Fraction Multiplication and Division

Grade 5: Unit 3

Standards addressed: 5.NF.B, 5.NF.B.4, 5.NF.B.6, 5.NF.B.7, 5.NBT.B.7

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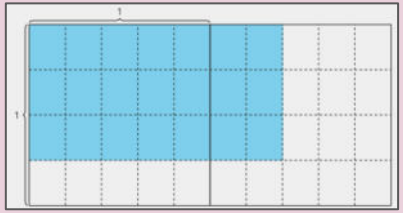
Unit 3 Progression Overview

Section A
Lessons 1-8
5.NF.B.4, 5.NF.B.4.a, 5.NF.B.4.b, 5.NF.B.6

- ➔ Recognize and use this generalization to multiply fractions numerically

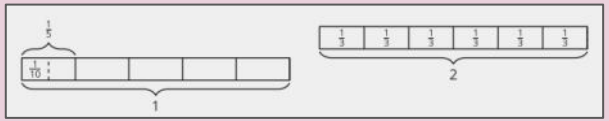
$$\frac{a}{b} \times \frac{c}{d} = \frac{a \times c}{b \times d}$$

- ➔ Represent and describe multiplication of a fraction by a fraction using area concepts.



Section B
Lessons 9-16
5.NBT.B.7, 5.NF.B.7, 5.NF.B.7.a, 5.NF.B.7.b, 5.NF.B.7.c

- ➔ Divide a unit fraction by a whole number using whole-number division concepts.
- ➔ Divide a whole number by a unit fraction using whole-number division concepts.



Section C
Lessons 17-19
5.NF.B, 5.NF.B.4, 5.NF.B.6, 5.NF.B.7

- ➔ Solve problems involving fraction multiplication and division.

Unit 3 Quick Links

L1 L2 L3 L4 L5 L6 L7 L8

L9 L10 L11 L12 L13 L14 L15 L16

L17 L18 L19

TOY THEATER
LEARN • CREATE • PLAY

GregTangMath

1

One Piece of One Part

Let’s solve problems about unit fractions.

5.NF.B.4.a

Warm up

Notice and Wonder: Baked Macaroni and Cheese

What do you notice?

What do you wonder?

Of What?

Activity #1

At a family dinner, a pan of macaroni and cheese is ½ full. Jada eats ⅓ of the remaining macaroni and cheese in the pan.

1. Draw a diagram to represent the situation.
2. How much of the whole pan of macaroni and cheese did Jada eat? Explain or show your reasonin

The Same, but Different

Activity #2

- Partner A: Diego eats macaroni and cheese from a pan that is ½ full. He eats ¼ of the remaining macaroni and cheese in the pan

    1. Draw a diagram to represent the situation.
    2. How much of the whole pan did Diego eat?

- Partner B: Kiran eats macaroni and cheese from a pan that is ⅓ full. He eats ¼ of the remaining macaroni and cheese in the pan.

    1. Draw a diagram to represent the situation.
    2. How much of the whole pan did Kiran eat?

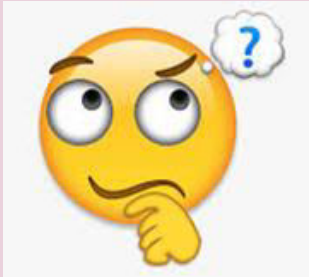
Discuss your solution with your partner. What is the same about these situations? What is different?

Lesson Synthesis

Mai eats some macaroni and cheese from a pan that has some macaroni and cheese left in it. Draw a square, for all to see, to represent the pan of macaroni and cheese.

What do we need to know to figure out how much of the whole pan of macaroni and cheese Mai ate?

Mai eats macaroni and cheese from a pan that is ½ full. She eats ½ of the remaining macaroni and cheese in the pan.



Describe how you would draw a diagram to represent this situation. Describe how you would determine how much of the whole pan of macaroni and cheese Mai ate.

Lesson Synthesis

$$\frac{1}{2} \times \frac{1}{2}$$

How does this expression represent how much of the pan Mai ate?

2

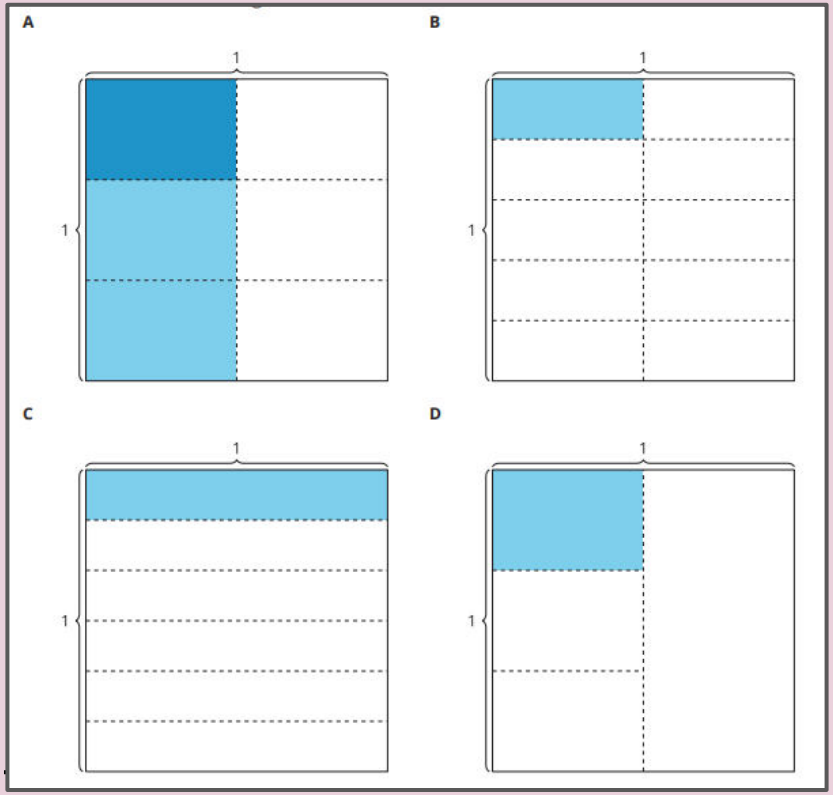
Represent Unit Fraction Multiplication

Let’s multiply unit fractions.

5.NF.B.4.a

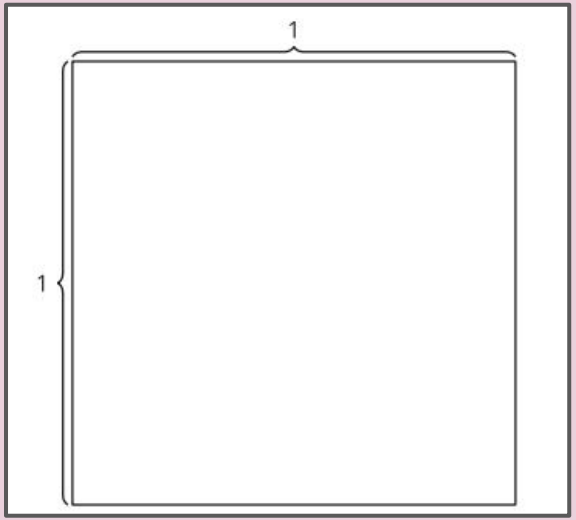
Warm up

Which One Doesn't Belong: Diagrams

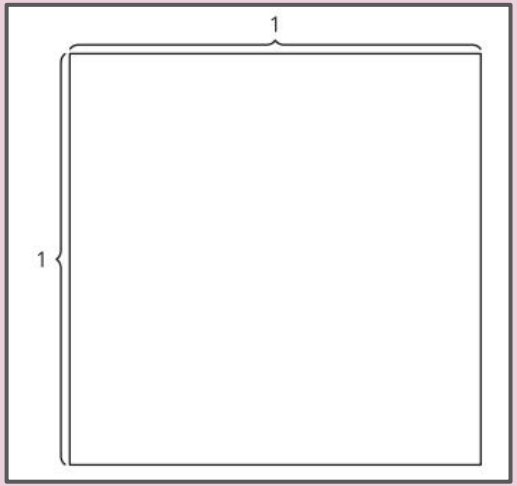


Interpret Diagrams

Activity #1



1. Show $\frac{1}{3}$ of the square.
   Shade $\frac{1}{4}$ of $\frac{1}{3}$ of the square.
   How much of the whole square is shaded?



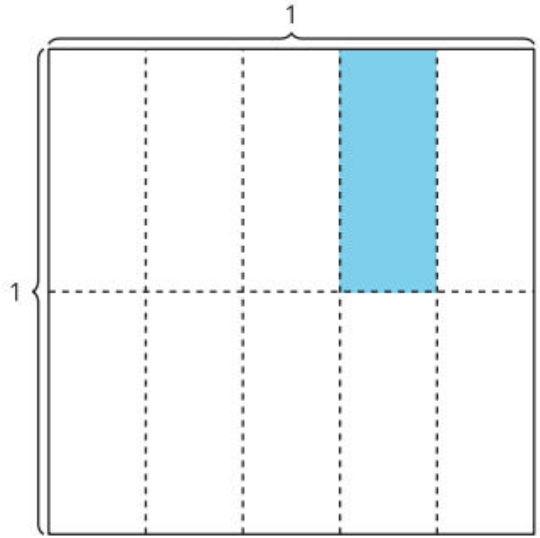
2. Show $\frac{1}{4}$ of the square.
   Shade $\frac{1}{3}$ of $\frac{1}{4}$ of the square.
   How much of the whole square is shaded?

3. How are the diagrams the same and how are they different?

Activity #2

Write an Expression

Priya shaded part of a square.



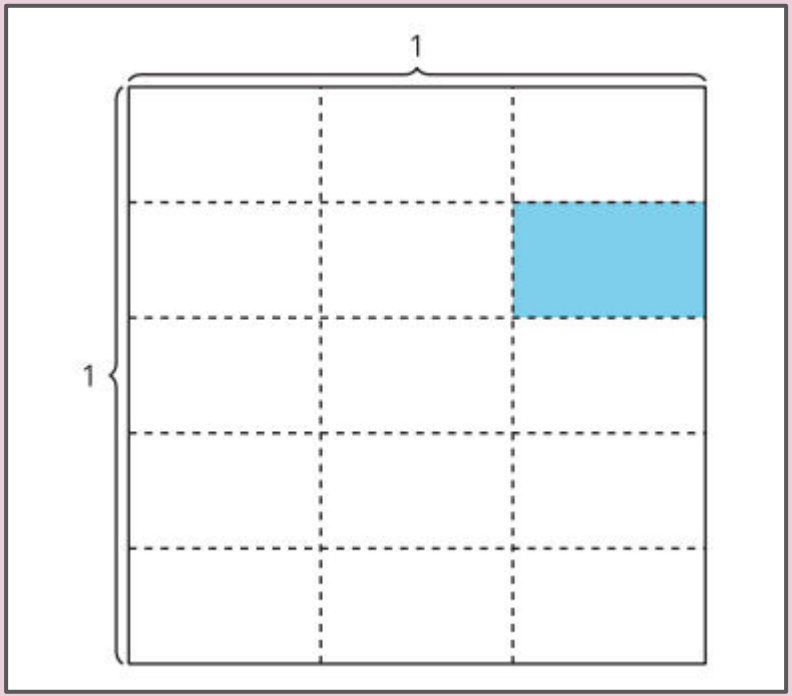
1. Explain how the shaded rectangle represents $\frac{1}{5} \times \frac{1}{2}$.

2. Explain how the shaded rectangle represents $\frac{1}{2} \times \frac{1}{5}$.

3. Write a multiplication expression to represent the shaded rectangle. Be prepared to explain your reasoning.

Activity #2

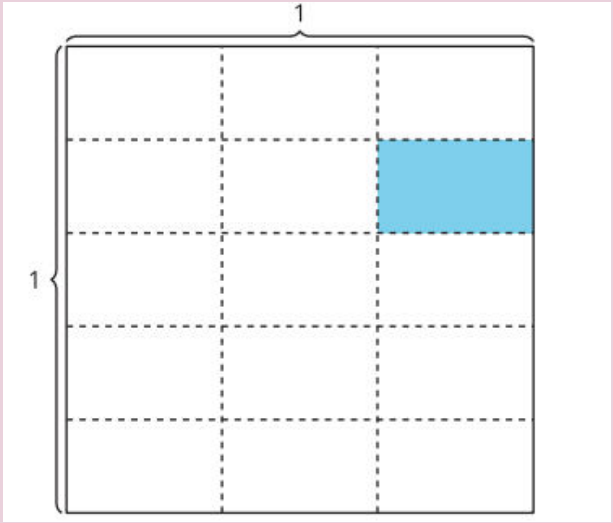
Write an Expression



4. How much of the whole square is shaded?

Lesson Synthesis

Today we wrote multiplication expressions to represent shaded rectangles. We also wrote fractions to represent the size of the shaded piece.



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

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

How do you know these equations are true?

3

Multiply Unit Fractions

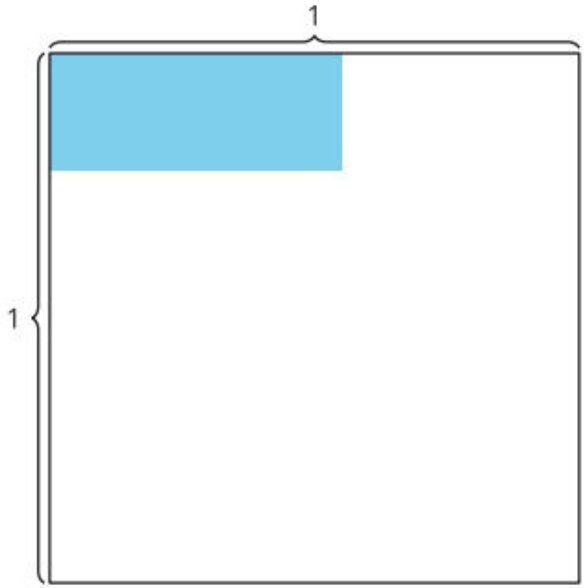
Let’s solve equations.

5.NF.B.4.a

Warm up

Estimation Exploration: How Much is Shaded?

How much is shaded?

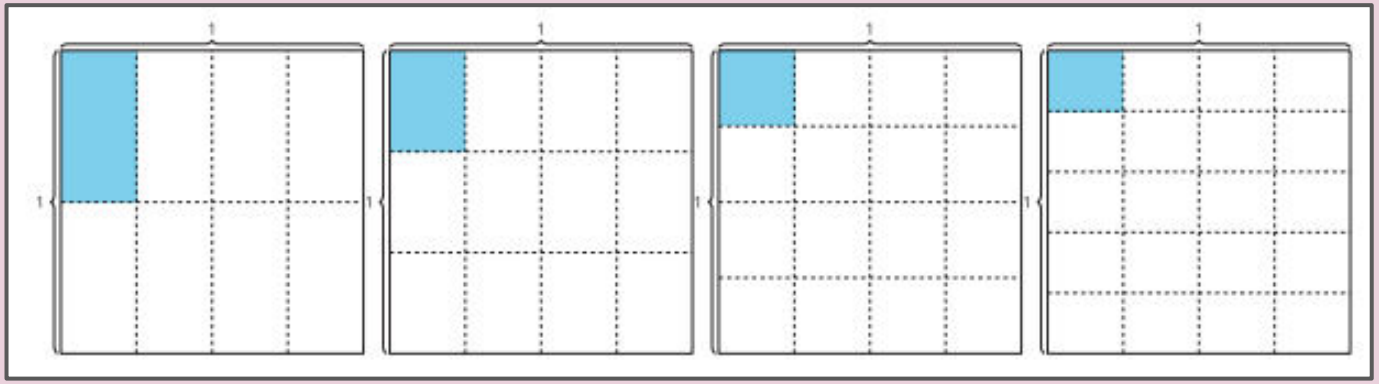


Record an estimate that is:

too low	about right	too high

Find the Value of the Expression

Activity #1

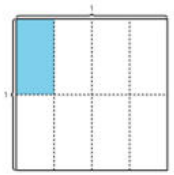
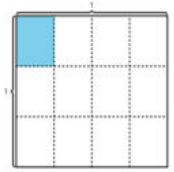
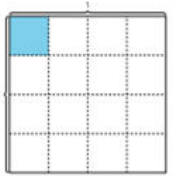
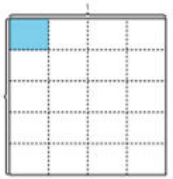


1. If the pattern continues, draw what you think the next diagram will look like. Be prepared to explain your thinking.

Find the Value of the Expression

Activity #1

2. Complete the table.

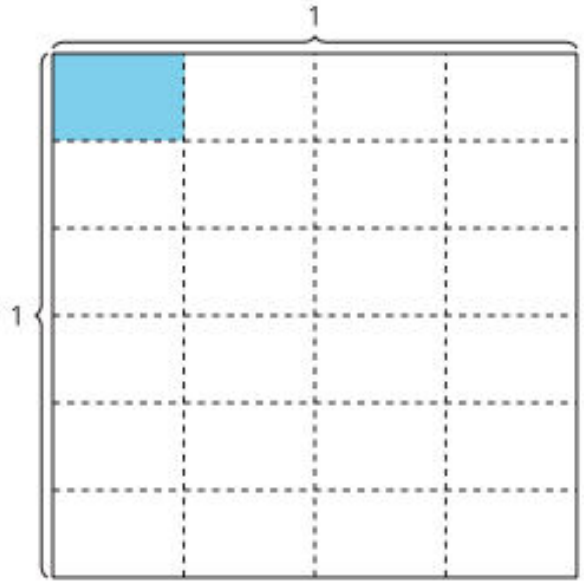
diagram	expression	How much of the square is shaded?
A. 		
B. 		
C. 		
D. 		

3. What patterns do you notice in the table?

Find the Value of the Expression

Activity #1

4. Explain how the diagram represents this equation. $\frac{1}{4} \times \frac{1}{6} = \frac{1}{24}$

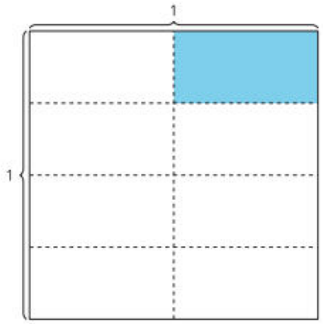


Write a Multiplication Equation

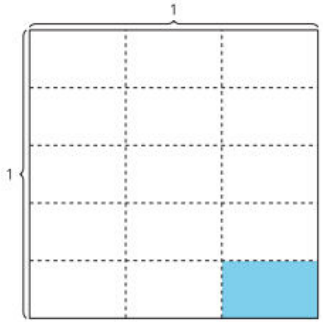
Activity #2

1. For each diagram, write a multiplication equation to represent the area of the shaded rectangle.

a.



b.



2. Solve each equation. Use a diagram, if it is helpful.

a. $\frac{1}{2} \times \frac{1}{6} = ?$

b. $\frac{1}{5} \times \frac{1}{4} = ?$

Lesson Synthesis

Today we represented products of unit fractions with diagrams and with equations.

How is multiplying unit fractions the same as multiplying whole numbers? How is it different

In future lessons, we are going to multiply fractions that have a numerator greater than 1. What do you wonder about that?

4

More Pieces of a Part and More Parts of a Piece

Let’s solve more problems about fraction multiplication.

5.NF.B.4.a

Number Talk: More Halving

Warm up

Evaluate each expression mentally.

$$\frac{1}{2} \times \frac{1}{2}$$

Number Talk: More Halving

Warm up

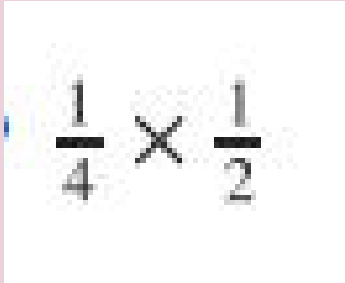
Evaluate each expression mentally.

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

Number Talk: More Halving

Warm up

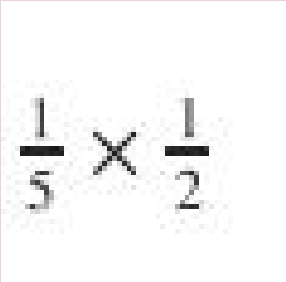
Evaluate each expression mentally.



Number Talk: More Halving

Warm up

Evaluate each expression mentally.

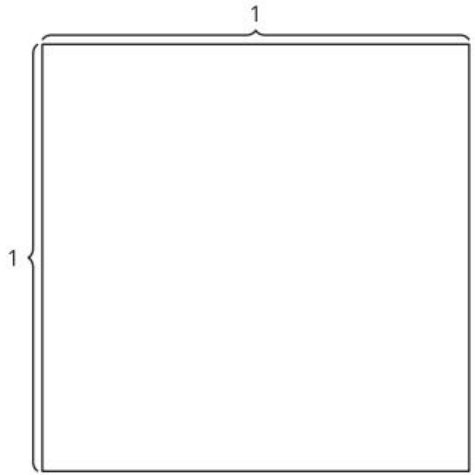


Activity #1

The Park

A city is designing a park on a square piece of land. $\frac{2}{3}$ of the park will be used for different sports. $\frac{1}{2}$ of the land set aside for sports will be soccer fields.

1. Draw a diagram of the situation.



2. Write a multiplication expression to represent the area of the park that will be soccer fields.

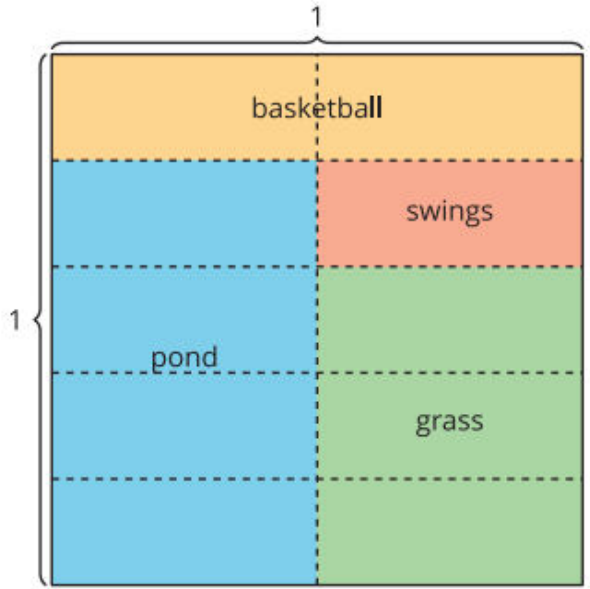
_____

3. What fraction of the whole park is used for soccer fields? Explain how you know.

Activity #2

A Different Park

1. Here is a diagram for a different park that Elena drew.



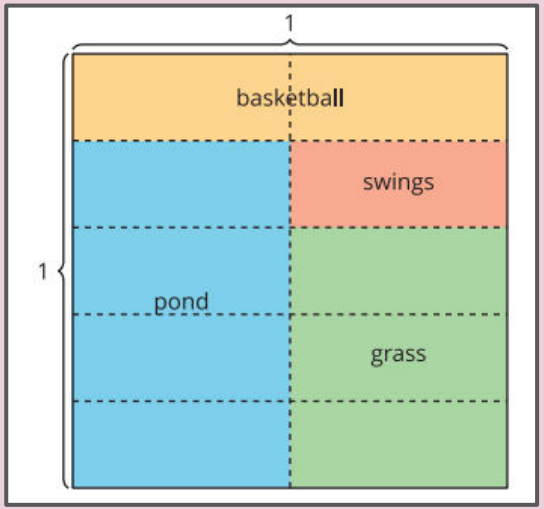
a. Which part of the park takes up $\frac{3}{5} \times \frac{1}{2}$ of the park? Explain how you know.

b. Pick one of the other parts of the park and write a multiplication expression for its area.

c. Trade expressions with your partner and figure out which part of the park their expression represents. Be prepared to explain your reasoning.

Lesson Synthesis

Today we represented multiplication of a unit fraction and a non-unit fraction with diagrams and expressions.



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

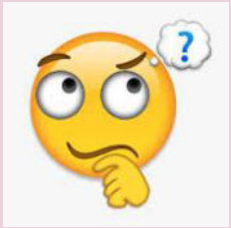
$$\frac{2}{2} \times \frac{1}{5} = \frac{2}{10}$$

$$\frac{3}{5} \times \frac{1}{2} = \frac{3}{10}$$

$$\frac{4}{5} \times \frac{1}{2} = \frac{4}{10}$$

Each of these equations represents a part of the park. Where do we see each equation in the diagram?

What patterns do you notice in the equations?



5

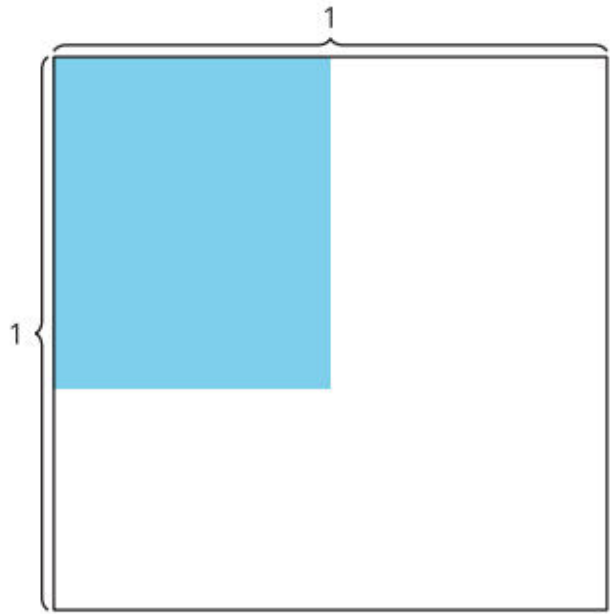
Multiply a Unit Fraction by a Non-unit Fraction

Let's look for more patterns when we multiply fractions.

Warm up

Estimation Exploration: Shaded Rectangle

What is the shaded area?



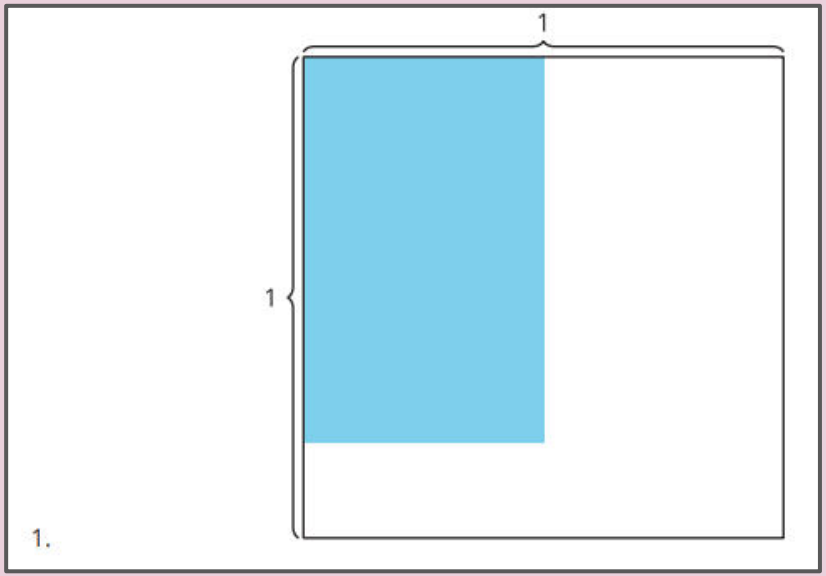
Record an estimate that is:

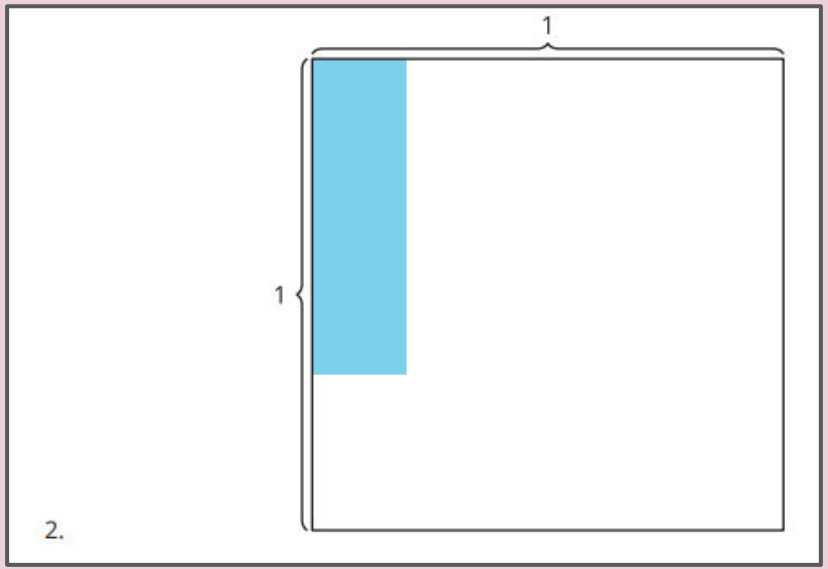
too low	about right	too high

Activity #1

Estimate With Expressions

Write a multiplication expression that might represent the area of the shaded rectangle. Be prepared to explain your reasoning.

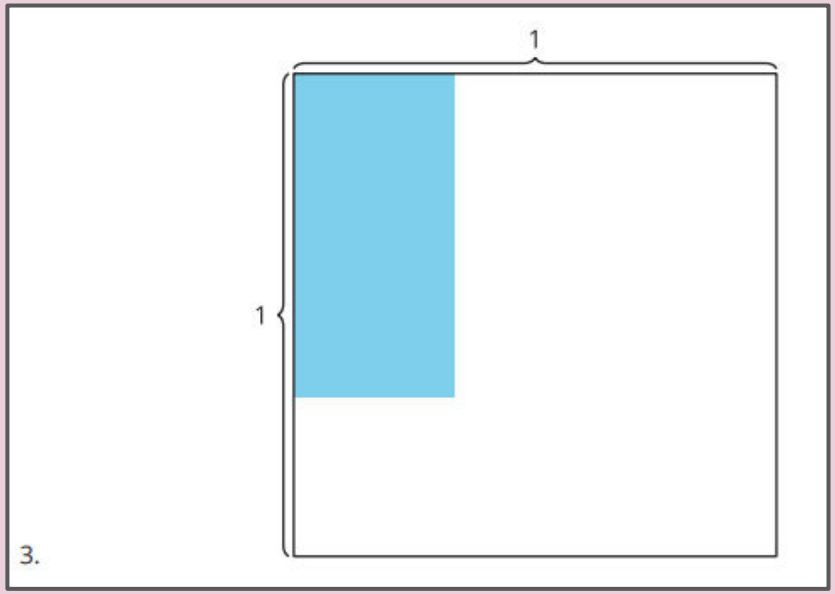


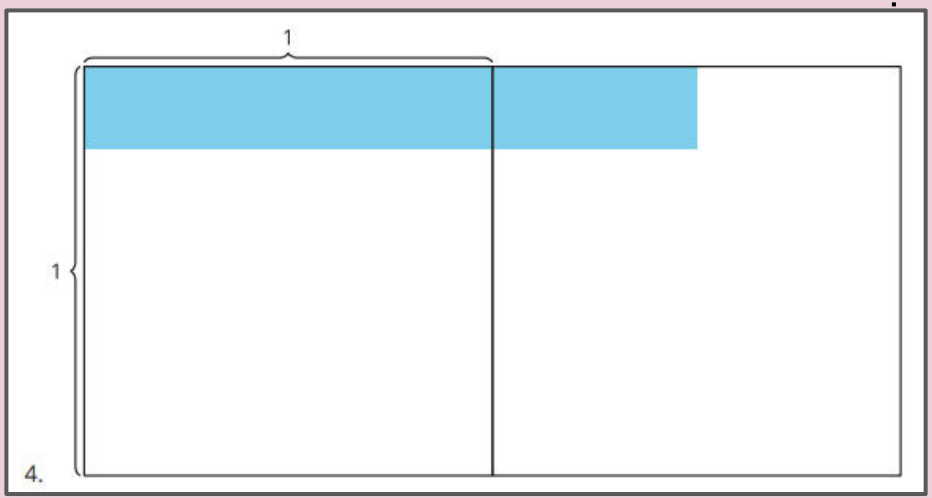


Activity #1

Estimate With Expressions

Write a multiplication expression that might represent the area of the shaded rectangle. Be prepared to explain your reasoning.

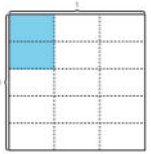
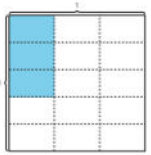
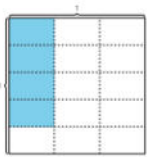




Write Equations

Activity #2

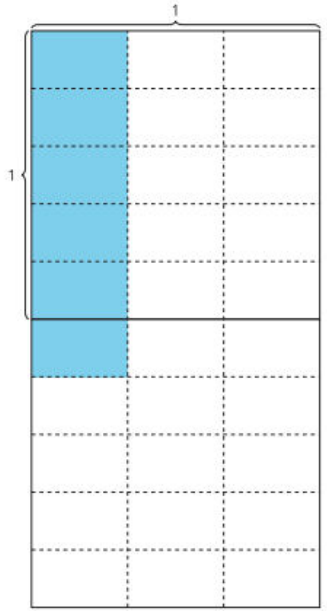
1. Complete the table.

diagram	multiplication expression	area of shaded rectangle
		
		
		

2. What patterns do you notice in the table?

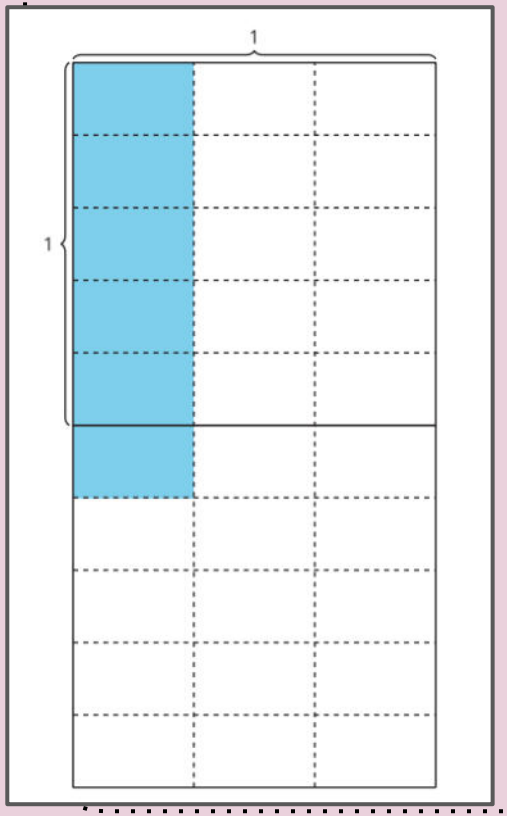
3. Han wrote this equation to represent the area of the shaded rectangle. Explain where you see the equation in the diagram.

$$\frac{6}{5} \times \frac{1}{3} = \frac{6}{15}$$



Lesson Synthesis

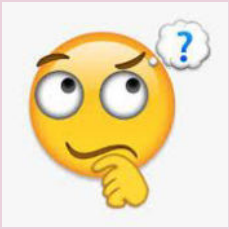
Today we multiplied a unit fraction by a non-unit fraction.



Kiran wrote this explanation:
I think the area of the shaded rectangle is 6/30 because 6/10 of ⅓ of the whole thing is shaded.

What do you think Kiran means?

What mistake did Kiran make?



6

Multiply Fractions

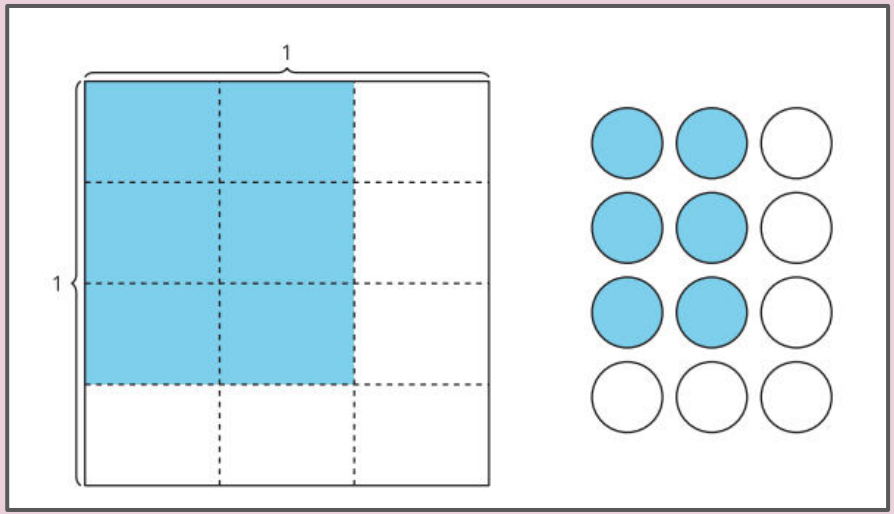
Let’s multiply two non-unit fractions using diagrams and expressions.

5.NF.B.4, 5.NF.B.4.b

Notice and Wonder: Area and Arrays

Warm up

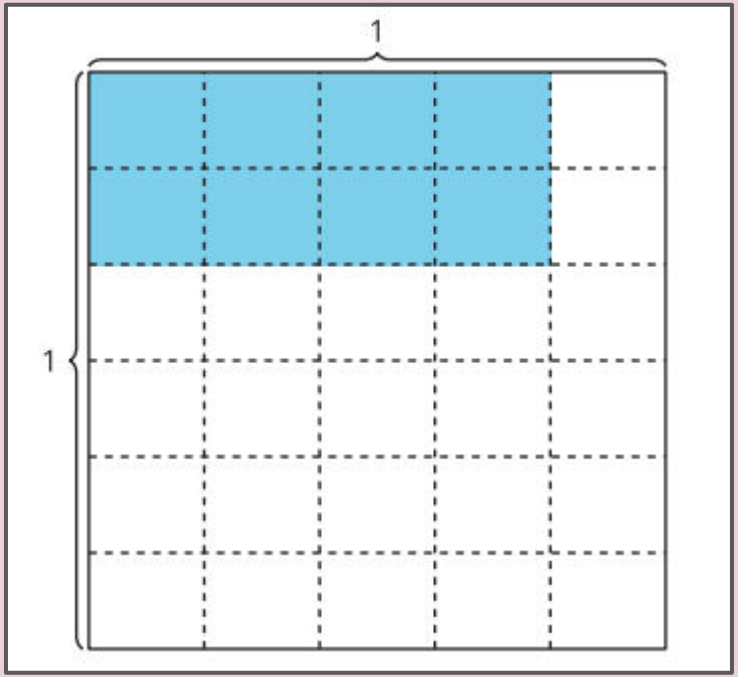
What do you notice?



What do you wonder?

Activity #1

Many Expressions



1. Explain how each expression can represent the shaded rectangle. Be prepared to share your thinking.

   a. $\frac{8}{30}$

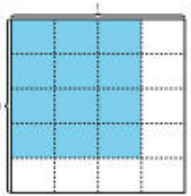
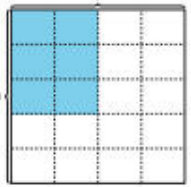
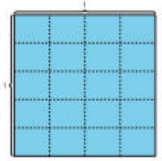
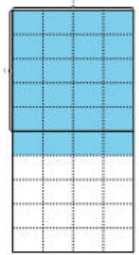
   b. $2 \times 4 \times (\frac{1}{5} \times \frac{1}{6})$

   c. $\frac{2}{6} \times \frac{4}{5}$

Activity #2

More Patterns

1. Complete the table.

diagram	multiplication expression	area of shaded rectangle
A. 		
B. 		
C. 		
D. 		

2. What patterns do you notice in the table? (Pause for teacher direction.)

More Patterns

Activity #2

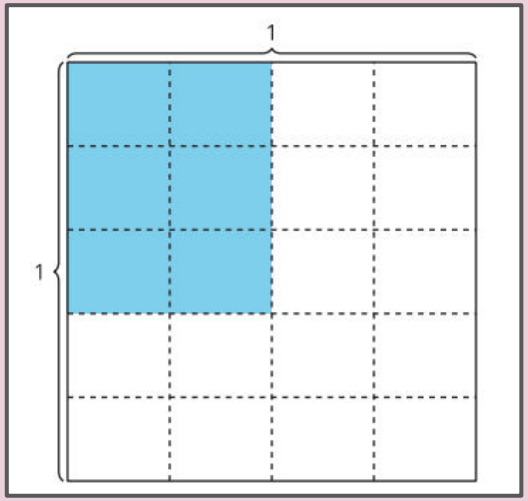
3. Priya uses whole number multiplication to explain how $\frac{6}{20}$ represents the area of the shaded rectangle in Diagram A. She says:

   "I see a 2 by 3 array inside a 4 by 5 array. $2 \times 3 = 6$ and $4 \times 5 = 20$, so the area of the shaded rectangle is $\frac{6}{20}$."

   Diego disagrees with Priya. He says you can't use whole number multiplication because the shaded rectangle represents a fraction.

   Who do you agree with? Explain or show your reasoning.

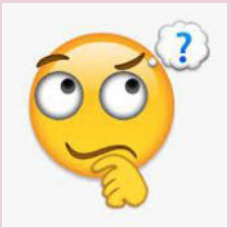
Lesson Synthesis



What does the 6 represent in the diagram?

$\frac{6}{20}$

What does the 20 represent in the diagram?



How does this expression represent the area of the shaded rectangle in Diagram A?

$\frac{(2\times3)}{(4\times5)}$

Discuss with a partner where you see this expression in the diagram.

7

Will It Always Work?

Let’s multiply fractions.

5.NF.B.4, 5.NF.B.4.a

Warm up

Number Talk: Multiply ¾

Evaluate each expression mentally.

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

Warm up

Number Talk: Multiply ¾

Evaluate each expression mentally.

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

Warm up

Number Talk: Multiply ¾

Evaluate each expression mentally.

$$\frac{3}{3} \times \frac{3}{4}$$

Warm up

Number Talk: Multiply ¾

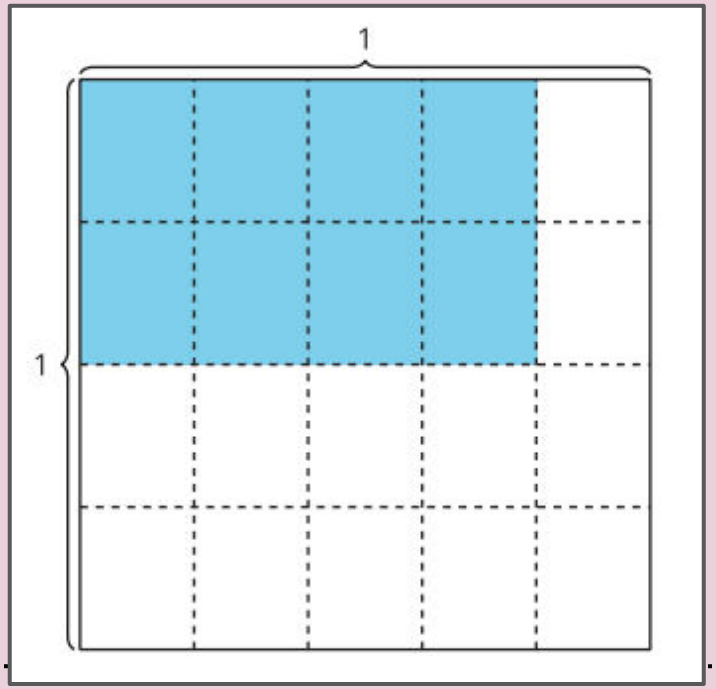
Evaluate each expression mentally.

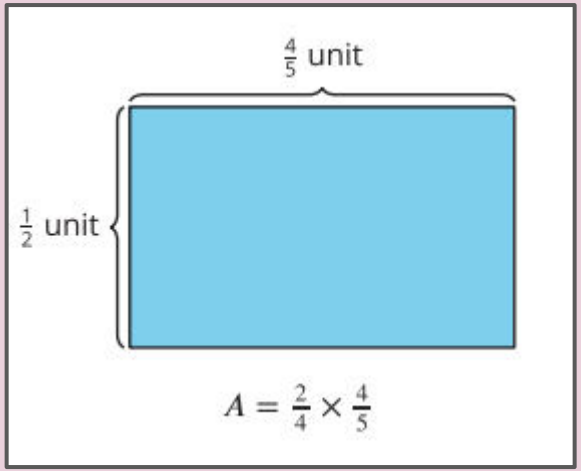
$$\frac{4}{3} \times \frac{3}{4}$$

Equations and Area

Activity #1

Look at the two shaded rectangles. What do you notice? What do you wonder?

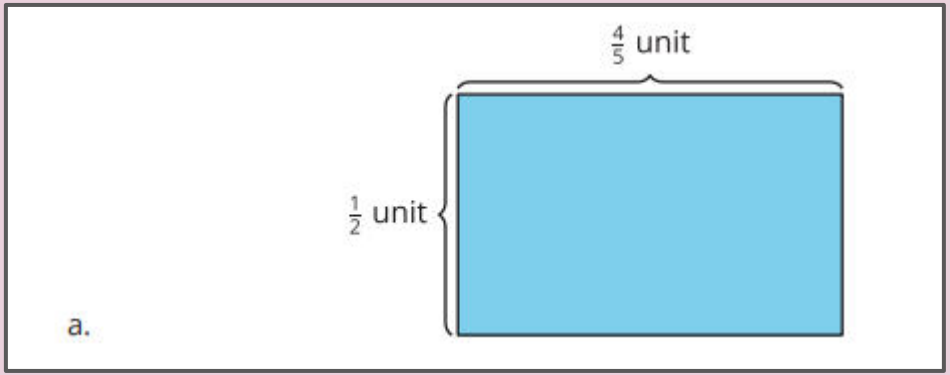


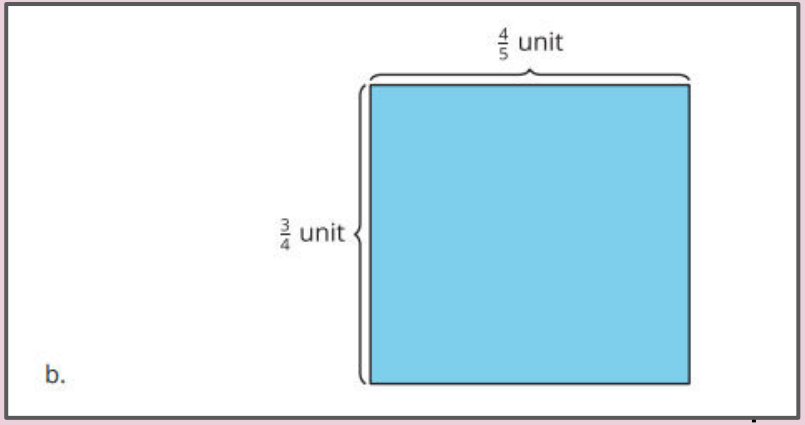


Equations and Area

Activity #1

1. Write a multiplication equation to represent the area of each diagram. Use a letter to represent the unknown value. Then, find the area.

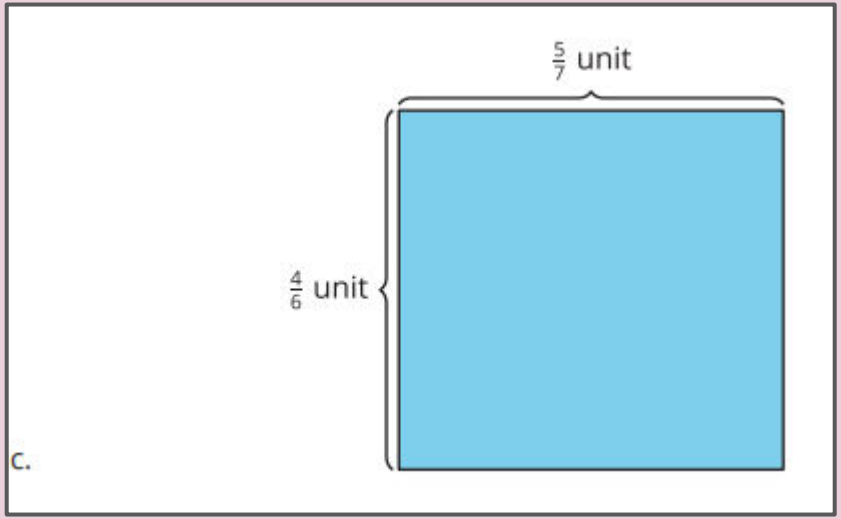


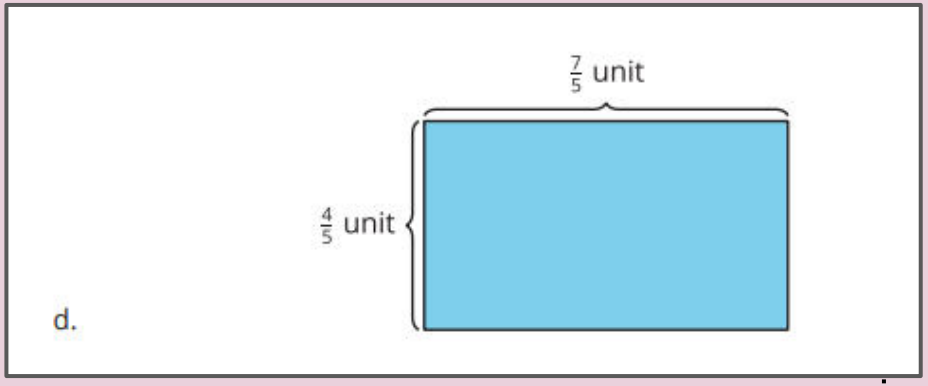


Equations and Area

Activity #1

1. Write a multiplication equation to represent the area of each diagram. Use a letter to represent the unknown value. Then, find the area.

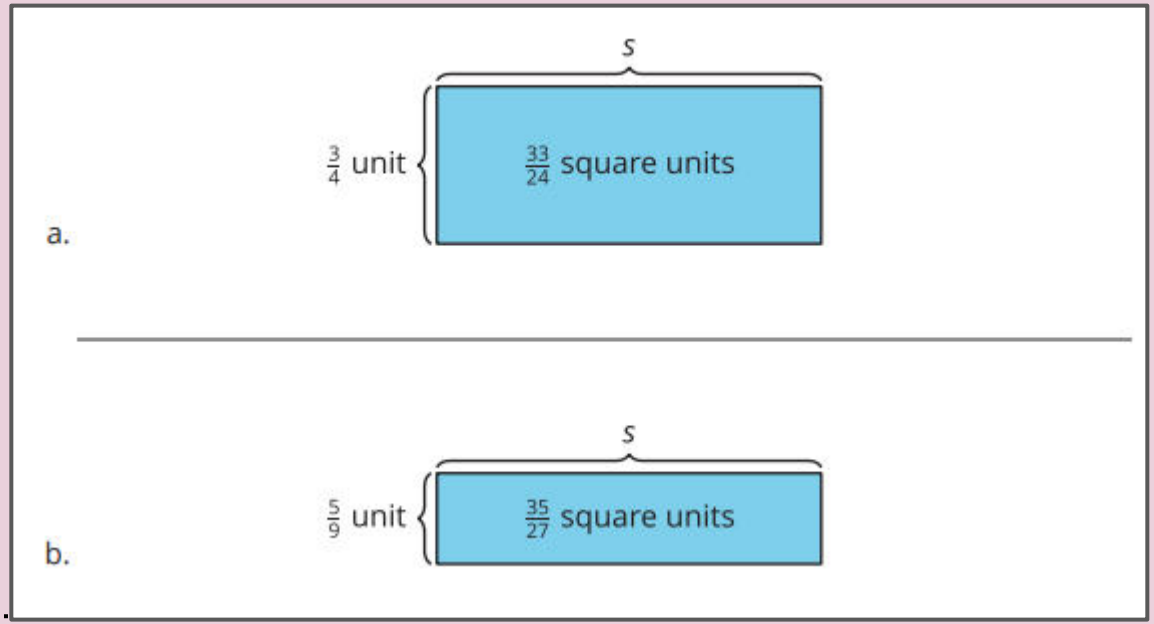




Equations and Area

Activity #1

2. Write a multiplication equation to represent the area of each diagram. Use a letter to represent the unknown value. Then, find the unknown value.



Activity #2

Multiply Fractions

Complete each equation. Draw a diagram, if it is helpful.

1. $\frac{3}{8} \times \frac{2}{5} =$ _____

2. $\frac{3}{4} \times \frac{9}{5} =$ _____

3. $\frac{10}{5} \times \frac{6}{5} =$ _____

4. $\frac{8}{9} \times$ _____ $= \frac{56}{36}$

5. $5 \times$ _____ $= \frac{15}{8}$

Any Questions? (Optional)

Activity #3

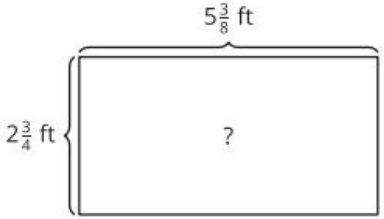
Partner 1:

- Write a mathematical question to represent the question mark in Diagram A.

_____

- Exchange questions with your partner and answer your partner's question.

A



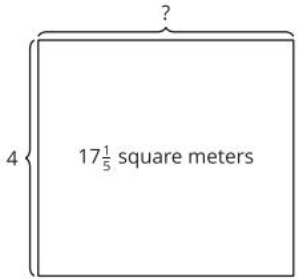
Partner 2:

- Write a mathematical question to represent the question mark in Diagram B.

_____

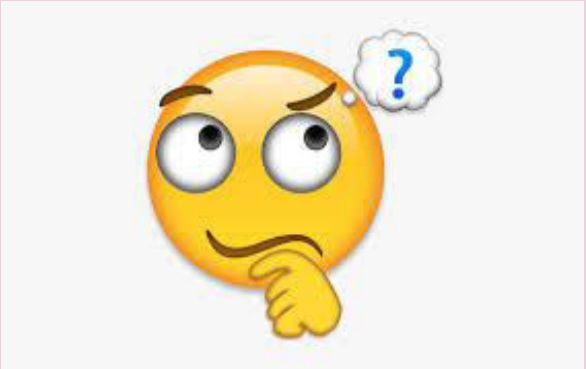
- Exchange questions with your partner and answer your partner's question.

B



Lesson Synthesis

What do you know about multiplying fractions?



8

Solve Problems with Fraction Multiplication

Let’s solve problems about flags.

5.NF.B.4.a, 5.NF.B.6

Warm up

Number Talk: (13/5)

Evaluate each expression mentally.

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

Warm up

Number Talk: (13/5)

Evaluate each expression mentally.

$$\frac{2}{3} \times \frac{3}{5}$$

Warm up

Number Talk: (13/5)

Evaluate each expression mentally.

$$\frac{5}{3} \times \frac{3}{5}$$

Warm up

Number Talk: (13/5)

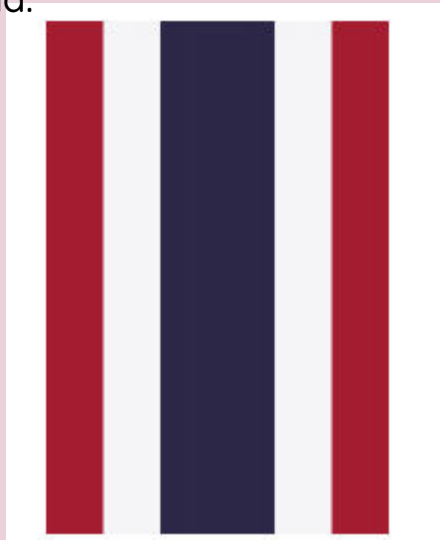
Evaluate each expression mentally.

$$\frac{2}{3} \times \frac{13}{5}$$

Flags

Activity #1

Jada has a small replica of a flag of Thailand.



It is 5 inches wide and 7 ½ inches long

1. What is the area of the flag? Explain your reasoning.

2. Each red stripe is $\frac{5}{6}$ inches wide. What is the area of each red stripe? Explain your reasoning.

3. The blue stripe is $\frac{10}{6}$ inches wide. What is the area of the blue stripe? Explain your reasoning.

Activity #2

More Flags

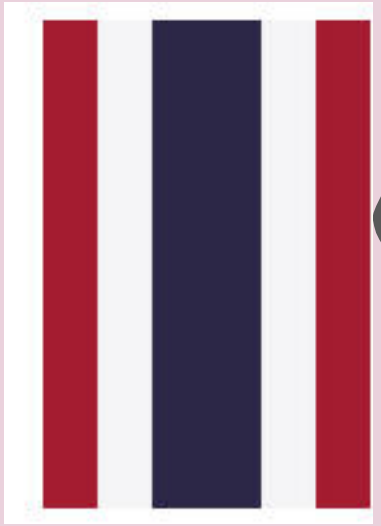
Han has a replica of the flag of Columbia. It is 3 ½ inches wide and 5 ¼ inches long. The yellow stripe is ½ of the width of the flag and the blue and red stripes are each ¼ of the width.

1. $\frac{1}{4} \times 3\frac{1}{2} = \frac{7}{8}$. The answer is $\frac{7}{8}$ inch. What is the question?

2. $\frac{1}{2} \times 3\frac{1}{2} = \frac{7}{4}$. $\frac{7}{4} \times \frac{21}{4} = \frac{147}{16}$. The answer is $\frac{147}{16}$ square inches. What is the question?

Lesson Synthesis

Today we solved problems using measurements of flags.



What might Kiran mean?

Kiran says the area of the red, white, and blue sections are equal. Do you agree?

The flag is 5 inches wide and $7\frac{1}{2}$ inches long.

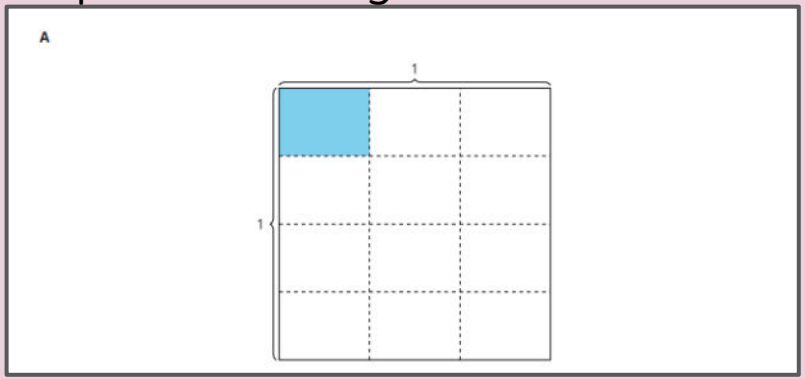
The white stripe is $\frac{5}{6}$ inches wide.

The blue stripe is $\frac{10}{6}$ inches wide.

What information in the problem confirms what Kiran said.

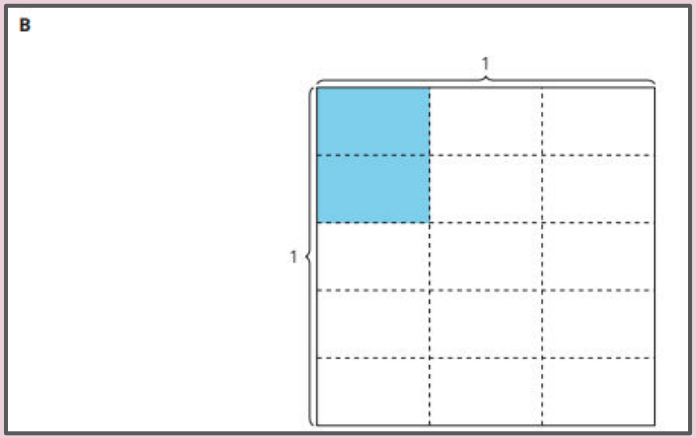
Section Summary

In this unit, we learned to multiply fractions. First we learned to multiply unit fractions. For example, we learned that $\frac{1}{3} \times \frac{1}{4} = \frac{1}{12}$. Another way to show this relationship is with a diagram.



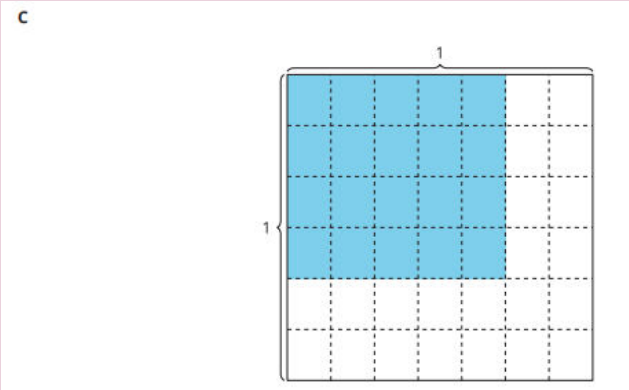
In diagram A, we can see that ⅓ of ¼ of a square is the same size as 1/12 of the whole square. Next, we learned to multiply unit fractions by non-unit fractions. For example, we learned that $\frac{2}{5} \times \frac{1}{3} = \frac{2}{15}$.

Section Summary



In diagram B, we can see that ⅖ of ⅓ of a square is the same size as 2/15 of the whole square. Next, we learned how to multiply any fraction by a fraction

Section Summary



In diagram C, we can see that $\frac{4}{6} \times \frac{5}{7} = \frac{20}{42}$ We can multiply the numerators, 4 x 5 to find the numerator in the product. We can multiply the denominators, 6 x 7 , to find the denominator in the product. We can represent this relationship with the equation: $\frac{(4 \times 5)}{(6 \times 7)} = \frac{20}{42}$ Diagram C represents a 4 by 5 array inside a 5 by 7 array. It also represents 20 pieces that are each 1/42 of the whole square.

9

Whole Number Division

Let’s think about quotients

5.NBT.B.7, 5.NF.B.7

Warm up

Number Talk: Same Dividend, Different Divisor

Find the value of each expression mentally.

$$120 \div 12$$

Warm up

Number Talk: Same Dividend, Different Divisor

Find the value of each expression mentally.

$$120 \div 6$$

Warm up

Number Talk: Same Dividend, Different Divisor

Find the value of each expression mentally.

$$120 \div 3$$

Warm up

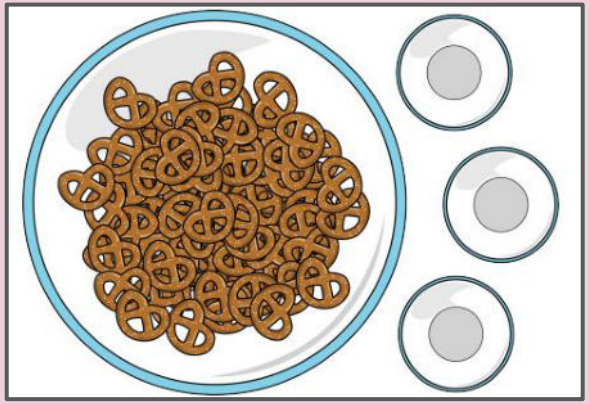
Number Talk: Same Dividend, Different Divisor

Find the value of each expression mentally.

$$120 \div 2$$

Activity #1

Share Pretzels



Order the situations from greatest to least based on the number of pretzels each student will get. Be prepared to explain your reasoning.

3 students equally share 42 pretzels
14 students equally share 42 pretzels
3 students equally share 24 pretzels
3 students equally share 45 pretzels
7 students equally share 42 pretzels
3 students equally share 6 pretzels
6 students equally share 42 pretzels

Activity #2

Division Patterns

1. Solve.

$36 \div 3$

$12 \div 3$

$9 \div 3$

$6 \div 3$

$3 \div 3$

$1 \div 3$

2. What patterns do you notice?

3. Why is the quotient getting smaller?

4. What do you know about this expression: $\frac{1}{3} \div 3$?

5. Draw a diagram to show what $\frac{1}{3} \div 3$ might look like.

Lesson Synthesis

Today we noticed patterns while dividing whole numbers.
What do we know about division?

10

Divide a Unit Fraction by a Whole Number

Let’s divide a unit fraction by a whole number.

5.NF.B.7.a, 5.NF.B.7.b

Warm up

Number Talk: Double the Divisor

Find the value of each expression mentally.

$$72 \div 4$$

Warm up

Number Talk: Double the Divisor

Find the value of each expression mentally.

$$36 \div 4$$

Warm up

Number Talk: Double the Divisor

Find the value of each expression mentally.

$$4 \div 4$$

Warm up

Number Talk: Double the Divisor

Find the value of each expression mentally.

$$1 \div 4$$

Activity #1

More Macaroni and Cheese

Jada and her 2 sisters equally share ½ a pan of macaroni and cheese.

1. Draw a diagram to represent the situation.

2. Explain how this expression represents the situation: $\frac{1}{2} \div 3$

3. How much of the whole pan of macaroni and cheese will each person get?

More People Share

Activity #2

1.
4 people equally share ½ a pan of macaroni and cheese.

a. Draw a diagram to represent the situation.

b. Explain where you see . $\frac{1}{2} \div 4$

c. How much macaroni and cheese did each person get? Be prepared to explain your reasoning

2.
5 people equally share ½ a pan of macaroni and cheese.

a. Draw a diagram to represent the situation.

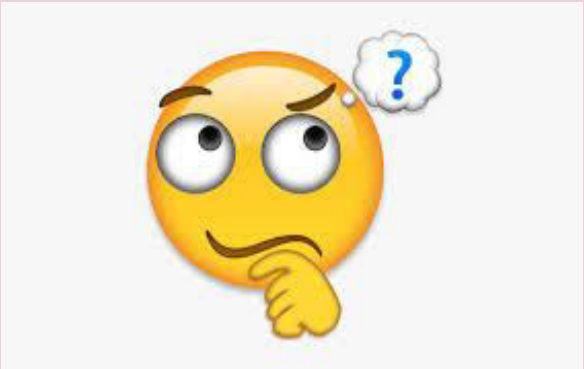
b. Explain where you see . $\frac{1}{2} \div 5$

c. How much macaroni and cheese did each person get? Be prepared to explain your reasoning.

d. How are the problems the same? How are they different?

Lesson Synthesis

What can we add to our poster to show what we learned about division today?



11

Patterns with Division of a Unit Fraction by a Whole Number

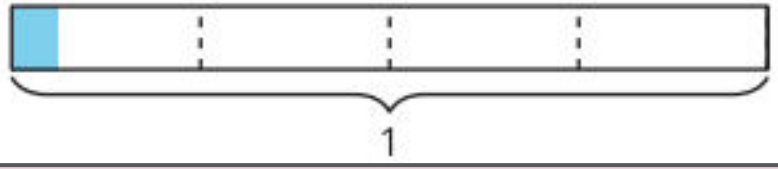
Let’s make sense of the division of a unit fraction by a whole number.

5.NF.B.7.b

Warm up

Estimation Exploration: How Much is Shaded?

How much is shaded?



Record an estimate that is:

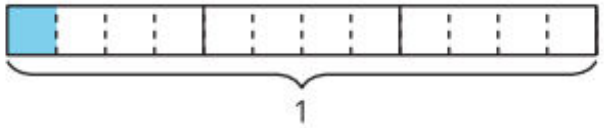
too low	about right	too high

Diagrams, Equations, Situations

Activity #1

Priya and Mai used the diagrams below to find the value of $\frac{1}{3} \div 4 =$ _____.

Priya's diagram:



Mai's diagram:

1. What is the same about the diagrams?

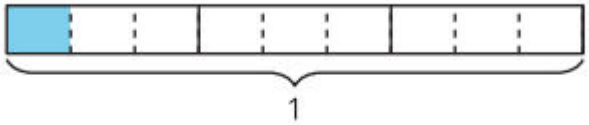
2. What is different?

3. Find the value of the missing number. $\frac{1}{3} \div 4 =$ _____

Diagrams, Equations, Situations

Activity #1

4. Han drew the diagram below to represent $\frac{1}{3} \div 3$. Where do you see $\frac{1}{3} \div 3$?



5. Find the value of the missing number. Explain or show your reasoning.

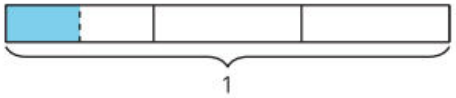
$\frac{1}{3} \div 3 =$ _____

Reason About Revisions

Activity #2

1. Find the value of the expression. Show or explain your thinking. $\frac{1}{3} \div 2$_____

2. This is Priya's work for finding the value of $\frac{1}{3} \div 2$:



$\frac{1}{3} \div 2 = \frac{1}{2}$ because I divided $\frac{1}{3}$ into 2 equal pieces and $\frac{1}{2}$ of $\frac{1}{3}$ is shaded in.

a. What questions do you have for Priya?

b. Priya's equation is incorrect. How can Priya revise her explanation?

c. Revise your work if necessary.

Activity #3

Look for Patterns

1. Solve the equations. Use a diagram if it is helpful.

a. $\frac{1}{4} \div 2 =$ _____

b. $\frac{1}{4} \div 3 =$ _____

c. $\frac{1}{4} \div 4 =$ _____

2. What patterns do you notice?

_____

_____

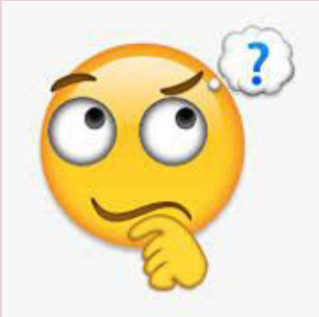
3. Fill in the blanks to make the equation true. Show or explain your reasoning.

$\frac{1}{3} \div$ _____ $= \frac{1}{__} \times \frac{1}{3}$

Lesson Synthesis

$$\frac{1}{3} \div ____ = \frac{1}{____} \times \frac{1}{3}$$

What are some numbers we can write in the blanks to make the equation true?



Explain to your partner why the number in the blanks on each side of the equation is the same

12

Dividing a Whole Number by a Unit Fraction

Let’s divide whole numbers by unit fractions.

5.NF.B.7.b

Notice and Wonder: Quilts

Warm up

What do you notice?

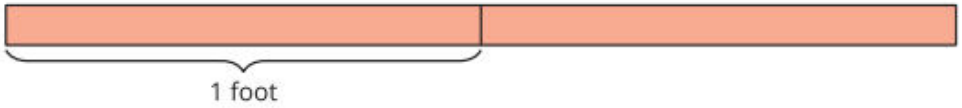
What do you wonder?

My Way Quilt

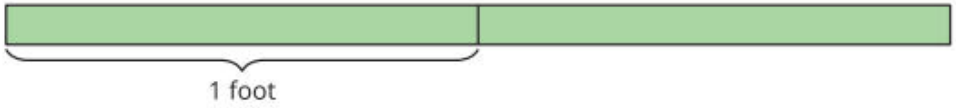
Activity #1

Below are diagrams that show strips of different colored paper. Each strip is 2 feet long. The paper strips will be cut into different sized pieces

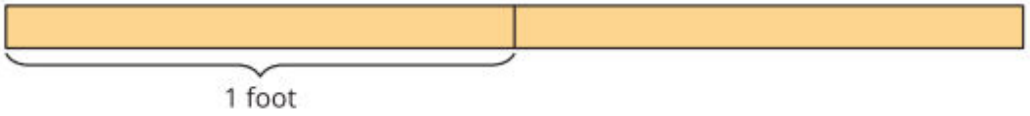
1. The red strip will be cut into pieces that are ½ foot long. How many pieces will there be?



2. The green strip will be cut into pieces that are ⅓ foot long. How many pieces will there be?



3. The orange strip will be cut into pieces that are ¼ foot long. How many pieces will there be?



4. Describe what was the same about the problems you solved. Describe what was different.

Activity #2

More Quilt Strips

Kiran has a yellow strip of paper that is 2 feet long.
He wants to cut the strip into foot pieces.

1. How many pieces will Kiran have? Show or explain your reasoning.

2. Write a division equation to represent the situation.

3. How would the number of pieces change if Kiran had a strip of paper that is 3 feet long?

4. Describe how this equation represents a strip of paper that is 3 feet long being cut into equal sized pieces

$3 \div \frac{1}{6} = 18$

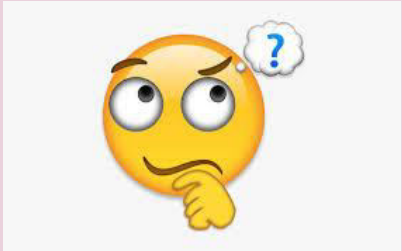
Lesson Synthesis

Today, we solved problems about cutting strips of paper into small pieces. We wrote equations to represent dividing a whole number by a unit fraction

$$2 \div \frac{1}{2} = 4$$
$$2 \div \frac{1}{3} = 6$$
$$2 \div \frac{1}{4} = 8$$
$$2 \div \frac{1}{6} = 12$$

These are some of the equations we discussed today. Why is the quotient getting larger in each equation?

Here is another equation we discussed. In this equation, the size of the piece is the same as the equation above it. Why is the quotient larger than the dividend?



We are going to learn more about the relationships between the numbers in division equations with unit fractions in the next lesson.

13

More Division of Whole Numbers by Unit Fractions

Let’s use equations to represent division of a whole number by a unit fraction.

5.NF.B.7.b

Warm up

Number Talk: Increasing Quotients

Find the value of each expression mentally.

$$6 \div 1$$

Warm up

Number Talk: Increasing Quotients

Find the value of each expression mentally.

$$6 \div \frac{1}{2}$$

Warm up

Number Talk: Increasing Quotients

Find the value of each expression mentally.

$$6 \div \frac{1}{3}$$

Warm up

Number Talk: Increasing Quotients

Find the value of each expression mentally.

$$6 \div \frac{1}{6}$$

Notice Patterns

Activity #1

Set A

1. Solve the equations. Draw a diagram if it is helpful.
   - $3 \div \frac{1}{4} =$ _____
   - $4 \div \frac{1}{4} =$ _____
   - $5 \div \frac{1}{4} =$ _____
   - $6 \div \frac{1}{4} =$ _____

What patterns do you notice?

Set B

1. Solve. Draw a diagram if it is helpful.
   - $3 \div \frac{1}{2} =$ _____
   - $3 \div \frac{1}{3} =$ _____
   - $3 \div \frac{1}{4} =$ _____
   - $3 \div \frac{1}{5} =$ _____

What patterns do you notice?

2. What is the same about problem set A and B? What is different?

Match the Situation to the Equation

Activity #2

1. Match each problem to an equation that represents the problem. Some equations will not have a match. Be prepared to explain your reasoning.
   a. One serving of popcorn is $\frac{1}{4}$ cup of kernels. There are 3 cups of kernels in the bowl. How many servings are in the bowl?

   b. One serving of orange juice is $\frac{1}{4}$ liter. The container of juice holds 2 liters. How many servings are in the container?

   c. One serving of granola is $\frac{1}{2}$ cup. The bag of granola holds 5 cups. How many servings are in the bag?

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

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

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

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

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

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

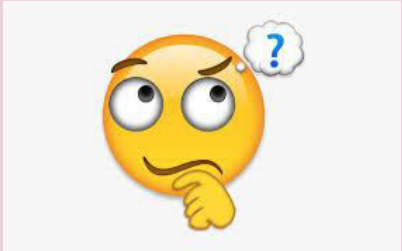
2. Solve the equations.

Lesson Synthesis

Today we used equations to represent and solve problems involving the division of a whole number by a unit fraction

Jada says when you divide a whole number by a unit fraction, the answer will always be a whole number

Do you agree with Jada? Be prepared to explain your thinking



Discuss your thinking with your partner.

Make Connections

Let’s connect what we know about multiplication and division.

Warm up

Estimation Exploration: How Many One Fifths?

$447 \div \frac{1}{5}$ Record an estimate that is:

too low	about right	too high

Greater Than or Less Than 1

Activity #1

1. Without solving, write each expression under the correct category.

The value of the expressions is less than 1:

The value of the expression is greater than 1:

$18 \div \frac{1}{3}$

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

$\frac{1}{2} \div 11$

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

$11 \div \frac{1}{2}$

$\frac{1}{3} \div 18$

2. Explain your strategy for determining whether an expression is going to be less than 1 or greater than 1.

3. Find the value of each expression.

4. Revise the expression sort, if needed.

Activity #2

Solve Equations

Solve the equations.

1. $15 \div \frac{1}{3} =$ _____

2. $24 \div \frac{1}{2} =$ _____

3. $\frac{1}{4} \div 8 =$ _____

4. $25 \div \frac{1}{5} =$ _____

5. $\frac{1}{3} \div 15 =$ _____

Lesson Synthesis

What is the same and different about the explanations?

15

Match, Solve, and Write

Let’s solve division problems involving whole numbers and unit fractions.

5.NF.B.7, 5.NF.B.7.c

Warm up

Number Talk

$$6 \div 3$$

Warm up

Number Talk

$$6 \div \frac{1}{3}$$

Warm up

Number Talk

$$\frac{1}{3} \div 6$$

Warm up

Number Talk

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

Card Sort: Fraction Division Problem Sort

Activity #1

1. Your teacher will give you a set of cards. Match each equation with a situation. Some equations do not have a matching situation.

2. Solve each equation. Be prepared to share your reasoning.

Activity #2

Division Story Problems

1. Choose one of the equations from the card sort and write a story problem to represent the equation.

_____

_____

_____

_____

2. Trade story problems with your partner and solve.

Lesson Synthesis

What can we add to our chart to show what we learned about division in this section?

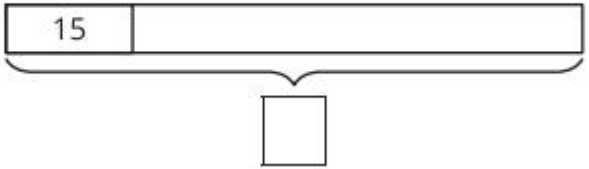
How Much in One?

Let’s solve “How much in one?” problems.

Warm up

Estimation Exploration: What Number Goes in the Blank?

What number goes in the blank?



Record an estimate that is:

too low	about right	too high

Different Equations

Activity #1

1. If $\frac{1}{3}$ of the class is 9 students, how many students are in the class? Explain or show your reasoning.

2. Explain how each of these equations can represent this situation.

   a. $\frac{1}{3} \times _____ = 9$

   b. $_____ \div 3 = 9$

   c. $3 \times 9 = _____$

Activity #2

How Big is the Class?

1. Jada's class has 24 students in it. That is $\frac{1}{4}$ the total students in the 5th grade. How many students are in the 5th grade? Explain or show your reasoning.

2. Select all the equations that could be used to represent this problem.

   a. $\frac{1}{4} \times 24 = ____$

   b. $____ \div 4 = 24$

   c. $\frac{1}{4} \div 24 = ____$

   d. $24 \div \frac{1}{4} = ____$

   e. $24 = \frac{1}{4} \times ____$

Activity #3

How many in One Group? (Optional)

Solve each problem. Show or explain your reasoning.

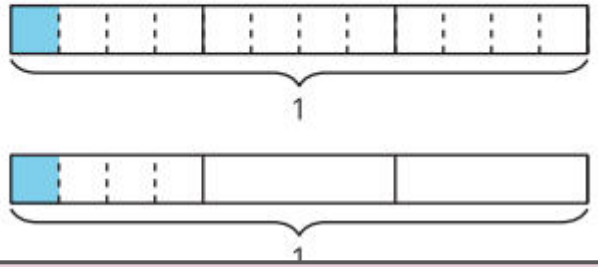
1. 250 mg of calcium is $\frac{1}{4}$ of the daily recommended allowance. What is the daily recommended allowance of calcium? Show or explain your reasoning.

2. A rocket took 60 days to get $\frac{1}{5}$ of the way to Mars. How many days did it take the rocket to get to Mars? Show or explain your reasoning.

Section Summary

In this unit, we learned to divide with whole numbers and unit fractions. We used diagrams to solve problems involving division of unit fractions by whole numbers.

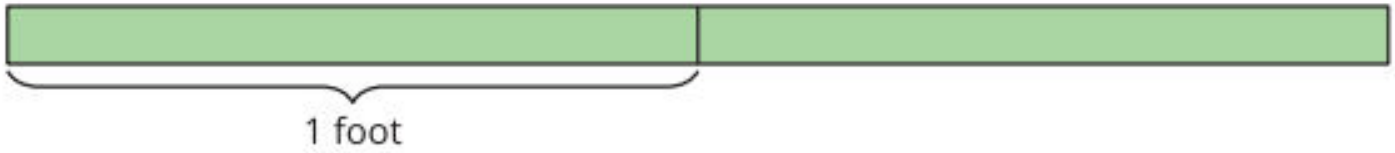
We can see that $\frac{1}{3} \div 4$ equals $\frac{1}{12}$ of the whole.



Section Summary

We noticed the relationship between division and multiplication. For example, we explained $\frac{1}{3} \div 4 = \frac{1}{4} \times \frac{1}{3}$. If we divide $\frac{1}{3}$ into 4 equal pieces, that is the same as finding $\frac{1}{4}$ of $\frac{1}{3}$.

We used diagrams to solve problems involving division of whole numbers by unit fractions.



Section Summary

We wrote equations to represent dividing a whole number by a unit fraction. For example $2 \div \frac{1}{6} = 12$ shows there will be 12 pieces if a strip of paper 2 feet long is cut into $\frac{1}{6}$ foot pieces.

We noticed patterns when dividing whole numbers and fractions. We noticed whole numbers divided by fractions were greater than 1. Fractions divided by whole numbers were less than 1. For example $12 \div \frac{1}{4}$ is greater than 1 because you divide more than 1 into fractional pieces. $\frac{1}{3} \div 18$ is less than 1 because you divide a fraction into many pieces.

17

Fraction Multiplication and Division

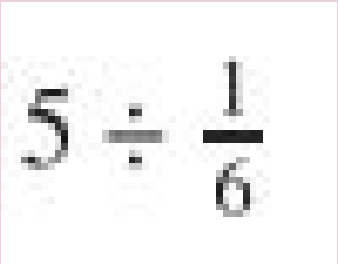
Let’s multiply and divide fractions.

5.NF.B.4, 5.NF.B.6, 5.NF.B.7

Warm up

Number Talk: Multiply and Divide

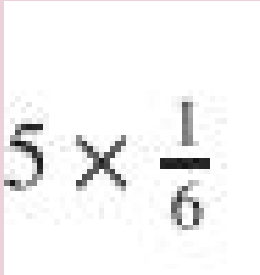
Find the value of each expression mentally.



Warm up

Number Talk: Multiply and Divide

Find the value of each expression mentally.



Warm up

Number Talk: Multiply and Divide

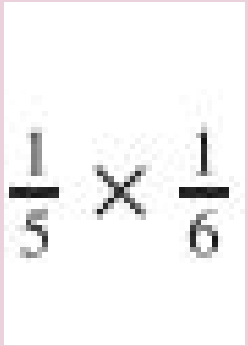
Find the value of each expression mentally.

$\frac{1}{5} \div 6$

Warm up

Number Talk: Multiply and Divide

Find the value of each expression mentally.



Info Gap: Tiles

Activity #1

Your teacher will give you either a problem card or a data card. Do not show or read your card to your partner.

If your teacher gives you the *problem card*:

1. Silently read your card and think about what information you need to answer the question.
2. Ask your partner for the specific information that you need.
3. Explain to your partner how you are using the information to solve the problem.
4. Solve the problem and explain your reasoning to your partner.

Info Gap: Tiles

Activity #1

If your teacher gives you the *data card*:

1. Silently read the information on your card.
2. Ask your partner, "What specific information do you need?" and wait for your partner to ask for information. Only give information that is on your card. (Do not figure out anything for your partner!)
3. Before telling your partner the information, ask, "Why do you need that information?"
4. After your partner solves the problem, ask them to explain their reasoning and listen to their explanation.

Pause here so your teacher can review your work. Ask your teacher for a new set of cards and repeat the activity, trading roles with your partner.

Activity #2

Multiplication or Division (Optional)

Solve each problem. Show or explain your reasoning.

1. If 11 grains of rice weigh $\frac{1}{3}$ gram, how much does each grain of rice weigh?

2. Mai's road is $\frac{9}{10}$ mile long. She ran $\frac{3}{4}$ of her road. How far did she run?

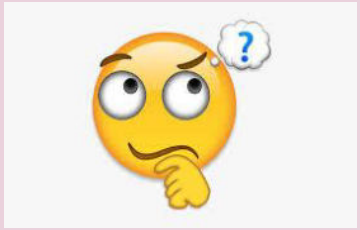
3. If each tennis ball weighs $2\frac{1}{16}$ ounces how much do 9 tennis balls weigh?

Lesson Synthesis

$$5 \div \frac{1}{6} = 30$$
$$5 \times \frac{1}{6} = \frac{1}{6}$$
$$\frac{1}{5} \div 6 = \frac{1}{30}$$
$$\frac{1}{5} \times \frac{1}{6} = \frac{1}{30}$$

What relationships do you see in these problems?

Describe one relationship to your partner



What do we know about the relationship between multiplication and division?

18

Multiplication and Division 1

Let’s solve problems involving multiplication and division with fractions.

5.NF.B.4, 5.NF.B.6, 5.NF.B.7

Estimation Exploration: Multiply Fractions

Warm up

$$2 \times 1\frac{8}{9}$$

Record an estimate that is:

too low	about right	too high

To Multiply or Divide? Part 1

Activity #1

Some of the problems below can be solved using multiplication or division. Other problems need a different operation.

1. Select the ones that can be solved by multiplying. Justify your reasoning.

2. Select the ones that can be solved by dividing. Justify your reasoning.

3. For the remaining problems, what operation might be appropriate?

a. $\frac{2}{3}$ of the students in Lin's fifth grade class have short hair. $\frac{1}{4}$ of the girls wear glasses. What fraction of Lin's class are people with short hair who wear glasses?

b. A garden is in the shape of a rectangle $2\frac{4}{6}$ feet long and 2 feet wide. What is the area of the garden?

c. There was $\frac{1}{2}$ liter of water in Han's water bottle. He drank $\frac{1}{3}$ liter of water. How many liters of water does he have left in the bottle?

d. A pizza is cut into 8 slices. There is $\frac{3}{4}$ of the pizza left. If Noah eats another slice of the original whole pizza, what fraction of the original pizza is left over?

e. You have $\frac{1}{2}$ of a bag of pretzels and you want to share them equally among 4 people. How much of the bag does each person get?

To Multiply or Divide? Part 1

Activity #1

Some of the problems below can be solved using multiplication or division. Other problems need a different operation.

f. Jada was planting a garden. She planted $\frac{3}{8}$ of the garden with carrots and $\frac{2}{8}$ of the garden with squash. What fraction of the garden is planted with carrots or squash?

_____

g. Elena bought 3 pineapples that each weighed about $1\frac{2}{3}$ pounds. How many pounds of pineapple did she buy?

_____

h. A big water container can hold 4 gallons of water. If one bottle can hold $\frac{1}{10}$ gallon of water, how many bottles are needed to fill the entire container?

_____

i. The track at school is $\frac{2}{3}$ of a mile long. If Diego runs $\frac{1}{3}$ of the way around the track each day, what fraction of a mile does he run?

_____

j. Clare plays her favorite song 6 times on repeat while she gets ready for school in the morning. If the song is $3\frac{9}{10}$ minutes long, how long does it usually take Clare to get ready in the morning?

Activity #2

To Multiply or Divide? Part 2

1. Solve the problems that involve multiplication or division from the previous activity. Make sure to include appropriate units in the answer.

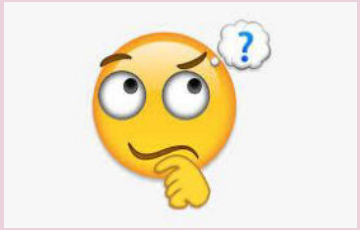
2. If you have time, solve the other problems.

Lesson Synthesis

Today we looked at different situations and analyzed those that could be solved using either multiplication or division.

Andre has ⅓ of a bottle of juice.
He has 10 ounces in his bottle.
How much juice does the bottle hold when it is completely full?

$10 \div \frac{1}{3} = 30$ and $3 \times 10 = 30$.



How do we see both of these equations in this situation?

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Multiplication and Division 2

Let’s solve real world multiplication and division problems.

5.NF.B, 5.NF.B.4, 5.NF.B.6, 5.NF.B.7

Warm up

Number Talk: Three and a Tenth

$$3 \times \frac{1}{10}$$

Warm up

Number Talk:
Three and a Tenth

$$\frac{1}{10} \times 3$$

Warm up

Number Talk: Three and a Tenth

$$\frac{1}{10} \div 3$$

Warm up

Number Talk: Three and a Tenth

$$3 \div \frac{1}{10}$$

Putting it All Together: Multiplication and Division

Activity #1

Diego's dad is making hamburgers for the picnic. There are 2 pounds of beef in the package. Each burger uses $\frac{1}{4}$ pound. How many burgers can be made with the beef in the package?

1. Draw a diagram to represent the situation.
2. Write a division equation to represent the situation.
3. Write a multiplication to represent the situation

Putting it All Together: Multiplication and Division

Activity #1

Diego and Clare are going to share $\frac{1}{4}$ pound of potato salad. How many pounds of potato salad will each person get?

1. Draw a diagram to represent the situation.
2. Write a division equation to represent the situation.
3. Write a multiplication to represent the situation

Activity #2

Multiplication or Division?

1. Write a multiplication or division expression for each situation in your set of problems

2. Answer the question and write an equation. Make sure to include appropriate units. Draw a diagram, if needed.

3. Trade papers with your partner, and check your partner's equations. If you disagree, work to reach an agreement.

Activity #2

Multiplication or Division?

Partner A:

1. The distance from Han's house to Priya's house is $\frac{4}{5}$ kilometers. Han has walked $\frac{3}{4}$ of the way already. How many kilometers has he walked?

2. Clare's science class will test water samples in class. If there is a total of $\frac{1}{2}$ gallon of water and 10 groups, how much water will each group get if Clare's teacher passes out an equal amount to each group?

3. A container with 3 kilogram of strawberries is $\frac{1}{5}$ full. How many kilograms can the container hold?

Activity #2

Multiplication or Division?

Partner B:

1. It takes Han 4 minutes to walk $\frac{1}{3}$ kilometer. How many minutes will it take him to walk 1 kilometer?

2. Clare's goal was to collect 4 kilograms of soil sample for her science project. She collected $2\frac{2}{3}$ times her goal. What was the amount of soil she collected?

3. A container that can hold a $\frac{1}{2}$ pound of strawberries is $\frac{3}{5}$ of the way full. How many pounds of strawberries are in the container?

Lesson Synthesis

What do we know about the relationship between multiplication and division?”

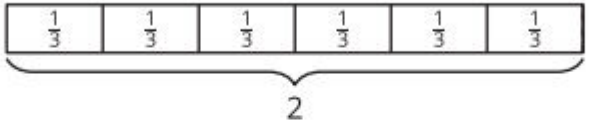
Section Summary

In this unit we solved problems involving fraction multiplication and division. First, we looked at different situations and analyzed those that could be solved using either multiplication or division. For example, a problem that can be solved with division, such as $10 \div \frac{1}{3} = 30$ can also be solved using multiplication, or $3 \times 10 = 30$.

Next, we used the relationship between multiplication and division to write both multiplication and division equations to represent the same situation. For example, there are 2 pounds of beef in the package. Each burger uses $\frac{1}{4}$ pound. We can write $2 \div \frac{1}{4} = 8$ and $8 \times \frac{1}{4} = 2$ to represent the situation.

Section Summary

We also wrote multiplication and division equations to represent the same diagram. For example:



We can write $6 \times \frac{1}{3} = 2$ because the diagram shows 6 groups of $\frac{1}{3}$ and the total value is 2. We can also write $2 \div \frac{1}{3} = 6$ because the diagram shows that there are 6 groups of $\frac{1}{3}$ in 2.

Section Summary

We wrote equations to represent dividing a whole number by a unit fraction. For example $2 \div \frac{1}{6} = 12$ shows there will be 12 pieces if a strip of paper 2 feet long is cut into $\frac{1}{6}$ foot pieces.

We noticed patterns when dividing whole numbers and fractions. We noticed whole numbers divided by fractions were greater than 1. Fractions divided by whole numbers were less than 1. For example $12 \div \frac{1}{4}$ is greater than 1 because you divide more than 1 into fractional pieces. $\frac{1}{3} \div 18$ is less than 1 because you divide a fraction into many pieces.