Multiply Fractions to Find Area

Dear Family,

This week your child is learning to multiply fractions to find the area of rectangles.

Math Tools

Multiplication Models

Fraction Models

Your child might see a problem like this:

Kareem has a square placemat that measures 1 foot on each side. He divides it in half vertically and in thirds horizontally. He wants to decorate each part with a different pattern. What is the area of each part of the placemat?

To understand the problem, your child could draw and label a picture.
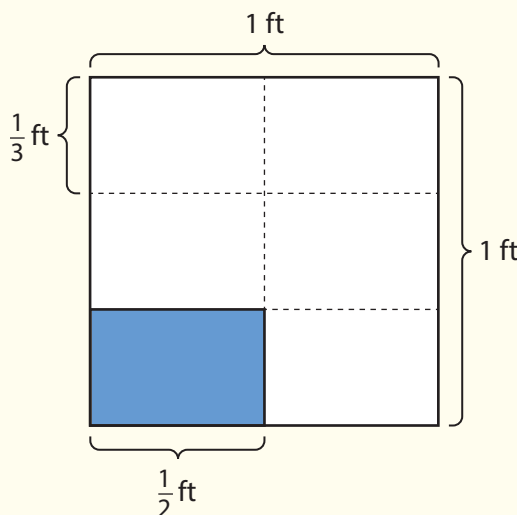
The dashed lines show 6 equal parts.

Each part is $\frac{1}{2}$ foot long and $\frac{1}{3}$ foot wide. Each part is $\frac{1}{6}$ of the whole. Multiply to find the area of each part.

$$\frac{1}{2} \text{ foot} \times \frac{1}{3} \text{ foot} = \frac{1}{6} \text{ square foot}$$

The area of each part of the placemat is $\frac{1}{6}$ square foot.

Invite your child to share what they know about multiplying fractions to find the area of rectangles by doing the following activity together.

ACTIVITY MULTIPLYING FRACTIONS TO FIND AREA

Do this activity with your child to find the area of a rectangle by multiplying fractions.

- Look at the rectangle below.

$\frac{4}{5}$ mile

$\frac{2}{3}$ mile
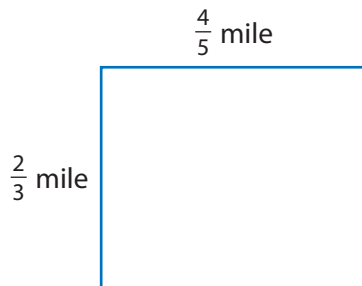
- Remind your child that you can find the area of a rectangle by multiplying the length by the width. (area = length × width)

- Together with your child, find the area of the rectangle shown above by multiplying the length by the width.

- Check your answer by using an area model. The square below has an area of 1 square mile. Ask your child to shade parts of the square below to show the same area as the rectangle above.

1 mile

1 mile
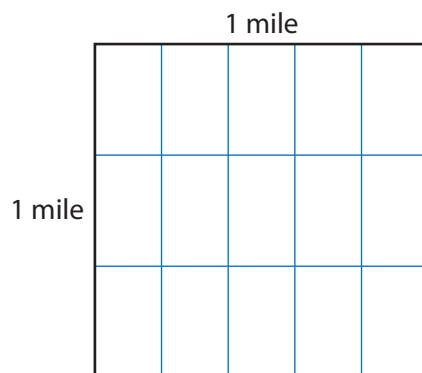
- Together with your child, find the area of the shaded part of the square by finding the fraction of the square that is shaded. Ask your child: *Does this match your answer from above?*

Answer: Area = $\frac{4}{5}$ mile × $\frac{2}{3}$ mile = $\frac{8}{15}$ square mile

Explore Multiplying Fractions to Find Area

Previously, you learned about multiplying fractions. Now you will use area models to multiply fractions and find areas of rectangles. Use what you know to try to solve the problem below.

> **Mr. Morales designs a square park with a side length of 1 mile. His design includes another square with $\frac{5}{10}$-mile sides for a dog play space. How many square miles of the park does he use for the dog play space?**

TRY IT

🧰 Math Toolkit
- fraction models
- multiplication models
- geoboard
- rubber bands
- base-ten blocks
- grid paper
- index cards

DISCUSS IT

Ask your partner: How did you get started?

Tell your partner: I am not sure how to find the answer because . . .

🎯 Learning Targets
- Find the area of a rectangle with fractional side lengths by tiling.
- Find the area of a rectangle with fractional side lengths by multiplying.

CONNECT IT

1 LOOK BACK

Explain how you found the area of the park used for the dog play space.

2 LOOK AHEAD

Suppose you want to find the area of a square section of the park that is $\frac{3}{10}$ mile by $\frac{3}{10}$ mile. You can find the area in different ways.

a. Tile the section with unit squares. The 1-mile square park is divided up into 10 columns and 10 rows so that one tile is $\frac{1}{10}$ mile by $\frac{1}{10}$ mile.
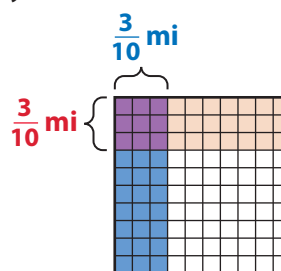
What is the area of one tile? .... square mile

How many tiles are in the $\frac{3}{10}$ mile-by-$\frac{3}{10}$ mile section? ....

What is the area of the $\frac{3}{10}$ mile-by-$\frac{3}{10}$ mile section? .... square mile

b. You can find the area by multiplying the side lengths of the section, $\frac{3}{10} \times \frac{3}{10}$.

Multiply the fractions to find the area.

$\frac{3}{10} \times \frac{3}{10} =$ ....   The area of the section is .... square mile.

3 REFLECT

Look at the area model and equation for $\frac{3}{10} \times \frac{3}{10}$. Explain how the numerators and denominators in the equation are related to the squares in the area model.
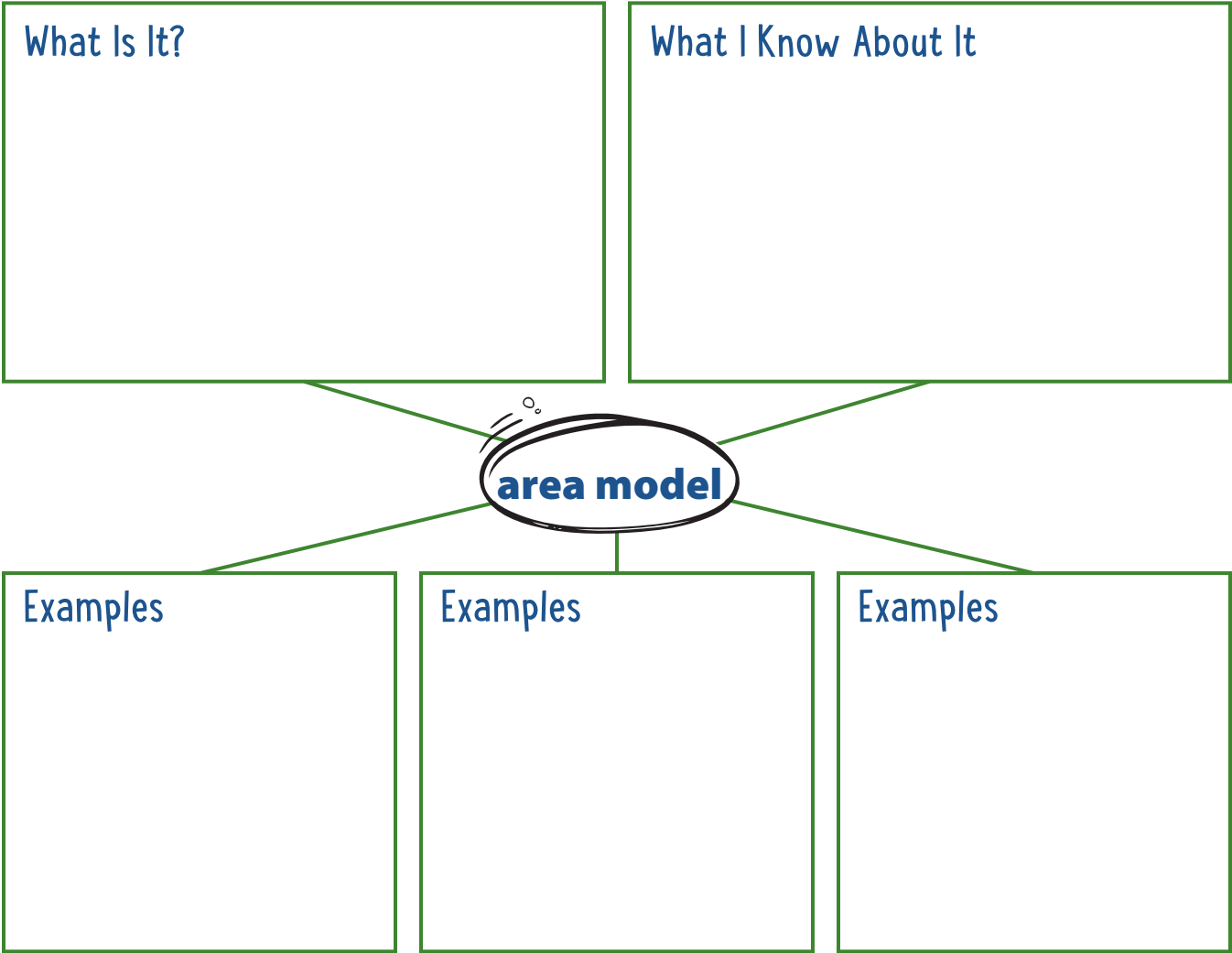
....

....

....

Prepare for Multiplying Fractions to Find Area

1 Think about what you know about the area of a rectangle. Fill in each box. Use words, numbers, and pictures. Show as many ideas as you can.

What Is It?	What I Know About It

area model

Examples	Examples	Examples

2 The area of the whole square at the right is 1 square mile. What is the area of the shaded part of the square?

Solution ....

Lesson 20 Multiply Fractions to Find Area   **405**
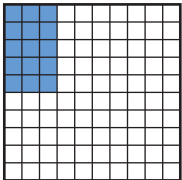
3 Solve the problem. Show your work.

Mrs. Patel designs a square park with a side length of 1 mile. She makes a square with $\frac{6}{10}$-mile sides in her park for sports fields. How many square miles of the park does she use for sports fields?

Solution ....

4 Check your answer. Show your work.

©Curriculum Associates, LLC   Copying is not permitted.

Develop Multiplying Unit Fractions to Find Area

Read and try to solve the problem below.

> Tamera learns to make batik cloth from her aunt. The first step is to use a block to press wax onto the cloth. The rectangular block is $\frac{1}{2}$ foot long and $\frac{1}{4}$ foot wide. What is the area of the block in square feet?

TRY IT

🧰 **Math Toolkit**
- fraction models
- multiplication models
- grid paper
- index cards
- cardstock
- rulers
- scissors

DISCUSS IT

Ask your partner: Why did you choose that strategy?

**Tell your partner:** A model I used was . . . It helped me . . .

Explore different ways to understand multiplying two unit fractions to find area.

> Tamera is learning to make batik cloth from her aunt. The first step is to use a block to press wax onto the cloth. The rectangular block is $\frac{1}{2}$ foot long and $\frac{1}{4}$ foot wide. What is the area of the block in square feet?

PICTURE IT

You can understand the problem by picturing how blocks of the same size could fill a square.

You can arrange 8 blocks, each $\frac{1}{2}$ foot by $\frac{1}{4}$ foot, to form a square. When rectangles fill a square without gaps or overlaps, they are said to *tile* the square.
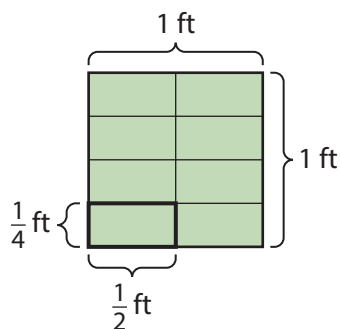
MODEL IT

You can model the problem with an equation.

The rectangular block has a length of $\frac{1}{2}$ foot and a width of $\frac{1}{4}$ foot.

area = length × width

area = $\frac{1}{2}$ foot × $\frac{1}{4}$ foot

$\frac{1}{2}$ foot × $\frac{1}{4}$ foot = $\left(\frac{1}{2} \times \frac{1}{4}\right)$ square foot

CONNECT IT

Now you will use the problem from the previous page to help you understand how to multiply two unit fractions to find area.

1 Why can a square with an area of 1 square foot be tiled by 4 rows of 2 blocks?

2 What portion of the square is represented by each block?

_____ of the square, or _____ of 1 square foot

3 Look at the equations in **Model It**. What product of unit fractions can you use

to find the area of the block? _____

4 Multiply the denominators of the unit fractions. How does the product relate to the number of equal-size parts in the model in **Picture It**?

5 Multiply the numerators of the unit fractions. How does the product relate to the number of outlined parts of the model in **Picture It**?

6 Explain how to find the area of the block.

7 REFLECT

Look back at your **Try It**, strategies by classmates, and **Picture It** and **Model It**. Which models or strategies do you like best for finding the area of a rectangle with fractional side lengths? Explain.

....

....

....

APPLY IT

Use what you just learned to solve these problems.

8 What is the area of a rectangle with a length of $\frac{1}{3}$ yard and width of $\frac{1}{6}$ yard?
Use an area model and an equation to show your work.

Solution ....

9 An artist designs rectangular refrigerator magnets. The magnets
need to be the same size. Each magnet needs to cover $\frac{1}{12}$ square
foot. Draw lines in the model below to show one way to tile a
1-foot square with magnets with the correct area. What are the
length and width of each magnet?

1 ft

1 ft
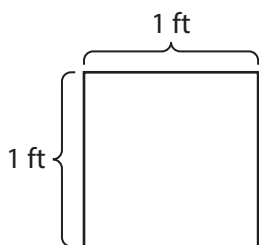
Solution ....

10 What is the area of a rectangle that has a length of $\frac{1}{4}$ inch and a width of $\frac{1}{8}$ inch?

Ⓐ $\frac{1}{12}$ square inch

Ⓑ $\frac{2}{12}$ square inch

Ⓒ $\frac{1}{32}$ square inch

Ⓓ $\frac{2}{32}$ square inch

Practice Multiplying Unit Fractions to Find Area

**Study the Example that shows multiplying unit fractions to find area.
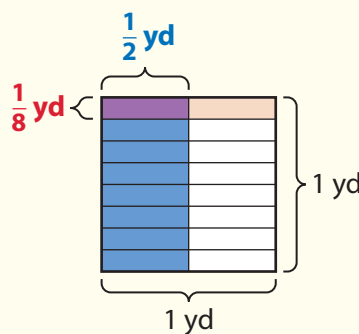Then solve problems 1–5.**

EXAMPLE

A sheet of cardboard that measures 1 yard on each side is cut into rectangular pieces
that are $\frac{1}{8}$ yard wide and $\frac{1}{2}$ yard long. What is the area of each piece?

You can model the problem with a picture as shown.

You also can model the problem with an equation.

$$\text{area} = \frac{1}{2} \times \frac{1}{8}$$
$$= \frac{1 \times 1}{2 \times 8}$$
$$= \frac{1}{16}$$

The area of each piece is $\frac{1}{16}$ square yard.

1   Suppose the length of each piece in the Example is shortened to $\frac{1}{4}$ yard. Is the
area of each piece now greater than or less than $\frac{1}{16}$ square yard? Explain.

2   Which expression represents the area in square yards of a rectangular piece
described in problem 1?

Ⓐ $\frac{1}{2} \times \frac{1}{4}$

Ⓑ $\frac{1}{2} \times \frac{1}{8}$

Ⓒ $\frac{1}{4} \times \frac{1}{8}$

Ⓓ $\frac{1}{4} \times \frac{1}{16}$

3 A corn maze is a maze cut into a field of corn that visitors can walk through. Victoria's parents make a rectangular corn maze on their farm. The maze has a length of $\frac{1}{4}$ mile and a width of $\frac{1}{8}$ mile. What is the area of the corn maze? Show your work.
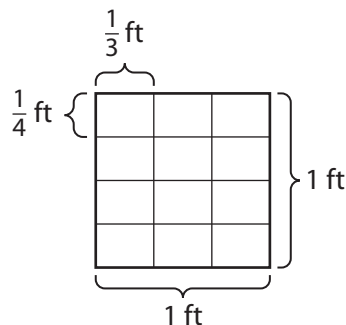
Solution ....

4 Mr. Khan's 5th-grade class is going on a field trip. Each student gets a rectangular name card to wear that is $\frac{1}{4}$ foot wide and $\frac{1}{3}$ foot long.

Shade the model to find the area of each name card.
Complete the equation.

$\frac{1}{4}$ foot $\times$ $\frac{1}{3}$ foot $=$ $\frac{\square}{\square}$ square foot

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

5 Lucía has a square piece of poster board that measures 1 yard on each side. She cuts rectangular signs from the poster board. Each sign is $\frac{1}{3}$ yard long and $\frac{1}{9}$ yard wide. How many signs can be cut from the poster board? What is the area of each sign? Show your work.

Solution ....

Develop Tiling a Rectangle to Find Area

Read and try to solve the problem below.

> A rectangular postage stamp has a length of $\frac{3}{2}$ inches and a width of $\frac{3}{4}$ inch. What is the area of the stamp in square inches?

TRY IT

Math Toolkit
- fraction models
- multiplication models
- half-inch grid paper
- index cards
- rulers

DISCUSS IT

**Ask your partner:** Can you explain that again?

Tell your partner: I started by . . .

Explore different ways to understand modeling the area of a rectangle through tiling and equations.

> **A rectangular postage stamp has a length of $\frac{3}{2}$ inches and a width of $\frac{3}{4}$ inch. What is the area of the stamp in square inches?**
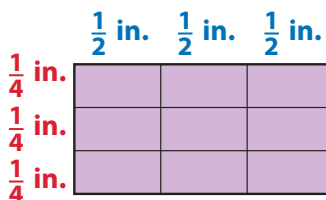
PICTURE IT

You can picture tiling the rectangular stamp with smaller rectangles that have unit fractions as side lengths.

You can tile a unit square with rectangles that have unit fractions as side lengths. Each rectangular tile is $\frac{1}{2}$ inch by $\frac{1}{4}$ inch.
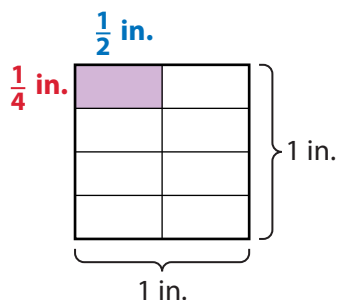
You can also use $\frac{1}{2}$ inch-by-$\frac{1}{4}$ inch tiles to tile a rectangular stamp with a length of $\frac{3}{2}$ inches and a width of $\frac{3}{4}$ inch.
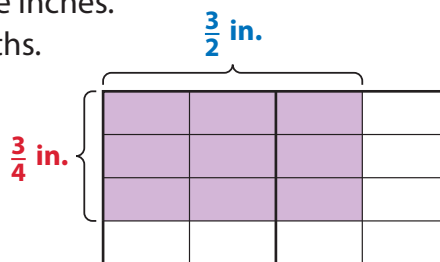
MODEL IT

You can model the area of the rectangular stamp with an equation.

Think of the stamp as part of two whole square inches. Use the area formula to multiply the side lengths.

area = length × width

area = $\frac{3}{2}$ **inches** × $\frac{3}{4}$ **inch**

$\frac{3}{2}$ inches × $\frac{3}{4}$ inch = $\left(\frac{3}{2} \times \frac{3}{4} \right)$ square inches

CONNECT IT

Now you will use the problem from the previous page to help you understand how to use tiling or equations to find area.

1 Use the unit square in **Picture It** to explain how to find the area of one tile.

2 Look at the model of the stamp in **Picture It**. Explain why nine $\frac{1}{2}$ inch-by-$\frac{1}{4}$ inch rectangles tile the $\frac{3}{2}$ inches-by-$\frac{3}{4}$ inch stamp.

3 Write an equation that uses the area of one tile to find the area of the stamp.

.... tiles $\times$ .... square inch $=$ .... square inches

4 Now look at the area formula equation in **Model It**. Complete the equation to find the area of the stamp as shown in this model.

$$\frac{3}{2} \times \frac{3}{4} = \frac{\boxed{} \times \boxed{}}{\boxed{} \times \boxed{}} = \text{...................}$$ The area is .... square inches.

5 Does using the area formula equation result in the same area as you found by tiling the rectangle? Why?

6 **REFLECT**

Look back at your **Try It**, strategies by classmates, and **Picture It** and **Model It**. Which models or strategies do you like best for finding the area of a rectangle with fractional side lengths? Explain.

....

....

....

APPLY IT

Use what you just learned to solve these problems.

7 Alex and his mom make a rectangular Swedish rag rug for their kitchen. The rug is $\frac{5}{6}$ yard long and $\frac{2}{3}$ yard wide. How many square yards of the floor does the rug cover? Show your work.

Solution

8 Show one way to use tiles to find the area of the rectangle below. What is the area of the rectangle? What are the length and width of one of your tiles?

$\frac{7}{5}$ mi

$\frac{4}{5}$ mi
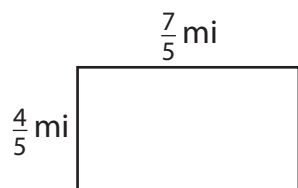
Solution

9 Rashon's rectangular poster is $\frac{7}{4}$ yards in length and $\frac{2}{3}$ yard in width. What is the area of Rashon's poster?

Ⓐ $\frac{2}{3}$ square yard

Ⓑ $\frac{14}{12}$ square yards

Ⓒ $\frac{9}{7}$ square yards

Ⓓ $\frac{7}{4}$ square yards

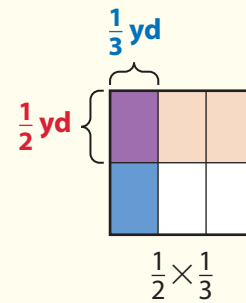# Practice Tiling a Rectangle to Find Area

Study the Example that shows tiling a rectangle to find its area.
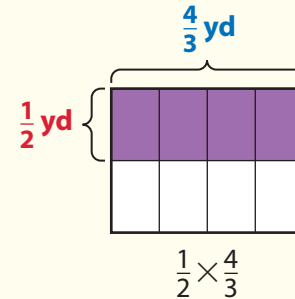**Then solve problems 1–6.**

EXAMPLE

What is the area of a rectangle that is $\frac{1}{2}$ yard wide and $\frac{4}{3}$ yards long?

The top area model shows that
$\frac{1}{2}$ yard $\times \frac{1}{3}$ yard $= \frac{1}{6}$ square yard.

The bottom model uses the same $\frac{1}{6}$-square-yard
parts to show an area that is $\frac{1}{2}$ yard $\times \frac{4}{3}$ yards.
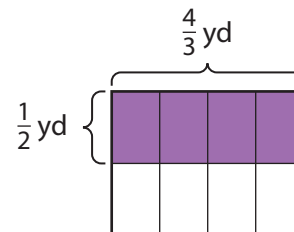
Four $\frac{1}{6}$-square-yard parts are shaded.

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

1 How many $\frac{1}{2}$-yard lengths are in 1 yard? ....

2 How many $\frac{1}{3}$-yard lengths are in 1 yard? ....

3 Draw a line around the part of the model from the
   Example that represents 1 square yard.

   Does $\frac{4}{6}$ square yard cover more area or less area than
   1 square yard? Explain.

4 Tamasha and her dad make a set of wooden dominoes. Each domino is shaped like a rectangle with a length of $\frac{5}{2}$ inches and a width of $\frac{5}{4}$ inches. Use a visual model to find how many square inches of wood Tamasha needs for each domino. Then write an equation to describe your model. Show your work.

Solution ....

....

5 Fidelia plants a rectangular strawberry patch behind her house with an area of exactly 1 square yard. Which of the following could be the width and length of the patch? Select all that apply.

Ⓐ $\frac{1}{2}$ yard wide and $\frac{3}{2}$ yards long

Ⓑ $\frac{2}{3}$ yard wide and $\frac{3}{2}$ yards long

Ⓒ $\frac{4}{5}$ yard wide and $\frac{5}{4}$ yards long

Ⓓ $\frac{2}{3}$ yard wide and $\frac{6}{4}$ yards long

Ⓔ $\frac{3}{4}$ yard wide and $\frac{12}{8}$ yards long

6 Look at problem 5. Can the length of the strawberry patch be greater than 1 yard? Explain.

Refine Multiplying Fractions to Find Area

Complete the Example below. Then solve problems 1–9.

EXAMPLE

Yolanda draws her own comic book. The drawing space on each page is a rectangle with a length of $\frac{1}{2}$ foot and a width of $\frac{3}{4}$ foot. What is the area of the drawing space on each page?

Look at how you could show your work using a unit square area model and an equation.
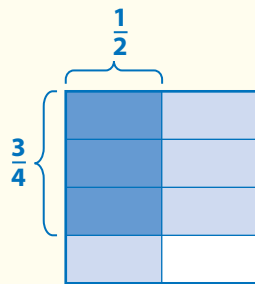
$$\frac{1}{2} \times \frac{3}{4} = \frac{1 \times 3}{2 \times 4}$$

Solution ....

> How many rectangles with an area of $\frac{1}{8}$ square foot are shown in the model?

PAIR/SHARE
How can you write $\frac{1}{2} \times \frac{3}{4}$ as a product of unit fractions and whole numbers?

APPLY IT

1 What is the area of a rectangle with a length of $\frac{11}{6}$ yards and a width of $\frac{1}{2}$ yard? Write an equation to represent your solution. Show your work.

> How can you represent a fractional side length with an area model?

PAIR/SHARE
Find the area of a rectangle with side lengths of $\frac{3}{4}$ yard and $\frac{10}{9}$ yards. How is the model different?

Solution ....

2 Susan La Flesche Picotte was the first Native American to graduate from medical school. Nahele makes a poster about Dr. Picotte for a class project. The rectangular poster is $\frac{3}{4}$ yard long and $\frac{1}{3}$ yard wide. What is the area of the poster? Show your work.

> Suppose I draw a square to represent a square yard. How can I represent fourths and thirds on the square?
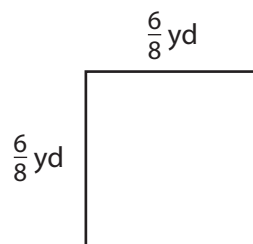
Dr. Susan La Fleshe Picotte Memorial Hospital, Walthill, Nebraska

PAIR/SHARE
Write an equation to represent your model. Explain the meaning of the numerators.

Solution ....

3 What is the area of the square?

Ⓐ $\frac{36}{64}$ square yard

Ⓑ $\frac{12}{16}$ square yard

Ⓒ $\frac{64}{36}$ square yards

Ⓓ $\frac{12}{8}$ square yards

$\frac{6}{8}$ yd

$\frac{6}{8}$ yd

> Think about the size of the two fractions. Will the product of the fractions be greater than 1 or less than 1?

Gavin chose Ⓓ as the correct answer. How did he get that answer?
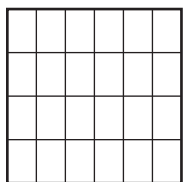
PAIR/SHARE
Does Gavin's answer make sense?

4 Rodrigo has a photo of Congaree National Park in South Carolina. The rectangular photo has a length of $\frac{2}{4}$ foot and a width of $\frac{2}{6}$ foot. What is the area of the photo? Show your work.
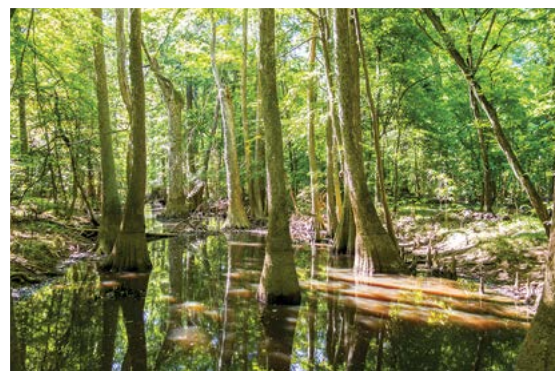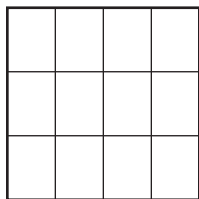
Solution ⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯

5 Fill in the missing numbers to make the equation true. Then complete the area model to check your answer.

$$\frac{1}{6} \times \frac{\square}{\square} = \frac{1}{24}$$

6 Which products could you find by shading the model below? Select all that apply.

Ⓐ $\frac{3}{4} \times \frac{1}{3}$

Ⓑ $\frac{1}{3} \times \frac{1}{6}$

Ⓒ $\frac{2}{3} \times \frac{1}{4}$

Ⓓ $\frac{5}{3} \times \frac{1}{4}$

Ⓔ $\frac{3}{4} \times \frac{3}{4}$

©Curriculum Associates, LLC   Copying is not permitted.

Lesson 20 Multiply Fractions to Find Area   **421**

7 Draw an area model to represent the expression $\frac{5}{4}$ miles $\times \frac{4}{5}$ mile.

What are the dimensions of one of the rectangular tiles in your model?

8 Explain how to find the area of the model you drew in problem 7. Then find the area.

9 MATH JOURNAL

Find the area of a rectangle $\frac{5}{3}$ units in length and $\frac{3}{4}$ unit in width. Show and explain how to find the area.

☑ SELF CHECK Go back to the Unit 3 Opener and see what you can check off.