This "Section-level slidedeck" uses the full unit slidedeck as a base. Only the slides aligning with the Section-level planning guide are revealed. The slides are color-coded to match the purple-orange-purple flow of the Section-level planning guides. Make a copy of the slidedeck to customize as you wish!
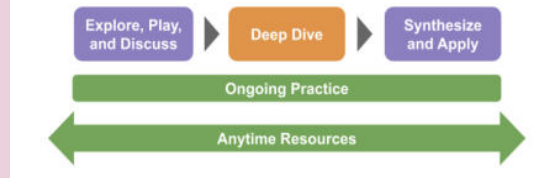
Fraction Multiplication and Division

Priority Unit (All Sections): Major Grade-level Work … identified by IM authors

Grade 5: Unit 3

Section-Level Slidedeck

Explore, Play, and Discuss ▶ Deep Dive ▶ Synthesize and Apply

Ongoing Practice

Anytime Resources

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

Unit 3 Progression Overview

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

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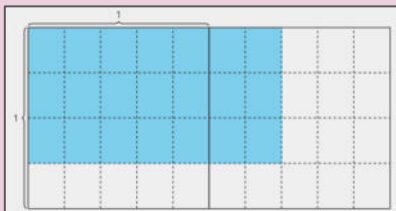
Lessons 17-19
5.NF.B, 5.NF.B.4, 5.NF.B.6, 5.NF.B.7

➔ 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.

➔ 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.

➔ Solve problems involving fraction multiplication and division.

Section A Goals

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

- Recognize that $\dfrac{a}{b} \times \dfrac{c}{d} = \dfrac{a \times c}{b \times d}$ and use this generalization to multiply fractions numerically.

Notice and Wonder:
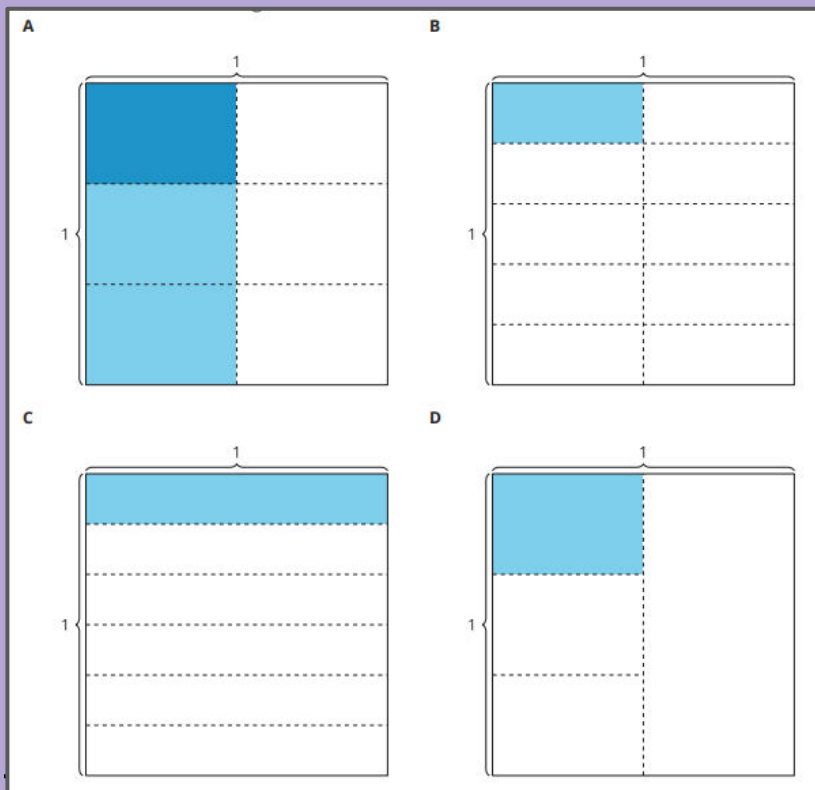# Baked Macaroni and Cheese

What do you notice?

What do you wonder?

Of What?

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.
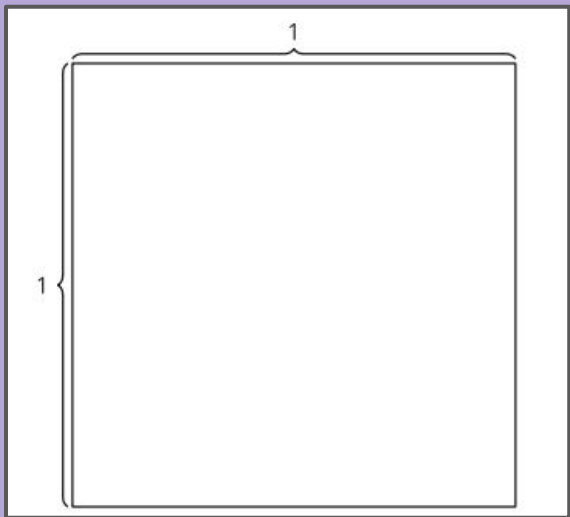
1. Draw a diagram to represent the situation.

2. How much of the whole pan of macaroni and cheese did Jada eat? Explain or show your reasoning.
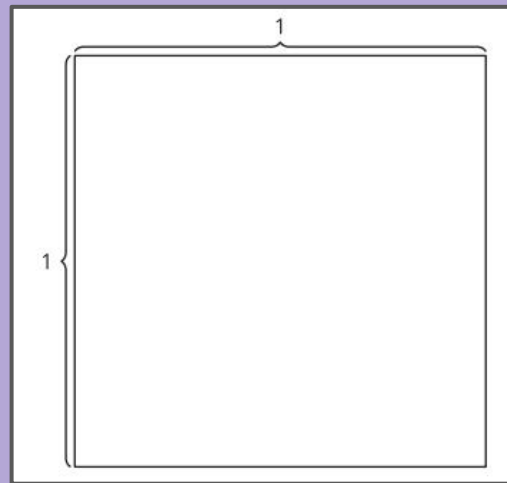
Which One Doesn't Belong: Diagrams

Interpret Diagrams

1. Show $\frac{1}{3}$ of the square.

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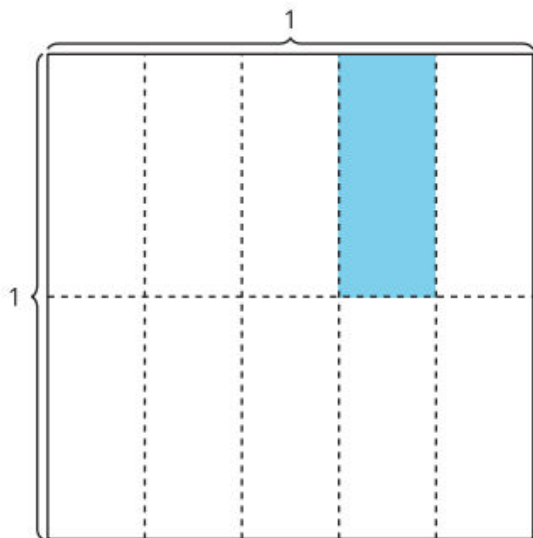
   How much of the whole square is shaded?

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?

Write an Expression
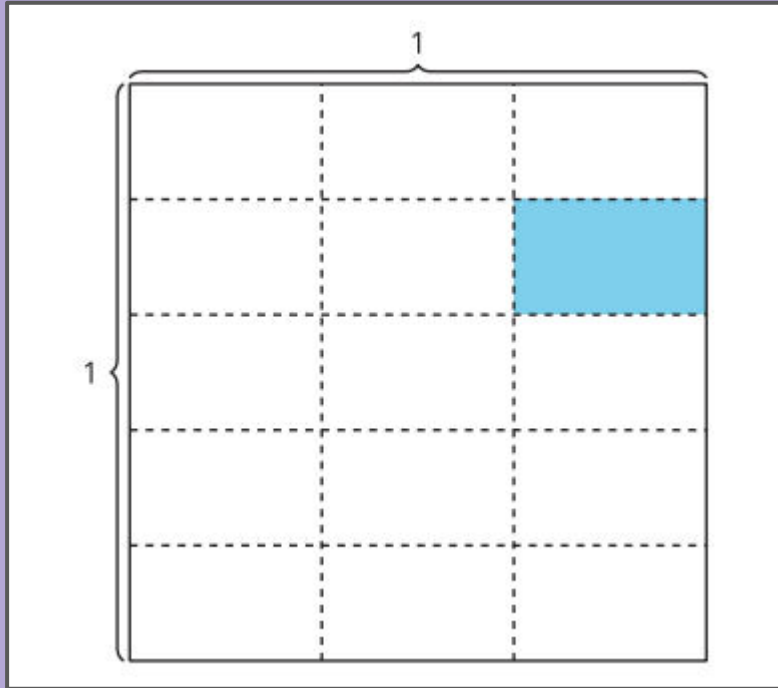
Priya shaded part of a square.

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.
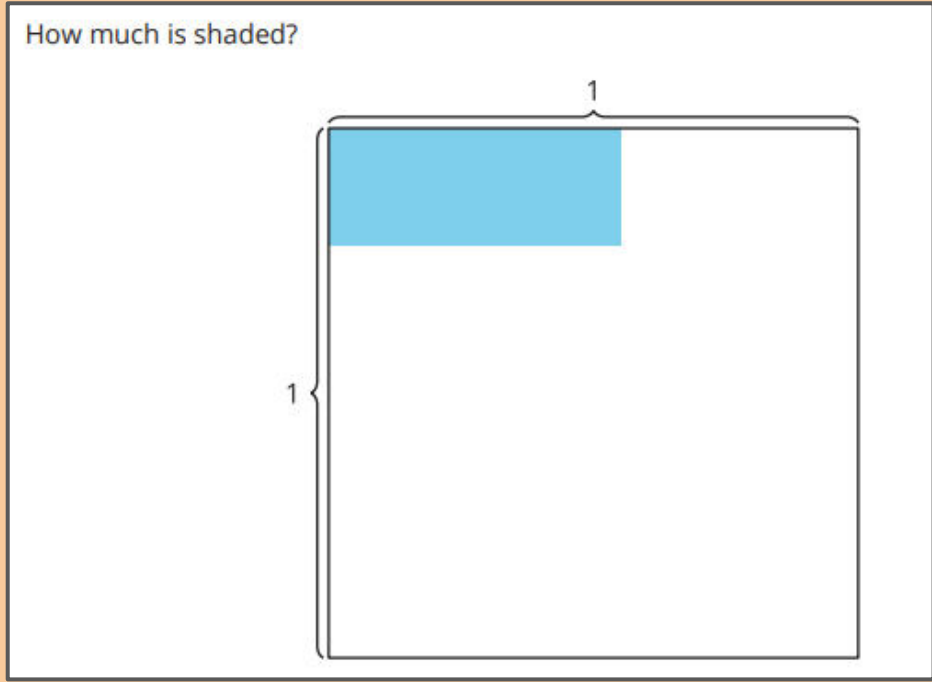
Write an Expression

4. How much of the whole square is shaded?

Scavenger Hunt!

Parts of Parts

1. Find an object or situation that shows half of a half.

2. Find an object or situation that shows any fraction of a fraction.
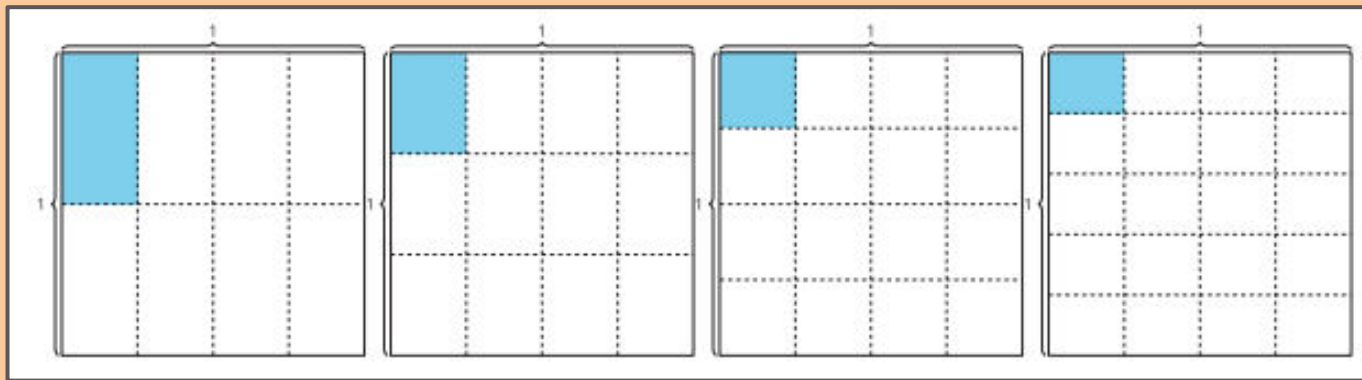
Estimation Exploration: How Much is Shaded?

How much is shaded?

1

1

Record an estimate that is:

too low	about right	too high

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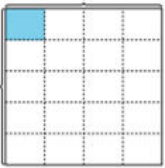
1. If the pattern continues, draw what you think the next diagram will look like. Be prepared to explain your thinking.

Find the Value of the Expression

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

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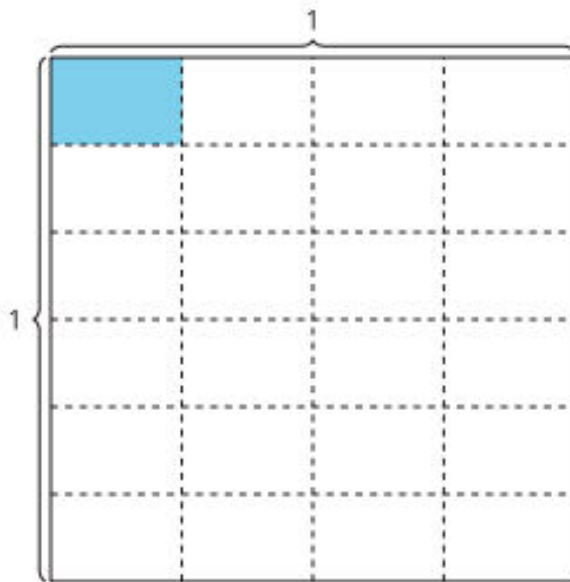
The Park

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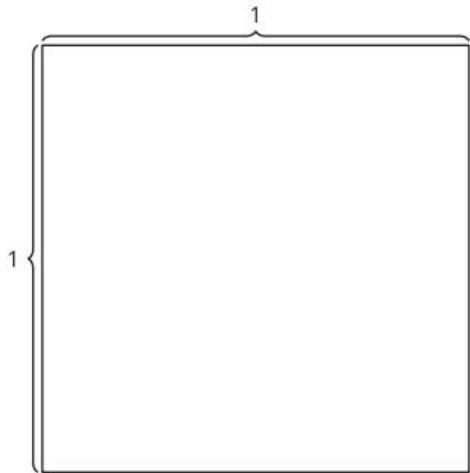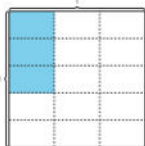
2. Write a multiplication expression to represent the area of the park that will be soccer fields.

   _____

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

Write Equations

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.

$$\frac{6}{5} \times \frac{1}{3} = \frac{6}{15}$$
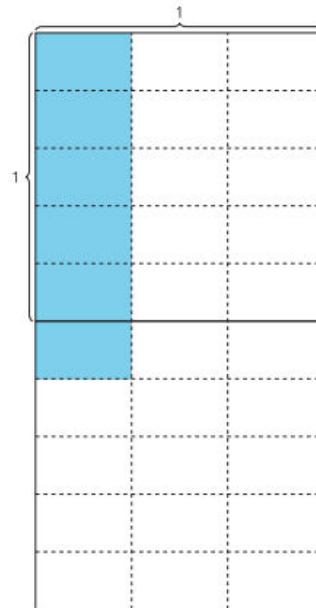
Many Expressions
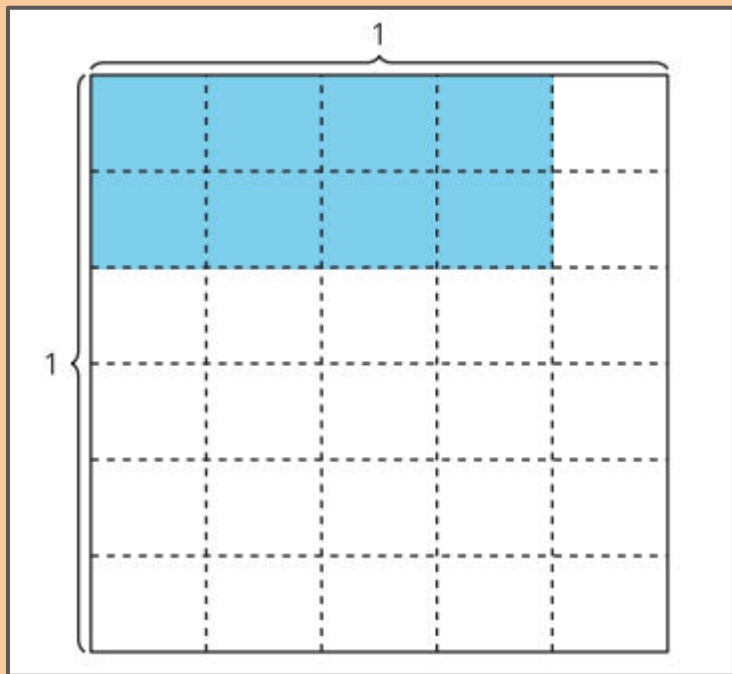
1. Explain how each expression can represent the shaded rectangle. Be prepared to share your thinking.
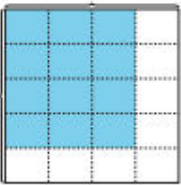
a. $\frac{8}{30}$

_____

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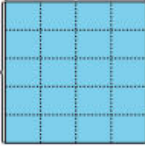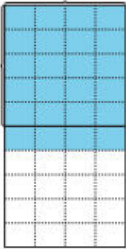
b. $2 \times 4 \times (\frac{1}{5} \times \frac{1}{6})$

_____

_____

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

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

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.

Equations and Area

Look at the two shaded rectangles. What do you notice? What do you wonder?
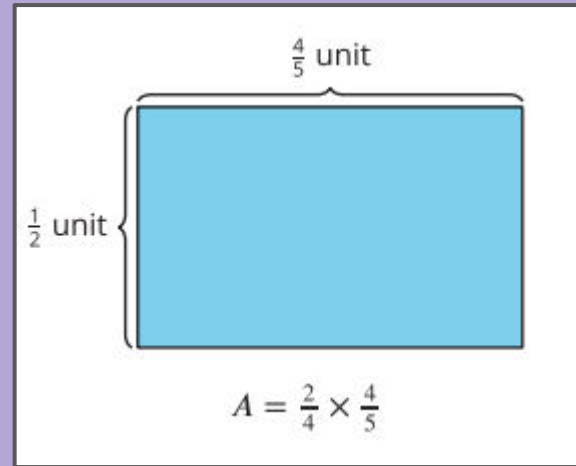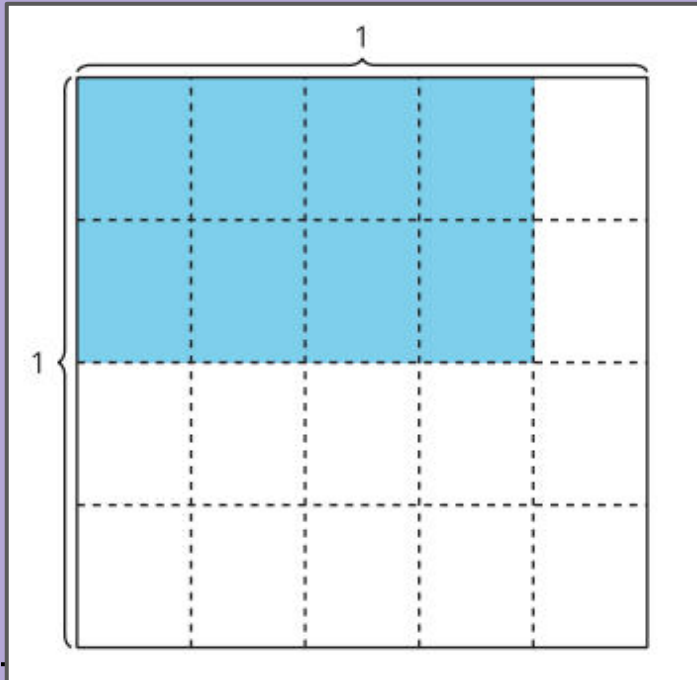
1

1

$\frac{4}{5}$ unit

$\frac{1}{2}$ unit

$A = \frac{2}{4} \times \frac{4}{5}$

Equations and Area

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

a. $\frac{4}{5}$ unit, $\frac{1}{2}$ unit

b. $\frac{4}{5}$ unit, $\frac{3}{4}$ unit

Equations and Area

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

$\frac{5}{7}$ unit

$\frac{4}{6}$ unit

c.

$\frac{7}{5}$ unit

$\frac{4}{5}$ unit

d.
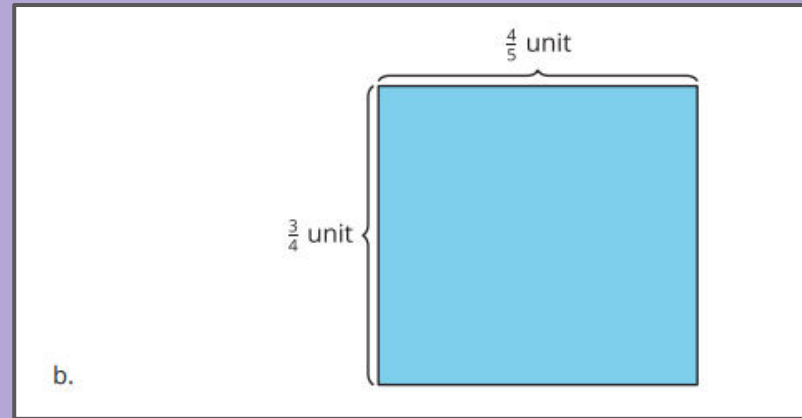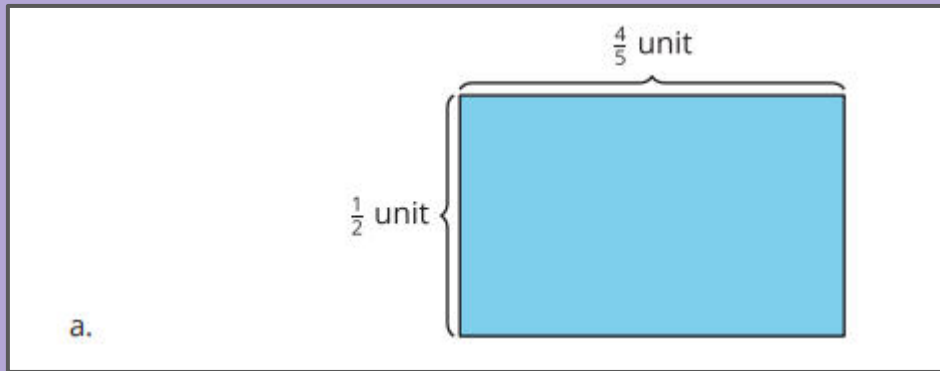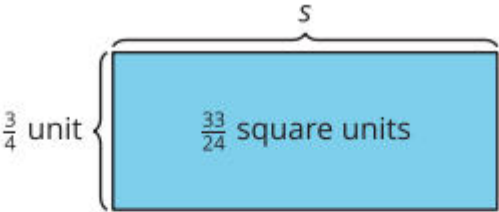
Equations and Area

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.

s

$\frac{3}{4}$ unit $\Big\{$ $\frac{33}{24}$ square units

a.

s

$\frac{5}{9}$ unit $\Big\{$ $\frac{35}{27}$ square units

b.

Number Talk: (13/5)

Evaluate each expression mentally.

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

Number Talk: (13/5)

Evaluate each expression mentally.

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

Number Talk: (13/5)

Evaluate each expression mentally.

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

Number Talk: (13/5)

Evaluate each expression mentally.

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

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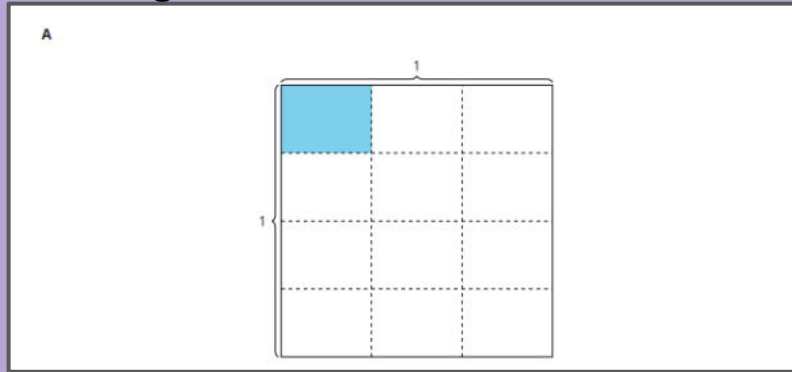
In diagram A, we can see that ⅓ of ¼ of a square is the same size as 1/12 of the whole square. Next, we learned to multiply unit fractions by non-unit fractions. For example, we learned that $\frac{2}{5} \times \frac{1}{3} = \frac{2}{15}$.

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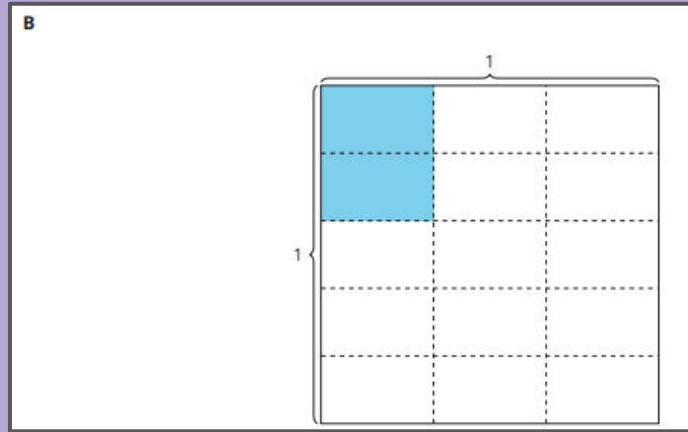
In diagram B, we can see that ⅖ of ⅓ of a square is the same size as 2/15 of the whole square. Next, we learned how to multiply any fraction by a fraction

Section Summary
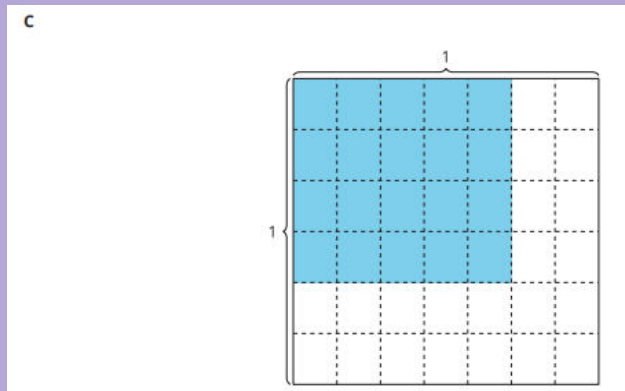
In diagram C, we can see that $\frac{4}{6} \times \frac{5}{7} = \frac{20}{42}$ We can multiply the numerators, 4 x 5 to find the numerator in the product. We can multiply the denominators, 6 x 7 , to find the denominator in the product. We can represent this relationship with the equation: $\frac{(4 \times 5)}{(6 \times 7)} = \frac{20}{42}$ 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.

Section B Goals

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

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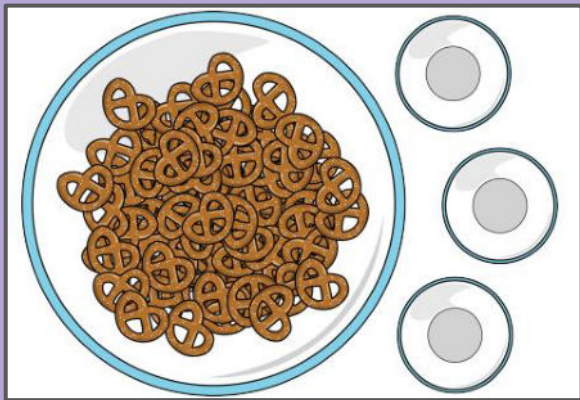
Order the situations from greatest to least based on the number of pretzels each student will get. Be prepared to explain your reasoning.

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

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.

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

What do you still wonder about division?
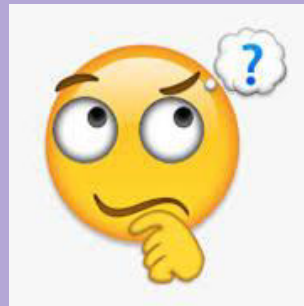
More Macaroni and Cheese

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

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?

Diagrams, Equations, Situations

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

Priya's diagram:
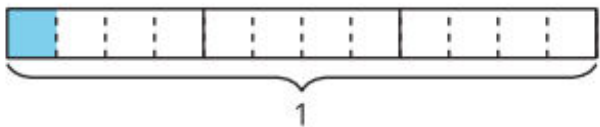
Mai's diagram:
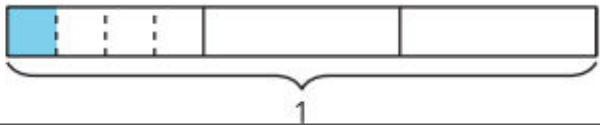
1. What is the same about the diagrams?

_____

2. What is different?

_____

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

Diagrams, Equations, Situations

4. Han drew the diagram below to represent $\frac{1}{3} \div 3$. Where do you see $\frac{1}{3} \div 3$?
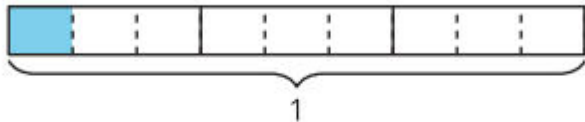
5. Find the value of the missing number. Explain or show your reasoning.

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

Reason About Revisions

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

Notice and Wonder: Quilts

What do you notice?

What do you wonder?

My Way Quilt

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?

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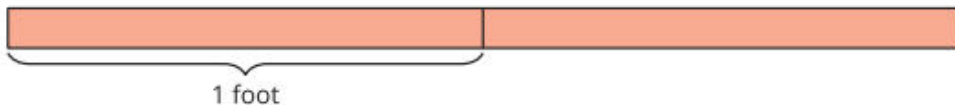
2. The green strip will be cut into pieces that are ⅓ foot long. How many pieces will there be?

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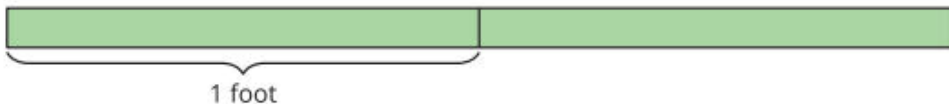
3. The orange strip will be cut into pieces that are ¼ foot long. How many pieces will there be?

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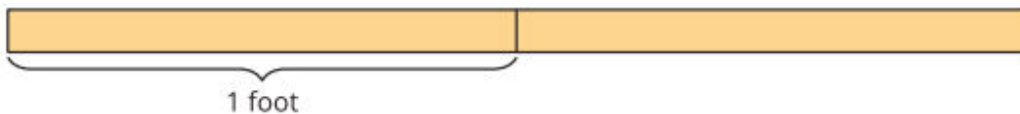
4. Describe what was the same about the problems you solved. Describe what was different.

Match the Situation to the Equation

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.

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

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

Number Talk

$$6 \div 3$$

Number Talk

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

Number Talk

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

Number Talk

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

Section B 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.
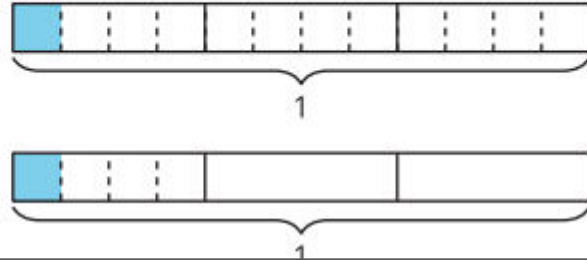
Section B Summary

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.

1 foot
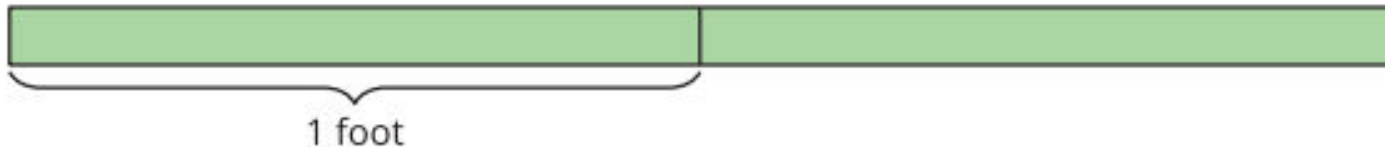
Section B Summary

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.

Section C Goals

- Solve problems involving fraction multiplication and division

Number Talk:
Multiply and Divide

Find the value of each expression mentally.

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

Number Talk:
Multiply and Divide

Find the value of each expression mentally.

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

Number Talk: Multiply and Divide

Find the value of each expression mentally.

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

Number Talk: Multiply and Divide

Find the value of each expression mentally.

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

Number Talk:
Three and a Tenth

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

Number Talk: Three and a Tenth

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

Number Talk:
Three and a Tenth

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

Number Talk:
Three and a Tenth

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

Estimation Exploration: Multiply Fractions

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

Record an estimate that is:

	too low	about right	too high

Info Gap: Tiles

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

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.

To Multiply or Divide? Part 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

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?

Putting it All Together: Multiplication and Division

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

> Diego and Clare are going to share $\frac{1}{4}$ pound of potato salad. How many pounds of potato salad will each person get?
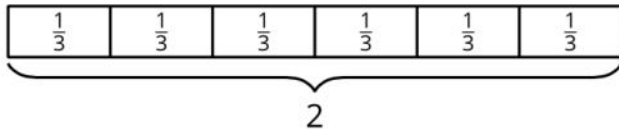
1. Draw a diagram to represent the situation.

2. Write a division equation to represent the situation.

3. Write a multiplication to represent the situation

Lesson 19: Diagrams and Equations

$$\underbrace{\boxed{\frac{1}{3}}\ \boxed{\frac{1}{3}}\ \boxed{\frac{1}{3}}\ \boxed{\frac{1}{3}}\ \boxed{\frac{1}{3}}\ \boxed{\frac{1}{3}}}_{2}$$

1. Write a multiplication equation shown by the diagram. Explain your reasoning.

2. Write a division equation shown by the diagram. Explain your reasoning.
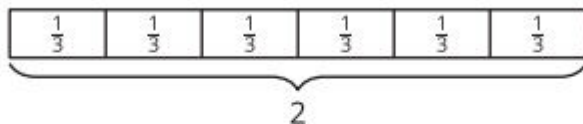
Section C Summary

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 C 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 C 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.