2	9
3	6

36	
1	36
2	18
3	12
4	9
6	6

5. List all the common factors.

1, 2, 3, 6, 9, 18

6. Which common factor is the GCF? 18

7. What is the greatest common factor of 13 and 14?

13	
1	13

14	
1	14
2	7

1

8. Find the GCF of 100 and 72.

4

100	
1	100
2	50
4	25
5	10

72	
1	72
2	36
3	24
4	18
6	12
8	9

Do you AGREE or DISAGREE with each student below (#9 - 11)? Justify your reasoning.

9. Veronica said that the greatest common factor of 14 and 28 is 7.

I disagree. 7 is a common factor, but 14 is the GCF.

10. Darius said that there is not a GCF for the numbers 4 and 15.

I disagree. 4 and 15 share a common factor of 1.

11. Arielle said that the GCF of two numbers can never be one of the two numbers.

I disagree. The GCF of 14 and 28 is 14, for example.

BONUS QUESTION: Determine the GCF of 30, 42, and 72.

30	
1	30
2	15
3	10
5	6

40	
1	40
2	20
4	10
5	8

72	
1	72
2	36
3	24
4	18
6	12
8	9

2

Name KEY

1. Find all the factors of 24 and 16. Then, identify the greatest common factor.

24

1	24
2	12
3	8
4	6

16

1	16
2	8
4	4

GCF: 8

2. Norah said the greatest common factor of 50 and 10 is 5. Do you agree or disagree? Explain.

10

1	10
2	5

50

1	50
2	25
5	10

I disagree. 5 is a common factor, but it's not the greatest. The GCF is 10.

3. Find the GCF of each pair of numbers.

15 and 17

15	
1	15
3	5

17	
1	17

1

9 and 27

9	
1	9
3	3

27	
1	27
3	9

9

3. What is the greatest common factor of 48 and 60? Show your reasoning.

48	
1	48
2	24
3	16
4	12
6	8

60	
1	60
2	30
3	20
4	15
5	12
6	10

12

4. Choose the statement that is true.

~~A.~~ The GCF of 4 and 8 is 2.
~~B.~~ The GCF of 12 and 30 is 12.
C. The GCF of 45 and 60 is 15.
D. The GCF of 24 and 64 is 4.

$\boxed{A}$

4	
1	4
2	2

8	
1	8
2	4

$\boxed{B}$

12	
1	12
2	6
3	4

30	
1	30
2	15
3	10
5	6

$\boxed{C}$

45	
1	45
3	15
5	9

60	
1	60
2	30
3	20
4	15
5	12
6	10

G6 U4 Lesson 16

Find the least common multiple of two numbers

G6 U4 Lesson 16 - Students will find the least common multiple of two numbers.

Warm Welcome (Slide 1): Tutor choice.

Frame the Learning/Connect to Prior Learning (Slide 2): In our last lesson, we explored how to find the greatest common factor (GCF) of two numbers. We'll see a little of that in today's work, but we're shifting our focus to think about the LEAST COMMON MULTIPLE (LCM) of two numbers. Ready to get started?

Let's Talk (Slide 3): Take a look at the list of numbers you see in front of you. **Think for a moment, and then tell me: What do you notice? What do you wonder about these lists?** Possible Student Answers, Key Points:

- The numbers get bigger. It looks like skip counting.
- It reminds me of multiplication. Like 2 x 1 = 2, and 2 x 2 = 4, and 2 x 3 = 6, and so on…
- Unlike yesterday when we were finding factors, these lists never end…they could keep going and going and going!

Nice work! Each of these is a list of multiples. A multiple is the product of one number multiplied by another number. So multiples of 2 would be 2 x 1, 2 x 2, 2 x 3, and so on. Multiples of 5 would be 5 x 1, 5 x 2, 5 x 3, and so on. Multiple…multiplied…they kind of sound the same. What multiples of 9 do we see here? 9, 18, 27, 36, 45, 54!

So yesterday we found factors of our numbers and looked for the GREATEST common factor. Today, our goal will be to find multiples of our numbers and look for the LEAST common multiple. Just like yesterday, we'll want to work systematically and carefully to make sure we don't miss any multiples. Let's give it a shot.

Let's Think (Slide 4): We're going to find the least common multiple, or LCM, of a few number pairs. Let's start by finding the LCM of 8 and 10. In order to find the LEAST common multiple, we have to find the common multiples. In order to find the COMMON multiples, we have to find the multiples of each number. Let's do that. We could keep listing multiples forever, so I like to start by listing out the first 10 multiples or so.

8: 8, 16, 24, 32, 40, 48, 56, 64, 72, 80

Help me list out the multiples of 8. I know 8 x 1 is 8 *(write multiples in a neat list as you go).* 8 x 2 is 16. 8 x 3 is 24. *(Continue and stop at 80)* Here are the first 10 multiples of 8.

8: 8, 16, 24, 32, 40, 48, 56, 64, 72, 80
10: 10, 20, 30, 40, 50, 60, 70, 80, 90, 100

Let's list the first 10 multiples of 10. Help me out. Notice that I'm writing them directly underneath, this will help me when I'm going back to find the least common multiple.

8: 8, 16, 24, 32, $\boxed{40}$, 48, 56, 64, 72, 80
10: 10, 20, 30, $\boxed{40}$, 50, 60, 70, 80, 90, 100

Multiples are different from factors, we see, but at this point we want to look for COMMON multiples just like we looked for common factors. Do you see any multiples that are in common? Yes, I notice 40 and 80! *(highlight both)* They are both common multiples. Which of these is the LEAST common multiple? 40, because it's less than 80! Correct, we would say the least common multiple, or LCM, of 8 and 10 is 40. It is the smallest multiple that both 8 and 10 share, or we can think of it as the smallest number that 8 and 10 both go into evenly.

Let's take a look at the second set of numbers. We want to find the least common multiple of 3 and 5. Let's list out the first 10 multiples of 3 and the first 10 multiples of 5.

3: 3, 6, 9, 12, 15, 18, 21, 24, 27, 30
5: 5, 10, 15, 20, 25, 30, 35, 40, 45, 50

You take a minute to do that and then we can compare our multiples. *(Give time for students to list out multiples, then cross-check and correct as needed)* Great, so here are our first 10 multiples of each number.

3: 3, 6, 9, 12, 15, 18, 21, 24, 27, 30
5: 5, 10, 15, 20, 25, 30, 35, 40, 45, 50

I see some common multiples. I see 15 is a multiple of both numbers AND 30 is a multiple of both numbers. So what is our LEAST common multiple? 15! Why isn't it 30? 30 is bigger than 15, and we're looking for the smallest multiple of both numbers!

You're doing great. Let's try one more. This last one is asking us for the least common multiple of 4 and 8.

4	
1	4
2	2

8	
1	8
2	4

I'm going to start showing my work to you for this one, and I want you to stop me if you see me do anything incorrect. *(Start modeling t-charts as if you're finding the GCF instead of the LCM. List out the factors of each number. Find the greatest of the common factors. Wait for the student to stop you at any point in this process.)* Oh wow, my mistake! **I was finding the greatest common factor when the question wanted me to find the least common multiple. What's the difference again?**

Possible Student Answers, Key Points:
- The greatest common factor is the biggest number that goes into both numbers, so you look for all the factors and find the greatest one that both numbers share.
- The least common multiple requires you to find the smallest number that both numbers can go into, so we list out the multiples of both numbers and select the least common multiple.
- When you're thinking about multiples you're multiplying, when you're thinking about factors you're sort of dividing.

4: 4, 8
8:

You're right. Let's do that. Go ahead and list out your multiples of 4 and 8. We'll check our work together when you finish. *(Allow student time to work, then compare and correct as needed)* Excellent, you listed out the first 10 multiples of each. I bet you already know the least common multiple. But I want to show you something really quick. *(Write out list as you narrate)* When I was listing out my multiples, I started with 4. **Then 8…then I stopped, because I realized something. What do you think I realized?**

Possible Student Answers, Key Points:
- You went 4, then 8…and realized that 8 was obviously going to be a factor of 8, so you stopped there.
- You didn't really need to list out all the factors, because you found a common factor quickly.

Yeah, sometimes the common factors show up quickly, so you might not always need to make a long list. I also want to point out here that sometimes our LCM actually is one of our numbers. In this case, the LCM of 4 and 8 was actually 8. Nice work wrapping up these three questions. **In your own words, share with me how you go about finding the LCM of two numbers.** Possible Student Answers, Key Points:
- You list out multiples of both numbers.
- Once you have your lists, look for multiples they have in common.
- The smallest of those will be your least common multiple. It's the smallest number that both of your numbers goes into or the smallest number that is a multiple of both numbers.

We've been listing out 10 multiples, which is a good rule of thumb, **but can you think of a situation where listing out 10 multiples might not be as helpful?** Possible Student Answers, Key Points:

- If you notice a common multiple quickly. Like I know with 2 and 4, that 4 is going to be a common multiple. I don't need to list out 10 multiples in that case
- Maybe you have numbers that don't have a common multiple within the first 10 multiples. Like 17 and 30. You might have to keep going past 10 multiples.

Excellent thinking. Keep that in mind as we move into the next part of our lesson. And one other thing to consider…just like I did, sometimes people get the greatest common factor and least common multiple mixed up, and they will mistakenly look for the GREATEST common multiple. **Think about our last example. Why would finding the GREATEST common multiple not make sense?** Possible Student Answers, Key Points:

- The multiples just keep going on forever, so we'd never find the greatest one.
- We would have to keep going and going. There are an infinite number of multiples.

Let's Try it (Slide 5-6): Now let's work together to find the least common multiple of two numbers. As we work, let's make sure we are carefully skip-counting or multiplying to create our list of multiples. Once we identify the multiples our numbers have in common, we'll simply select the LEAST common multiple from that set. Let's go!

WARM WELCOME

Today we will find the least common multiple of two numbers.

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Let's Talk:

What do you notice or wonder about the lists below?

2: 2, 4, 6, 8, 10, 12…

5: 5, 10, 15, 20, 25, 30…

9: 9, 18, 27, 36, 45, 54…

Let's Think:

What is the least common multiple of each number pair?

8 and 10	3 and 5	4 and 8

Let's Try It:

Let's find the least common multiple of two numbers!

Name ____________________ G6 Lesson 4.16 Let's Try It

Let's think about the numbers 4 and 8.

1. Write the first 10 multiples of 4.

   ___, ___, ___, ___, ___, ___, ___, ___, ___, ___

2. Write the first 10 multiples of 8.

   ___, ___, ___, ___, ___, ___, ___, ___, ___, ___

3. What common multiples appear in your lists?
4. What is the least common multiple (LCM) of 4 and 8. ________
5. What is the greatest common factor of 4 and 8?

Let's think about the numbers 11 and 6.

6. Write the first 10 multiples of 11.

   ___, ___, ___, ___, ___, ___, ___, ___, ___, ___

7. Write the first 10 multiples of 6.

   ___, ___, ___, ___, ___, ___, ___, ___, ___, ___

8. What common multiples appear in your lists?
9. What is the LCM of 11 and 6? ________
10. What is the GCF of 11 and 6?

Determine the LCM of each number pair below.

11. 12 and 10
12. 2 and 6
13. 5 and 7

14. Derrick said the least common multiple of 12 and 6 is 6. Explain Derrick's error and include the correct LCM in your response.

BONUS: What is the LCM of 2, 5, and 8?

On your Own:

Name ____________________ G6 Lesson 4.16 Independent Work

1. List the multiples of each number. Then circle the least common multiple.

6: ____, ____, ____, ____, ____, ____, ____

8: ____, ____, ____, ____, ____, ____, ____

2.

a. What is the least common multiple of 8 and 12? Show how you know.

b. What is the least common multiple of 4 and 9? Show how you know.

c. What is the least common multiple of 7 and 14? Show how you know?

3. Think about the numbers 9 and 15.

a. What is the LCM of 9 and 15?

b. What is the GCF of 9 and 15?

4. Think about Question #3. In your own words, explain the difference between what is meant by the LCM and what is meant by the GCF.

Let's think about the numbers 4 and 8.

1. Write the first 10 multiples of 4.

____, ____, ____, ____, ____, ____, ____, ____, ____, _____

2. Write the first 10 multiples of 8.

____, ____, ____, ____, ____, ____, ____, ____, ____, _____

3. What common multiples appear in your lists?

4. What is the least common multiple (LCM) of 4 and 8. __________

5. What is the greatest common factor of 4 and 8?

Let's think about the numbers 11 and 6.

6. Write the first 10 multiples of 11.

____, ____, ____, ____, ____, ____, ____, ____, ____, _____

7. Write the first 10 multiples of 6.

____, ____, ____, ____, ____, ____, ____, ____, ____, _____

8. What common multiples appear in your lists?

9. What is the LCM of 11 and 6? __________

10. What is the GCF of 11 and 6?

Determine the LCM of each number pair below.

11. 12 and 10

12. 2 and 6

13. 5 and 7

14. Derrick said the least common multiple of 12 and 6 is 6. Explain Derrick's error and include the correct LCM in your response.

BONUS: What is the LCM of 2, 5, and 8?

1. List the multiples of each number. Circle the common multiples and then put a box around the least common multiple.

6: _____, _____, _____, _____, _____, _____, _____

8: _____, _____, _____, _____, _____, _____, _____

2.

a. What is the least common multiple of 8 and 12? Show how you know.

b. What is the least common multiple of 4 and 9? Show how you know.

c. What is the least common multiple of 7 and 14? Show how you know?

3. Think about the numbers 9 and 15.

a. What is the LCM of 9 and 15?

b. What is the GCF of 9 and 15?

4. Think about Question #3. In your own words, explain the difference between what is meant by the LCM and what is meant by the GCF.

Name KEY

Let's think about the numbers 4 and 8.

1. Write the first 10 multiples of 4.

   4, 8, 12, 16, 20, 24, 28, 32, 36, 40

2. Write the first 10 multiples of 8.

   8, 16, 24, 32, 40, 48, 56, 64, 72, 80

3. What common multiples appear in your lists?

   8, 16, 24, 32, 40

4. What is the least common multiple (LCM) of 4 and 8. 8

5. What is the greatest common factor of 4 and 8?

   4: 1 | 4, 2 | 2

   8: 1 | 8, 2 | 4

   4

Let's think about the numbers 11 and 6.

6. Write the first 10 multiples of 11.

   11, 22, 33, 44, 55, 66, 77, 88, 99, 110

7. Write the first 10 multiples of 6.

   6, 12, 18, 24, 30, 36, 42, 48, 54, 60, 66, 72

8. What common multiples appear in your lists?

   None! I have to extend each count.

9. What is the LCM of 11 and 6? 66

10. What is the GCF of 11 and 6?

    11: 1 | 11

    6: 1 | 6, 2 | 3

    1

Determine the LCM of each number pair below.

11. 12 and 10

10, 20, 30, 40, 50, 60

12, 24, 36, 48, 60

60

12. 2 and 6

6, 12, 18

2, 4, 6, 8, 10

6

13. 5 and 7

5, 10, 15, 20, 25, 30, 35

7, 14, 21, 28, 35

35

---

14. Derrick said the least common multiple of 12 and 6 is 6. Explain Derrick's error and include the correct LCM in your response.

I think Derrick was finding the GCF by accident. The LCM is 12 because it's the smallest multiple of both 6 and 12.

BONUS: What is the LCM of 2, 5, and 8?

2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40

5, 10, 15, 20, 25, 30, 35, 40

8, 16, 24, 32, 40

Name KEY

1. List the multiples of each number. Circle the common multiples and then put a box around the least common multiple.

6: 6, 12, 18, $\boxed{24}$, 30, 36, 42, 48

8: 8, 16, $\boxed{24}$, 32, 40, 48, 56, 64

2.

a. What is the least common multiple of 8 and 12? Show how you know.

8, 16, 24, 32

12, 24, 36, 48

24

b. What is the least common multiple of 4 and 9? Show how you know.

4, 8, 12, 16, 20, 24, 28, 32, 36

9, 18, 27, 36

36

c. What is the least common multiple of 7 and 14? Show how you know?

7, 14

14

14

3. Think about the numbers 9 and 15.

a. What is the LCM of 9 and 15?

9, 18, 27, 36, 45

15, 30, 45

45

b. What is the GCF of 9 and 15?

9	
1	9
3	3

15	
1	15
3	5

3

4. Think about Question #3. In your own words, explain the difference between what is meant by the LCM and what is meant by the GCF.

The LCM is the smallest number that two numbers can both go into evenly.

The GCF is the ~~[illegible]~~ biggest number that can go into both numbers evenly.

G6 U4 Lesson 17

Solve word problems using common multiples and common factors

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G6 U4 Lesson 17 - Students will solve word problems using common multiples and common factors.

Warm Welcome (Slide 1): Tutor choice.

Frame the Learning/Connect to Prior Learning (Slide 2): In previous lessons, we've been exploring finding the greatest common factor and the least common multiple of two numbers. Today we're going to see how thinking about factors and multiples can help us solve real-life problems.

Let's Talk (Slide 3): Let's start by considering what we already know. **In your own words, what is the same or different about finding the LCM and the GCF of, say, the numbers 8 and 6.** Possible Student Answers, Key Points:

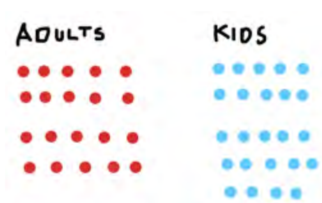
- They're similar in that we want to be organized. They're similar in that we look for what our numbers have in common.
- They're different because when we find common multiples, we're looking for a number that both of our numbers can multiply to get or that both of our numbers go into evenly. We can use skip-counting to list them out.
- They're different because when we find common factors, we're looking for numbers that we can multiply to make our numbers. We can list our factors in a t-chart to help us organize our thinking.

Great, so as we look at story problems today, keep these differences in mind. The story problem won't always tell us if it's a GCF or an LCM problem. We're going to have to think about what we know. If we have a story that involves splitting things into equal groups, that will likely involve common factors. Whereas if we have a problem that involves extending a pattern or thinking about multiple groups, that will likely involve common multiples.

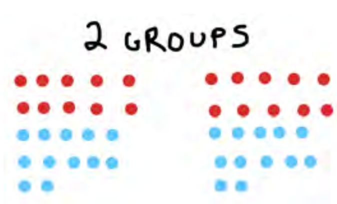
Let's Think (Slide 4): Let's see what this looks like in action. Listen while I read the first problem. It says "There are 20 adults and 24 children going to the amusement park. They want to form identical groups." Let's picture that *(If possible, have objects like counters or cubes to represent the adults and the children. This will be better than a drawing because it will be easier to form and reform groups.)*

The first part of the question says, "Each group must be made up of the same number of adults and children. What is the greatest number of groups that can be made?" **In your own words, what is this problem about?** Possible Student Answers, Key Points:

- It's like a field trip and they want to put the people into chaperone groups that are the same size with same number of adults and kids. They want to have the most groups possible; they don't want like one big group, maybe so that they can spread out.

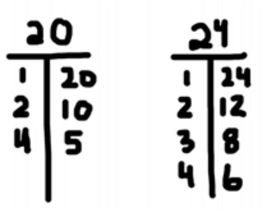


Yeah. So one option that probably won't work would be to stay in one big group like we see here with 20 adults and 24 kids. *(Move objects or redraw image as you narrate)* I wonder if we could split them into 2 equal groups?

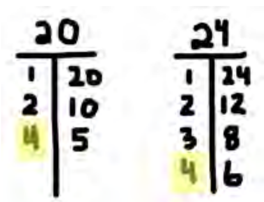


We have 20 adults, so 2 groups would mean 10 adults in each group. We have 24 children, so 2 groups would mean 12 children in each group. That worked! Which option is better for them right now? 2 groups, because they want the most groups possible!

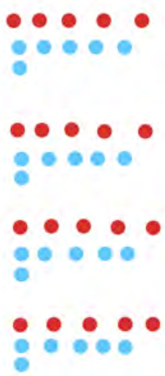
Great. So what if we kept going, do you think 3 groups would work? *(Give students a minute to reorganize the objects/drawing)* Hm, that didn't work, because we couldn't split 20 adults into 3 groups evenly. We'd have some adults left over. Before we keep going, do you see any connections between GCF or LCM in the thinking we're doing? We're trying to split 24 and 20 into equal groups, so it kind of feels like we're factoring.



We are factoring! We're thinking of all the ways we can break 24 into equal groups, and we're thinking of all the ways we can split 20 up into equal groups. Let's see if making t-charts to think about all of our factors can help us arrive at a solution to this problem. Take a second to make an organized list of factors of 24 adults and an organized list of factors of 20 children. Then we can compare our factors. *(Let student make t-chart and correct/support as needed)*



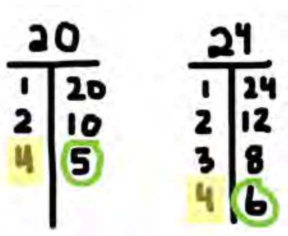
Great, so our list of factors show us that we could group the adults in 1 group of 20 or 20 groups of 1. We could group them in 2 groups of 10 or 10 groups of 2. We could group them in 4 groups of 5 or 5 groups of 4. How could we group the children, based on your factors? 1 group of 24 or 24 groups of 1, 2 groups of 12 or 12 groups of 2, 3 groups of 8 or 8 groups of 3, 4 groups of 6 or 6 groups of 4.



Given that information, the biggest number of groups we could form both numbers into is 4. I figured that out based on the GCF! *(Reorganize objects or drawing to demonstrate the groupings)*

The greatest number of identical groups we could form would be 4. It can't be something more than that, because think about 5 groups. I could split the adults up into 5 groups, but not the children because 5 is not a factor of 24. The GCF showed us that we can make 4 identical groups.

Can you use the work we have shown to answer the second part of the question? How many adults does each group have? How many children? I see 5 adults and 6 children in each group!



Excellent. We could also see that without the objects/drawings by looking at our factors. In our charts. 4 groups of adults means 5 in each group (*Circle 5)*. 4 groups of children, means 6 in each group *(Circle 6)*.

Let's Think (Slide 5): Since we just worked on a story problem where we used common factors to help get to our answer, you can probably guess our last problem will be about common multiples. You're correct, but I'm going to read it, and I want you to think about *why* using multiples might help us in this context. This question says: "Patrick's house needs some repairs. The smoke detector beeps every 3 minutes, and the dishwasher clanks every 4 minutes. If Patrick hears both sounds at 9:00AM, what is the next time he will hear both sounds at once?" **Why might multiples help us think through this problem?** Possible Student Answers, Key Points:

- If the smoke detector beeps every 3 minutes, we know it will beep on minute 3, minute 6, minute 9, and so on. Same with the dishwasher, but we'd be thinking about multiples of 4.
- Listing out the multiples will help us see when the sounds sync up.

3, 6, 9, 12, 15, 18, 21, 24, 27, 30

4, 8, 12, 16, 20, 24, 28, 32, 36, 40

Great thinking. We're going to have to extend the pattern of sounds, which might feel like repeated addition or finding multiples. Let's do it. Go ahead and list out multiples, not factors, of 3 and 4. Check with me when you're ready. *(Wait and support/correct as needed)*

3, 6, 9, 12, 15, 18, 21, 24, 27, 30

4, 8, 12, 16, 20, 24, 28, 32, 36, 40

Do we see times where both machines make a sound? Yes, at 12 minutes and 24 minutes. So if Patrick hears both sounds at 9:00AM, when is the next time he'd hear them together? 12 minutes later, which would be 9:12AM.

Now let's look at the second part of this question and see if we can use what we have done so far to help us. The second part asks how many times he will hear both sounds in an hour. How many times did they sound-off together so far based on our work? *Two times, 9:12 and 9:24!* Great, but the question is asking for the next hour, and I don't think we've gone that far in our thinking. What might we do to figure this out? Keep finding multiples. We can extend both lists until we reach an hour or 60 minutes.

3, 6, 9, 12, 15, 18, 21, 24, 27, 30
33, 36, 39, 42, 45, 48, 51, 54, 57, 60

4, 8, 12, 16, 20, 24, 28, 32, 36, 40
44, 48, 52, 56, 60

Let's do just that *(list out the remaining numbers)*. What multiples show us that the machines beeped together? *12, 24, 36, 48, 60!* So over the course of the next hour, how many times do the sounds happen at once? 5!

Great! We spent the past two slides using factors and multiples to help us solve real-world problems. **As we look at our different story problems moving forward, what clues can we listen/look for that can help us know whether common factors or common multiples will be most helpful?** Possible Student Answers, Key Points:

- If we're making equal groups or reorganizing numbers, like in the amusement park problem, common factors will come in handy.
- If we're extending a pattern, like in the problem about Patrick and the noises, common multiples are helpful.

Let's Try it (Slide 6-7): Now let's work together to solve word problems involving common multiples and common factors. As we dig into each word problem, we'll first think whether multiples or factors will help us in the given context. From there, we'll use t-charts or organized lists to help us identify common multiples/factors. Those lists will be the key to unlock the answer to practically any questions that might be thrown our way. Here we go!

WARM WELCOME

Today we will solve word problems using common multiple and common factors.

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Let's Talk:

What's the same or different about the LCM and the GCF?

8 and 6

Let's Think:

There are 20 adults and 24 children going to the amusement park. They want to form identical groups.

a. Each group must be made up of the same number of adults and children. What is the greatest number of groups that can be made?

b. How many adults does each group have? How many children?

Let's Think:

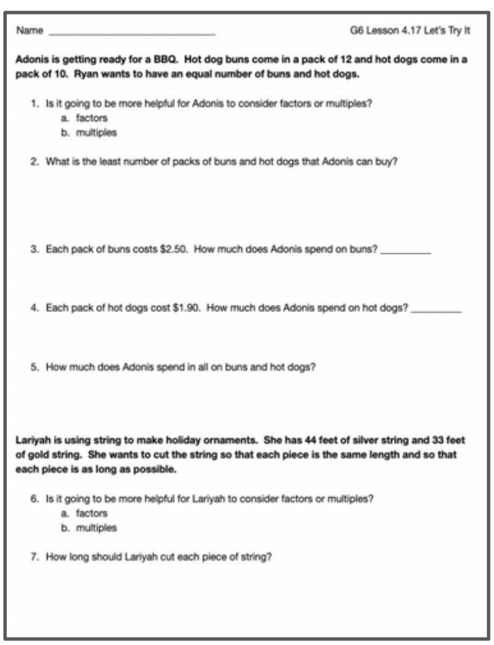
Patrick's house needs some repairs. The smoke detector beeps every 3 minutes, and the dishwasher clanks every 4 minutes.

a. If Patrick hears both sounds at 9:00am, what is the next time he will hear both sounds at once?

b. How many times will Patrick hear both sounds within that hour?

Let's Try It:

Let's solve word problems using common multiples and common factors!



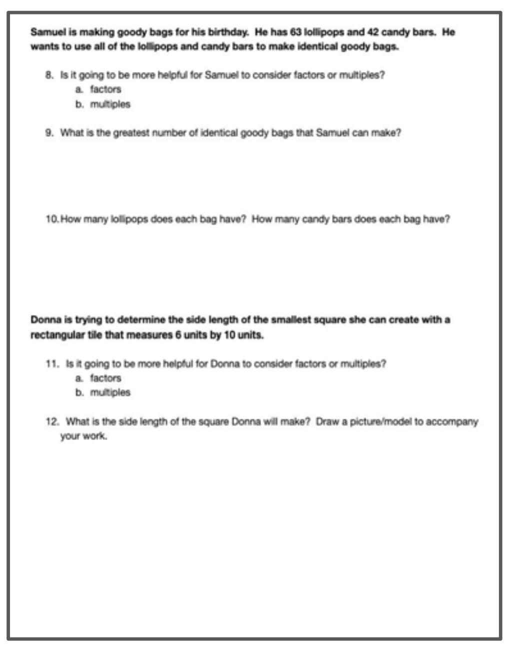
Name ____________________ G6 Lesson 4.17 Let's Try It

Adonis is getting ready for a BBQ. Hot dog buns come in a pack of 12 and hot dogs come in a pack of 10. Ryan wants to have an equal number of buns and hot dogs.

1. Is it going to be more helpful for Adonis to consider factors or multiples?
   a. factors
   b. multiples
2. What is the least number of packs of buns and hot dogs that Adonis can buy?
3. Each pack of buns costs $2.50. How much does Adonis spend on buns? ________
4. Each pack of hot dogs cost $1.90. How much does Adonis spend on hot dogs? ________
5. How much does Adonis spend in all on buns and hot dogs?

Lariyah is using string to make holiday ornaments. She has 44 feet of silver string and 33 feet of gold string. She wants to cut the string so that each piece is the same length and so that each piece is as long as possible.

6. Is it going to be more helpful for Lariyah to consider factors or multiples?
   a. factors
   b. multiples
7. How long should Lariyah cut each piece of string?



Samuel is making goody bags for his birthday. He has 63 lollipops and 42 candy bars. He wants to use all of the lollipops and candy bars to make identical goody bags.

8. Is it going to be more helpful for Samuel to consider factors or multiples?
   a. factors
   b. multiples
9. What is the greatest number of identical goody bags that Samuel can make?
10. How many lollipops does each bag have? How many candy bars does each bag have?

Donna is trying to determine the side length of the smallest square she can create with a rectangular tile that measures 6 units by 10 units.

11. Is it going to be more helpful for Donna to consider factors or multiples?
   a. factors
   b. multiples
12. What is the side length of the square Donna will make? Draw a picture/model to accompany your work.

On your Own:

Name ___________________________ G6 Lesson 4.17 Independent Work

1. Mario is making a game board out of square tiles. The game board needs to be 16 inches long by 12 inches wide.

a. What is the largest square tile Mario can use? How do you know?

b. How many of these tiles will he need to make his game board?

c. Find one other size tile Mario can use and how many of that size tile he will need to make his game board.

2. Gizelle is buying supplies for a New Year's Eve party. Hats come in packs of 4 and noisemakers come in packs of 10. She wants to have the same number of hats and noisemakers.

a. What number of hats and noisemakers can Gizelle use?

b. How many packs of hats will Gizelle need?

c. How many packs of noisemakers will she need?

3. There are 100 people in line for a bakery's grand opening. The bakery is giving away free items, and you are allowed to earn more than one free item. Every 5th person in line gets a free muffin. Every 4th person in line gets a free bagel. Every 3rd person in line gets a free cookie.

A. If you are the 18th person in line, will you get a free item? If so, what?

B. If you are the 30th person in line, will you get a free item? If so, what?

C. Is it possible to earn all three free items? Explain.

4. Write a math story problem that requires finding the greatest common factor. Then solve your problem.

Adonis is getting ready for a BBQ. Hot dog buns come in a pack of 12 and hot dogs come in a pack of 10. Adonis wants to have an equal number of buns and hot dogs.

1. Is it going to be more helpful for Adonis to consider factors or multiples?
   a. factors
   b. multiples

2. What is the least number of packs of buns and hot dogs that Adonis can buy?

3. Each pack of buns costs $2.50. How much does Adonis spend on buns? __________

4. Each pack of hot dogs cost $1.90. How much does Adonis spend on hot dogs? __________

5. How much does Adonis spend in all on buns and hot dogs?

Lariyah is using string to make holiday ornaments. She has 44 feet of silver string and 33 feet of gold string. She wants to cut the string so that each piece is the same length and so that each piece is as long as possible.

6. Is it going to be more helpful for Lariyah to consider factors or multiples?
   a. factors
   b. multiples

7. How long should Lariyah cut each piece of string?

Samuel is making goody bags for his birthday. He has 63 lollipops and 42 candy bars. He wants to use all of the lollipops and candy bars to make identical goody bags.

8. Is it going to be more helpful for Samuel to consider factors or multiples?
    a. factors
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    b. multiples

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1. Mario is making a game board out of square tiles. The game board needs to be 16 inches long by 12 inches wide.

a. What is the largest square tile Mario can use? How do you know?

b. How many of these tiles will he need to make his game board?

c. Find one other size tile Mario can use and how many of that size tile he will need to make his game board.

2. Gizelle is buying supplies for a New Year's Eve party. Hats come in packs of 4 and noisemakers come in packs of 10. She wants to have the same number of hats and noisemakers.

a. What number of hats and noisemakers can Gizelle use?

b. How many packs of hats will Gizelle need?

c. How many packs of noisemakers will she need?

3. There are 100 people in line for a bakery's grand opening. The bakery is giving away free items, and you are allowed to earn more than one free item. Every 5th person in line gets a free muffin. Every 4th person in line gets a free bagel. Every 3rd person in line gets a free cookie. A. If you are the 18th person in line, will you get a free item? If so, what? B. If you are the 30th person in line, will you get a free item? If so, what? C. Is it possible to earn all three free items? Explain.	**4. Write a math story problem that requires finding the greatest common factor. Then solve your problem.**

Name KEY

Adonis is getting ready for a BBQ. Hot dog buns come in a pack of 12 and hot dogs come in a pack of 10. ~~Ryan~~ Adonis wants to have an equal number of buns and hot dogs.

1. Is it going to be more helpful for Adonis to consider factors or multiples?
   a. factors
   b. multiples

2. What is the least number of packs of buns and hot dogs that Adonis can buy?

12: 12, 24, 36, 48, 60
1 2 3 4 5

5 packs of buns.

10: 10, 20, 30, 40, 50, 60
1 2 3 4 5 6

6 packs of hot dogs.

3. Each pack of buns costs $2.50. How much does Adonis spend on buns? $12.50

2.50 × 5

$$\begin{array}{r} 2\,50 \\ \times\ \ 5 \\ \hline 12.50 \end{array}$$

4. Each pack of hot dogs cost $1.90. How much does Adonis spend on hot dogs? $11.40

1.90 × 6

$$\begin{array}{r} 190 \\ \times\ \ 6 \\ \hline 11.40 \end{array}$$

5. How much does Adonis spend in all on buns and hot dogs?

$$\begin{array}{r} 12.50 \\ +\ 11.40 \\ \hline 23.90 \end{array}$$

$23.90

Lariyah is using string to make holiday ornaments. She has 44 feet of silver string and 33 feet of gold string. She wants to cut the string so that each piece is the same length and so that each piece is as long as possible.

6. Is it going to be more helpful for Lariyah to consider factors or multiples?
   a. factors
   b. multiples

7. How long should Lariyah cut each piece of string?

44	
1	44
2	22
4	11

33	
1	33
3	11

11 feet

Samuel is making goody bags for his birthday. He has 63 lollipops and 42 candy bars. He wants to use all of the lollipops and candy bars to make identical goody bags.

8. Is it going to be more helpful for Samuel to consider factors or multiples?
   a. factors
   b. multiples

9. What is the greatest number of identical goody bags that Samuel can make?

63	
1	63
3	21
7	9

42	
1	42
2	21
3	14
6	7

21 bags

10. How many lollipops does each bag have? How many candy bars does each bag have?

$63 \div 21$ bags = 3 lollipops per bag

$42 \div 21$ bags = 2 candy bars per bag

Donna is trying to determine the side length of the smallest square she can create with a rectangular tile that measures 6 units by 10 units.

equal sides

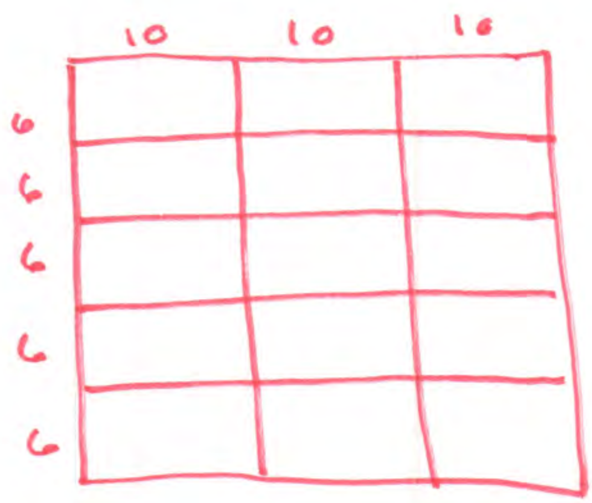
11. Is it going to be more helpful for Donna to consider factors or multiples?
   a. factors
   b. multiples

12. What is the side length of the square Donna will make? Draw a picture/model to accompany your work.

6: 6, 12, 18, 24, 30

10: 10, 20, 30

30 units



Name KEY

1. Mario is making a game board out of square tiles. The game board needs to be 16 inches long by 12 inches wide.

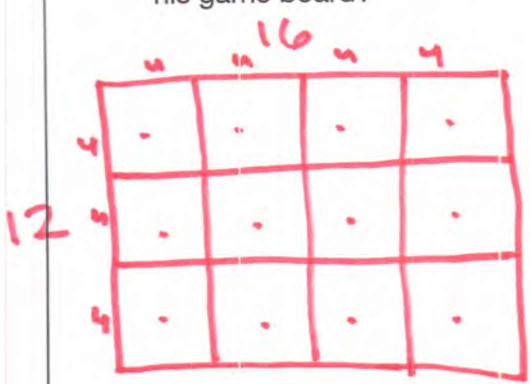
a. What is the largest square tile Mario can use? How do you know?

12	
1	12
2	6
3	4

16	
1	16
2	8
4	4

4 in × 4 in

b. How many of these tiles will he need to make his game board?



12

c. Find one other size tile Mario can use and how many of that size tile he will need to make his game board.

He could use 1 in × 1 in OR 2 in × 2 in.

He would need 192 or 48 tiles, respectively.

2. Gizelle is buying supplies for a New Year's Eve party. Hats come in packs of 4 and noisemakers come in packs of 10. She wants to have the same number of hats and noisemakers.

a. What number of hats and noisemakers can Gizelle use?

4: 4, 8, 12, 16, 20

10: 10, 20

20

b. How many packs of hats will Gizelle need?

4	8	12	16	20
1	2	3	4	5

5 packs

c. How many packs of noisemakers will she need?

10	20
1	2

2 packs

3. **There are 100 people in line for a bakery's grand opening. The bakery is giving away free items, and you are allowed to earn more than one free item. Every 5th person in line gets a free muffin. Every 4th person in line gets a free bagel. Every 3rd person in line gets a free cookie.**

A. If you are the 18th person in line, will you get a free item? If so, what?

$\boxed{M}$ 5, 10, 15, 20, 25, 30, 35

$\boxed{B}$ 4, 8, 12, 16, 20, 24

$\boxed{C}$ 3, 6, 9, 12, 15, 18 a cookie

B. If you are the 30th person in line, will you get a free item? If so, what?

You'd get a muffin and a cookie, since 30 is a multiple of 5 + 3.

C. Is it possible to earn all three free items? Explain.

Yes! The 60th person in line would win all three. 60 is a multiple of 3, 4, and 5.

4. **Write a math story problem that requires finding the greatest common factor. Then solve your problem.**

Juice boxes come in packs of 10. Cookie packs come in a case of 25. If Sean has 1 pack of juice and 1 case of cookies, how many picnic boxes can he make if he wants to make identical boxes for his friends and wants as many as possible?

10	
1	10
2	5

25	
1	25
5	5

He can make 5 picnic boxes.

Each will have 2 juices and 5 cookie packs.