Lesson Overview

LESSON 14

Understand Area

Lesson Objectives

Content Objectives

- Understand what a square unit is and the fact that it can be different sizes.
- Understand that a square unit is used to measure area.
- Understand how to measure area by covering a shape with square units and counting the squares.
- Find the area of shapes using different-sized square units, including square centimeters, square meters, square inches, and square feet.

Language Objectives

- Record the number of square units in a given rectangle or non-rectangular shape.
- Draw a rectangle with a given area.
- Orally define and use the key mathematical terms *area* and *square unit* to describe determining area to a partner.

Prerequisite Skills

- Understand that a rectangle can be partitioned into equal-sized squares that can be counted.
- Know that a square has four sides of equal length.
- Identify and describe different polygons.

Standards for Mathematical Practice (SMP)

SMPs 1, 2, 3, 4, 5, and 6 are integrated in every lesson through the *Try-Discuss-Connect* routine.*

In addition, this lesson particularly emphasizes the following SMPs:

2 Reason abstractly and quantitatively.

6 Attend to precision.

*See page 1i to see how every lesson includes these SMPs.

Lesson Vocabulary

- **area** the amount of space inside a closed two-dimensional figure. Area is measured in square units such as square centimeters.
- **square unit** the area of a square with side lengths of 1 unit.

Review the following key term.

- **measure** to find length, area, mass, or liquid volume by comparing to a known standard.

Learning Progression

Over the course of Grades 2 through 5 students develop spatial understanding and distinguish and make connections among length, area, and volume. This lesson is the first formal introduction of area and square units for students. Students were informally introduced to the concept of area **in Grade 2** when they used same-sized squares to tile a rectangle and when they decomposed a rectangle into rows and columns of same-sized squares.

In this lesson students gain a conceptual understanding of area as the amount of space inside a closed plane shape, or the amount of space the shape covers. Students recognize that a rectangle has both length and width and that square units can be used to measure the amount of space covered by a rectangle. They find the area of a rectangle and a non-rectangular shape by counting the number of square units that cover the rectangle or shape. Students learn that a square with sides that are 1 inch long has an area of 1 square inch and a square with sides that are 1 centimeter long has an area of 1 square centimeter.

In the next lesson students will relate area to multiplication by considering the square units in a rectangle as rows and columns in an array and multiplying to find area. In subsequent Grade 3 lessons students will find the areas of combined rectangles by using area models and the distributive property, will decompose a shape formed by rectangles to find its area, and will learn how the area of a rectangle is related to its perimeter.

Lesson Pacing Guide

Whole Class Instruction

SESSION 1
Explore
45–60 min

Area
- Start *5 min*
- Model It *10 min*
- Discuss It *5 min*
- Model It *10 min*
- Discuss It *10 min*
- Close: Exit Ticket *5 min*

Additional Practice
Lesson pages 305–306

SESSION 2
Develop
45–60 min

Understanding of Area
- Start *5 min*
- Model It: Rectangular Shapes *5 min*
- Discuss It *5 min*
- Model It: Non-Rectangular Shapes *5 min*
- Discuss It *5 min*
- Connect It *15 min*
- Close: Exit Ticket *5 min*

Additional Practice
Lesson pages 309–310

Fluency
Understanding of Area

SESSION 3
Refine
45–60 min

Ideas About Finding Area
- Start *5 min*
- Apply It *35 min*
- Close: Exit Ticket *5 min*

Lesson Quiz
or **Digital Comprehension Check**

Lesson Materials

Lesson *(Required)*	*Per student:* inch ruler, index card
Activities	*Per pair:* index card, string cut to length of index card, overhead light *For display:* yardstick, 1-foot ruler
Digital Math Tools	Perimeter and Area Tool, Multiplication Models

*We continually update the Interactive Tutorials. Check the Teacher Toolbox for the most up-to-date offerings for this lesson.

Teacher Toolbox

Small Group Differentiation

PREPARE

Ready Prerequisite Lessons

Grade 2
- Lesson 21 Measure in Feet and Meters
- Lesson 30 Partition Rectangles

RETEACH

Tools for Instruction

Grade 2
- Lesson 21 Measure in Feet and Meters
- Lesson 30 Fill a Rectangle with Squares

Grade 3
- Lesson 14 Finding Area

REINFORCE

Math Center Activities

Grade 3
- Lesson 14 Area
- Lesson 14 Square Units
- Lesson 14 Find Area
- Lesson 14 Area Game

EXTEND

Enrichment Activity

Grade 3
- Lesson 14 Building Pens

i-Ready

Independent Learning

PERSONALIZE

i-Ready Lesson*

Grade 3
- Understand Area

Connect to Family, Community, and Language Development

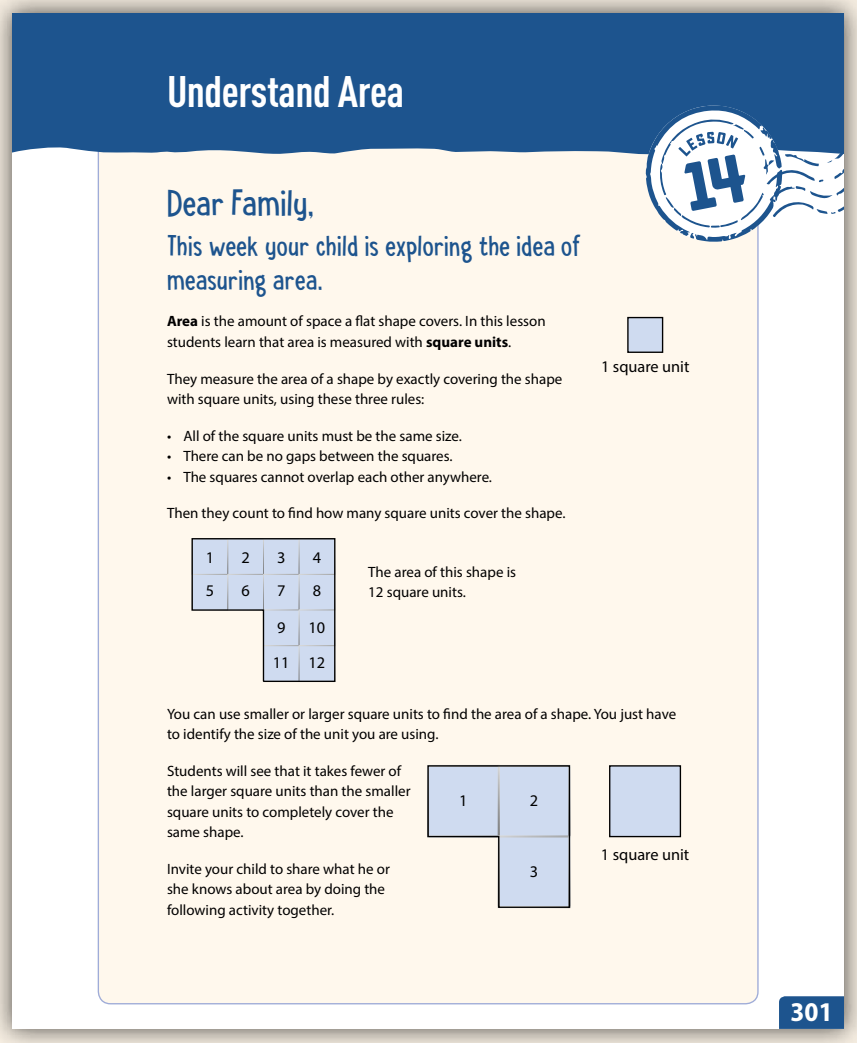
The following activities and instructional supports provide opportunities to foster school, family, and community involvement and partnerships.

Connect to Family

Use the **Family Letter**—which provides background information, math vocabulary, and an activity—to keep families apprised of what their child is learning and to encourage family involvement.

Available in Spanish

Teacher Toolbox



Understand Area

LESSON 14

Dear Family,

This week your child is exploring the idea of measuring area.

Area is the amount of space a flat shape covers. In this lesson students learn that area is measured with **square units**.

1 square unit

They measure the area of a shape by exactly covering the shape with square units, using these three rules:

- All of the square units must be the same size.
- There can be no gaps between the squares.
- The squares cannot overlap each other anywhere.

Then they count to find how many square units cover the shape.

The area of this shape is 12 square units.

You can use smaller or larger square units to find the area of a shape. You just have to identify the size of the unit you are using.

Students will see that it takes fewer of the larger square units than the smaller square units to completely cover the same shape.

1 square unit

Invite your child to share what he or she knows about area by doing the following activity together.

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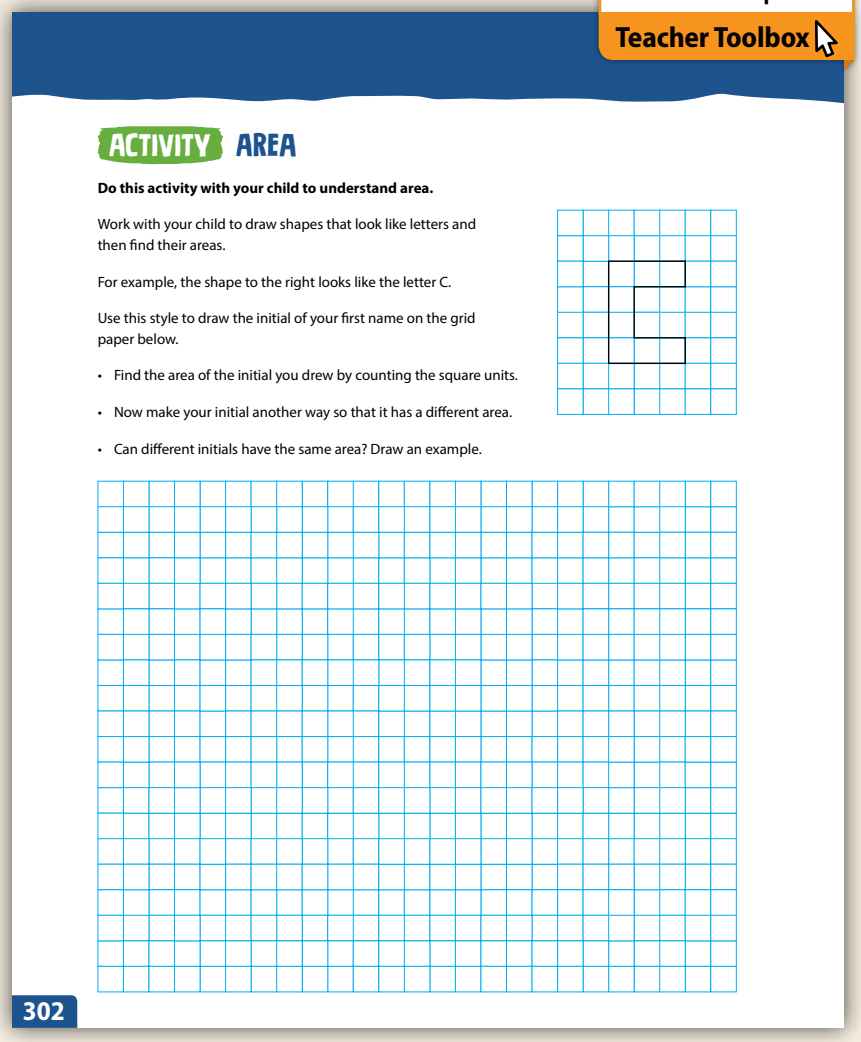

ACTIVITY AREA

Do this activity with your child to understand area.

Work with your child to draw shapes that look like letters and then find their areas.

For example, the shape to the right looks like the letter C.

Use this style to draw the initial of your first name on the grid paper below.

- Find the area of the initial you drew by counting the square units.
- Now make your initial another way so that it has a different area.
- Can different initials have the same area? Draw an example.

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Goal

The goal of the Family Letter is to show how the area of a shape or surface can be found by counting the number of square units it takes to cover the shape. The square units cannot overlap or have a gap between them. The concept of equal-sized squares is reinforced as the unit used to measure area.

Activity

Understanding the real-world application of area illustrates the relevance of mathematics for students. Look at the *Area* activity and adjust it if necessary to connect with your students.

Math Talk at Home

Encourage students to talk with their family members about the concept of area. Connect area to buying and laying flooring or planning and building a garden.

Conversation Starters Students can write these questions in their Family Letter or math journal to engage family members.

- *How can we figure out the area of a table top in our house?*
- *Which has a greater area, the floor and ceiling of a room, or its walls?*

Connect to Community and Cultural Responsiveness

Use these activities to connect with and leverage the diverse backgrounds and experiences of all students.

Sessions 1–3 **Use anytime during the sessions.**

- Display a one-foot line. Use a ruler and verify for students that the line is one foot long. Write *one foot* below the line. Give each student a ruler and a one-foot square piece of paper. Have students write their name on their square. Have students verify that each edge of the paper measures 1 foot. Trace one of the squares and record *one-foot square*. Explain that because each side of the square measures one foot, the square is described as *one-foot square*. Say: *Area is only measured in square units. The size of the square may change, but it will always be a square.* Select six students to lay their squares in a row on the floor with no gaps or overlaps. Ask students to count the squares. Record *6 square feet*. Select six different students to lay their squares on the floor in two equal rows with no gaps or overlaps. Asks students to count the squares. Repeat the activity with six more students; this time have the students make an L-shaped arrangement. Say: *The area of these arrangements all equal 6 square feet. How can that be when they are not the same shape?* Select students to share their thinking. Lead students to the generalization that measuring area is determined by the number of squares counted and not the shape of the surface being measured. Reinforce the stipulation that the squares cannot overlap or have gaps between them. If time permits, have students continue to determine the area of different shapes.

Connect to Language Development

For ELLs, use the Differentiated Instruction chart to plan and prepare for specific activities in every session.

ELL English Language Learners: Differentiated Instruction

Prepare for Session 1
Use with *Model It*.

Levels 1–3	Levels 2–4	Levels 3–5
Listening/Speaking Use before ***Model It***. Give partners index cards. Say: *This card has a length and a width.* Display the words *length* and *width*. Have students chorally repeat each word. Say: *The long side is called the length. The shorter side is the width. Which edge of the card is its length? Which edge is its width?* Provide the sentence starter: This edge is the *length/width* .	**Listening/Speaking** Use before ***Model It***. Give partners index cards. Say: *This card has a length and a width.* Display the words *length* and *width*. Have students chorally repeat each word. Say: *The long side is called the length. The shorter side is the width. Which edge of the card is its length? Which edge is its width?* Help partners identify the length and width of another rectangular surface.	**Listening/Speaking** Use before ***Model It***. Say: *A flat object shaped like a rectangle has a length and a width.* Display the words *length* and *width*. Have students chorally repeat each word. Provide the following sentence starters to help students connect *long* with *length* and *short* with *width*: *The longer side is called the* _____. *The shorter side is called the* _____. Have students identify rectangular surfaces and items in the classroom (such as a table top and a bulletin board) and locate the length and width of each.

LESSON 14

SESSION 1 Explore

Purpose In this session students explore the idea of area as the amount of space covered by a shape. The act of measuring area is introduced by showing a rectangle covered with square units.

Start

Connect to Prior Knowledge

Materials For each student: inch ruler, index card

Why Review the concept of measurement.

How Have students measure the length and width of an index card.

Use a ruler to measure the length and width of an index card in inches.

Possible Solutions

length: 5 inches
width: 3 inches
or
length: 6 inches
width: 4 inches

MODEL IT

Read the question at the top of the Student Worktext page. Remind students that they already know how to measure the length of a shape.

1 – 3 Tell students that they are going to use what they know about measuring the side of a rectangle to think about how they might measure the amount of space a rectangle covers. Then clarify the task and have students complete the problems.

Common Misconception **If** students cannot think of a way to measure the area of the rug, **then** draw their attention to the tiled floor in the picture. Ask them to think about the tiles covered by the rug.

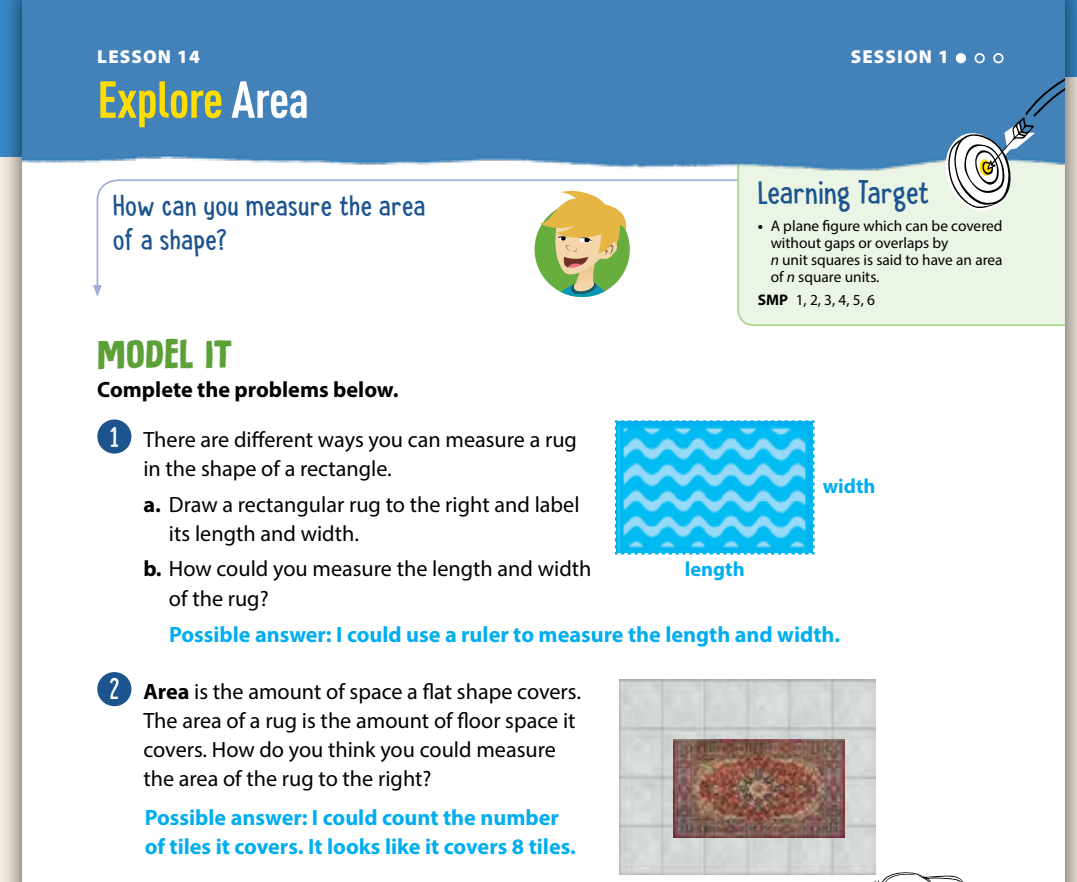
DISCUSS IT

Support Partner Discussion

Encourage students to refer to the picture of the rug on the tiled floor as they discuss the difference between measuring length and area.

Look for answers that include:

- the terms *length* and *space covered*
- using a ruler versus counting tiles



LESSON 14 SESSION 1 ● ○ ○

Explore Area

How can you measure the area of a shape?

Learning Target

- A plane figure which can be covered without gaps or overlaps by *n* unit squares is said to have an area of *n* square units.

SMP 1, 2, 3, 4, 5, 6

MODEL IT

Complete the problems below.

1 There are different ways you can measure a rug in the shape of a rectangle.

a. Draw a rectangular rug to the right and label its length and width.

b. How could you measure the length and width of the rug?

Possible answer: I could use a ruler to measure the length and width.

width

length

2 **Area** is the amount of space a flat shape covers. The area of a rug is the amount of floor space it covers. How do you think you could measure the area of the rug to the right?

Possible answer: I could count the number of tiles it covers. It looks like it covers 8 tiles.

3 How are your ways of measuring in problem 1 and problem 2 different?

Possible answer: In problem 1, I could use a ruler to measure the edges or outside length of the rug. In problem 2, I cannot use a ruler to measure how much floor is covered, but I can count how many square tiles are covered to get an idea of how much of the floor is covered.

DISCUSS IT

- Did you and your partner come up with the same way to measure in problem 2?
- I think measuring the length or width of a rectangle is different than measuring its area because . . .

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Support Whole Class Discussion

Prompt students to compare measuring length to measuring area.

Ask *What are some things that you could use a ruler to measure?*

Listen for A ruler can be used to measure the distance between two points, the length of a line, or the length of a small object, such as a pencil.

Ask *What are some things that you could find the area of?*

Listen for You can find the area of a sheet of paper, a bulletin board, a geometric shape, a puddle on the sidewalk, or a picture on the wall.

MODEL IT

4 Tell students that they will now think about how to measure area. Clarify the task and have students complete the problem.

NOTE: It is not necessary at this time for students to make the distinction between a *unit square* (a square with side length 1 unit) and a *square unit* (the amount of area covered by a unit square).

Common Misconception **If** students use the terms *unit* and *square unit* interchangeably, **then** use a square unit to demonstrate the difference between the length of one side (1 unit) and the area covered by the square (1 square unit).

DISCUSS IT

Support Partner Discussion

Again encourage students to refer to the rug as they discuss.

Look for answers that specify:

- square units that cover the rectangle to the edges, with no gaps
- square units that do not extend past the rectangle and do not overlap

Hands-On Activity

Use shadows to distinguish between length and area.

If . . . *students are unsure about the difference between length and area,*

Then . . . *use this activity to help them see an object's area as the amount of space it covers.*

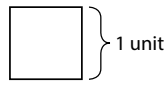
Materials For each pair: index card, string cut to length of index card, overhead light

- Have pairs confirm that their string is the same length as one side of their index card.
- Have one partner stretch the string over a sheet of paper while the other traces the string's linear shadow onto the paper.
- Have partners switch roles, this time holding the index card flat at the same height above the paper as was the string and shading the card's rectangular shadow onto the paper.
- Discuss the similarities and differences between the shadows made by the string and the card. Ask students to describe the difference between length and area.

MODEL IT

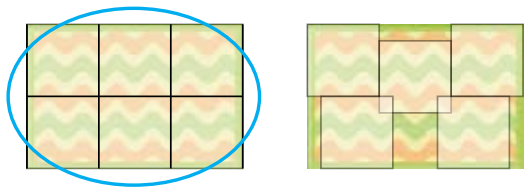
Complete the problems below.

4 You measure area in units that can cover space, called **square units**.



Area = 1 square unit

a. Circle the rug below that you think shows the correct way to use square units to measure its area.



b. Explain why your choice in Part a correctly measures area.

Posssible answer: The squares fully cover the space we want to measure. They completely cover the rug without going past the edge and with no gaps or overlapping.

c. What is the area of the rug in square units?

6 square units

DISCUSS IT

- Why was the other way to measure area in problem 4a wrong?
- I think square units need to be the same size when finding area because . . .

5 REFLECT

Explain how you use square units to find the area of a shape.

Possible answer: You cover the shape with square units and count how many it takes to cover the shape completely, without gaps or overlaps or going past the edge. The number of square units it takes to cover the shape is its area.

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Support Whole Class Discussion

Prompt students to compare the different ways that area is measured in problem 4a.

Ask *Would it be a good strategy to overlap the square units in order to make sure every bit of the rug is covered? Why or why not?*

Listen for The square units should not overlap because it would take more of them to cover the rug and the area measured would be incorrect.

Close: Exit Ticket

5 REFLECT

Look for understanding that identical square units are used to cover the shape completely and exactly, right to the edges of the shape without going past and without gaps or overlapping.

Common Misconception **If** students do not mention that the square units should not go past the edges, **then** draw a rectangle on the board and cover it with square sticky notes that go over the edges. Ask students whether you are measuring the area correctly.

Solutions

Support Vocabulary Development

1 Ask students to explain how to complete the graphic organizer. Clarify that an illustration is a drawing or diagram. Discuss examples versus non-examples. Ask: *What might be a way to show and explain—with words, numbers, and pictures—examples of a square unit?* Record student responses or provide examples as needed to stimulate student thinking.

2 Have students outline the shape of the rug with their pencil. Ask: *How can you tell how many rows of tiles the rug covers? How can you tell how many tiles are in each row covered by the rug? How can you count all of the tiles covered by the rug?*

Supplemental Math Vocabulary

- *area*
- *length*
- *measure*
- *width*

Name: _____ LESSON 14 SESSION 1

Prepare for Finding Area

1 Think about what you know about area. Fill in each box. Use words, numbers, and pictures. Show as many ideas as you can. **Possible answers:**

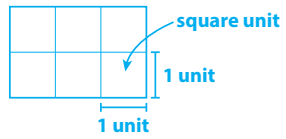
square unit

In My Own Words

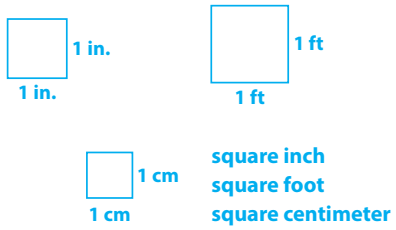
the area of a square with a side length of 1 unit

Square units are used to measure area.

My Illustrations



Examples



square inch
square foot
square centimeter

Non-Examples

a line, a circle

an inch, a foot, a centimeter

2 How do you think you could measure the area of the rug to the right in square units?

Possible answer: Each tile could be 1 square unit. I could count the number of tiles the rug covers. It looks like it covers 15 tiles, so its area is 15 square units.

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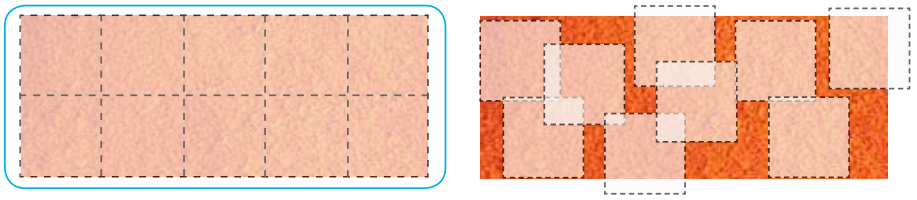
3 See Student Worktext page. Students should circle the rug on the left.
Medium

4 Student responses should include the understanding that square units cover the rug on the left without going past the edge, and with no gaps or overlapping, but the square units covering the rug on the right have gaps and overlaps.
Medium

5 10 square units
Medium

Solve.

3 Circle the rug below that you think shows the correct way to use square units to measure its area.



4 Explain why your choice in problem 3 correctly measures area.

Possible answer: The squares fully cover the space we want to measure. They completely cover the rug without going past the edge and with no gaps or overlapping.

5 What is the area of the rug in square units?

10 square units

ELL English Language Learners: Differentiated Instruction

Prepare for Session 2
Use with *Model It*.

Levels 1–3

Listening/Speaking Use before ***Model It***. Give each student a ruler. Identify the centimeter and inch edges. Say: *The beginning of the ruler is zero.* Model and ask: *How many of your fingers fit between zero and one inch? How many fit between zero and one centimeter? Which is larger in size, an inch or a centimeter?* [an inch] *How do you know?* [It is longer.] Give an index card to each student. Have students identify the length and width of the card. Say: *Use the ruler. With a partner, find the length and width of the card.* Display:

The length is _____ inches.

The width is _____ inches.

The length is _____ centimeters.

The width is _____ centimeters.

Levels 2–4

Speaking/Writing Use before ***Model It***. Give each student a ruler. Have students identify the centimeter and inch edges. Ask: *How many of your fingers fit between zero and one inch? How many fit between zero and one centimeter? Which is larger in size, an inch or a centimeter?* [an inch] *How do you know?* [It is longer.] Give an index card to each student. Have students identify the length and width of the card. Say: *Use the ruler. With a partner, find the length and width of the card.* Provide sentence starters:

The length is _____.

The width is _____.

The length is _____.

The width is _____.

Levels 3–5

Speaking/Writing Use before ***Model It***. Give a ruler to each student. Say: *Which edge measures inches? Which edge measures centimeters? How can you tell?* [Centimeters are smaller than inches.] Give an index card to each student. Say: *Use the ruler. Work with a partner to find the length and width of the card in both units. What words will you need to write a sentence for each measurement you find?* Have partners write and review their sentences. Call on pairs to read their sentences to the class.

LESSON 14

SESSION 2 Develop

Purpose In this session students use square units of different sizes to measure the areas of rectangles. Then they use square units to measure the areas of non-rectangular shapes.

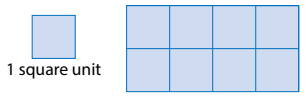
Start

Connect to Prior Knowledge

Why Reinforce how to use a given square unit to find the area of a rectangle.

How Have students find the area of a rectangle by counting the square units.

What is the area of the rectangle?



Area = ... square units

Solution
8 square units

Develop Language

Why Clarify the meaning of the prefix *non-*.

How List in two-columns: *fiction/nonfiction* and *stop/nonstop*. Explain that the prefix *non-* means *not*. Have students repeat the list of words using *not* in place of *non-*. Display the terms *rectangular* and *non-rectangular* and shapes that illustrate each. Have students draw shapes that fit the description of the terms.

MODEL IT: RECTANGULAR SHAPES

1 – 2 Present the problems and have students complete. As students work, have them identify that they are being asked to find the areas of the rectangles and that they are using different square units for each rectangle.

Common Misconception **If** students are confused by seeing the red and blue square units both labeled as "1 square unit," **then** explain that *unit* is a general term used when the actual unit of measure is unknown. Stress that the size of 1 unit may change from one situation to another, but it should remain a consistent size throughout a given problem.

Develop Understanding of Area

MODEL IT: RECTANGULAR SHAPES

Try these two problems.

1 Look at Square *A* to the right.

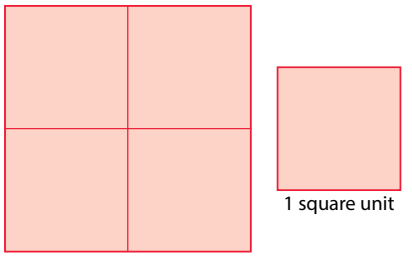
a. Use an inch ruler to measure the length and width of the square unit next to Square *A*. What is the area of this square unit?

1 square inch

b. What is the area of Square *A*?

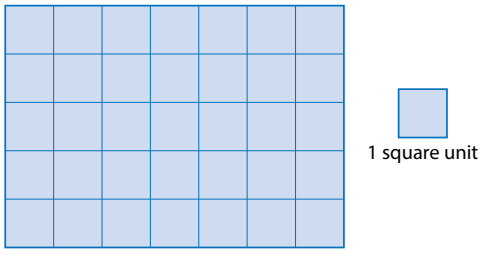
4 square inches

Square *A*



2 Look at Rectangle *B* below.

Rectangle *B*



a. Use a centimeter ruler to measure the length and width of the square unit next to Rectangle *B*. What is the area of this square unit?

1 square centimeter

b. What is the area of Rectangle *B*?

35 square centimeters

DISCUSS IT

- How did you find the area of each shape?
- I think it would take more square centimeters than square inches to find the area of the same shape because . . .

DISCUSS IT

Support Partner Discussion

Encourage students to think of different ways to find the areas of the rectangles.

Support as needed with questions such as:

- *Did you count each square of Rectangle B one by one?*
- *Could you have used another method to find the total number of squares?*

Support Whole Class Discussion

For each problem, have several students share their answers.

Ask *What is the difference between 1 square inch and 1 square centimeter? Do you think the area of Square A is more or less than 4 square centimeters? Do you think it is more or less than 35 square centimeters? What do you estimate the area of the square to be in square centimeters?*

Listen for A square inch is much bigger than a square centimeter. The area of Square *A* is more than 4 square centimeters but less than 35 square centimeters. The square looks a little bigger than half the rectangle, so its area is probably 20–30 square centimeters.

MODEL IT: NON-RECTANGULAR SHAPES

3 – 4 Present the problems and have students complete. As students work, have them identify that they are being asked to find the area of non-rectangular shapes using the method they used for rectangles.

DISCUSS IT

Support Partner Discussion

Encourage partners to think about how problems 3 and 4 are different from problems 1 and 2.

Support as needed with questions such as:

- *How were these problems different from the problems on the previous page?*
- *Did you use the same method to find the area in problems 3 and 4 that you used for problems 1 and 2?*

Support Whole Class Discussion

For each problem, have students share answers.

Ask *Which shape in problems 3 and 4 covers more space? How can you tell?*

Listen for problem 3; It is covered with more of the same-sized square units, so its area is greater.

Visual Model

Compare the areas of 1 square yard and 1 square foot.

If . . . *students question different-sized units,*

Then . . . *use this activity to demonstrate how 1 square yard and 1 square foot are related.*

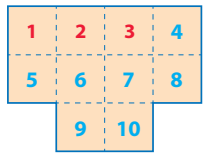
Materials For display: yardstick, 1-foot ruler

- Use a yardstick to draw a square on the board and label each side as 1 yard. Elicit that the area of this square unit is 1 square yard.
- Ask: *Is 1 foot longer or shorter than 1 yard?* [shorter] *So, does 1 square foot cover more or less area than 1 square yard?* [less]
- Have a volunteer use a 1-foot ruler to divide the square into 1-foot rows and columns. Have another volunteer find the number of square feet. [9]
- Ask: *If you found the area in square inches, would the number of square inches be greater than or less than the number of square yards? The number of square feet? Why?*

MODEL IT: NON-RECTANGULAR SHAPES

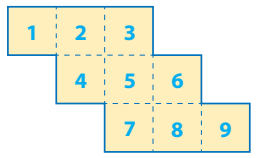
Number and count the square units to find the area of each shape.

3



Area = 10 square units

4



Area = 9 square units

DISCUSS IT

- Did you and your partner find the area of the shape in problem 4 in the same way?
- I think square units are different from square inches because . . .

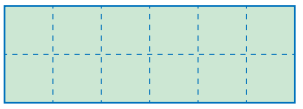
CONNECT IT

Complete the problems below.

5 How is finding the area of a rectangular shape like finding the area of a non-rectangular shape?

The area of both shapes can be found by counting the square units that cover the shape.

6 Explain how to find the area of the rectangle. Then find the area.



Possible answer: The rectangle is already covered with square units, so all I need to do is count the squares. The area is 12 square units.

CONNECT IT

5 Student responses show understanding that they can find the area of any shape that can be covered with same-sized square units.

Close: Exit Ticket

6 Look for recognition that the rectangle is already divided into same-sized squares. Given that each square is 1 square unit, students just have to count the squares to find the area.

Common Misconception **If** students do not use units in their answer, **then** remind them that when they are not given a unit of measure they should use the generic term *square units*.

Solutions

1. 14; 10
Basic

2. 6
Basic

Name: _____ LESSON 14 SESSION 2

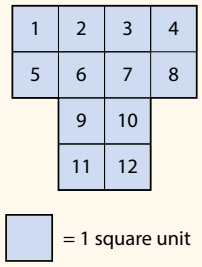
Practice Finding Area

Study how the Example shows how to count square units to find area. Then solve problems 1–7.

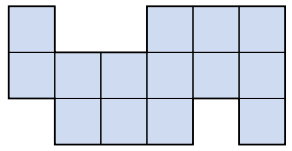
EXAMPLE

The shape is covered with squares of the same size. What is the area of this shape?

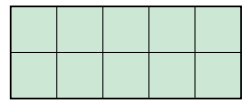
Count the square units. The area of the shape is 12 square units. You must use same-sized squares to find the area in square units.



1. Count to find each area.

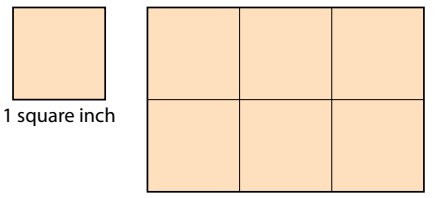


Area = 14 square units



Area = 10 square units

2. What is the area?



Area = 6 square inches

Vocabulary

area the amount of space a flat shape covers.

square unit the area of a square with side lengths of 1 unit.

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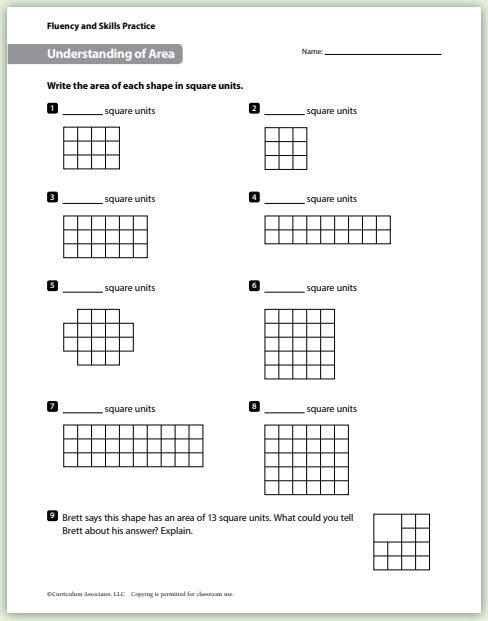
Fluency & Skills Practice

Teacher Toolbox

Assign *Understanding of Area*

In this activity students practice finding the areas of shapes by counting unit squares. Students may use this strategy to measure an unknown area by covering it with squares. Students may also use this strategy to understand a floor plan drawn on grid paper. Students can count unit squares to determine and compare the areas of different parts of the floor plan. They could also apply the strategy to create a floor plan of a space in their home.



Fluency and Skills Practice

Understanding of Area

Name: _____

Write the area of each shape in square units.

1. _____ square units
2. _____ square units
3. _____ square units
4. _____ square units
5. _____ square units
6. _____ square units
7. _____ square units
8. _____ square units
9. Brett says this shape has an area of 13 square units. What could you tell Brett about his answer? Explain.

3 12 square centimeters
Medium

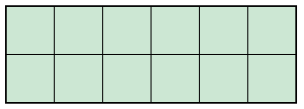
4 Disagree; See Student Worktext page for possible explanation.
Challenge

5 3; 5
Basic

6 The area is 15 square units; See Student Worktext page for possible explanation.
Medium

7 The area of Rectangle *C* is 15 square units; Rectangle *C* is larger. See Student Worktext page for possible explanation.
Challenge

3 What is the area of this rectangle?



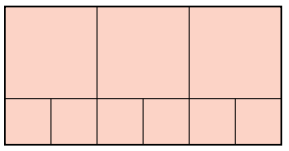
= 1 square centimeter

12 square centimeters

4 Ria says that the area of Rectangle *A* is 9 square units. Do you agree? Explain.

Possible answer: I do not agree. The units are not the same size.

Rectangle *A*



5 Fill in the blanks.

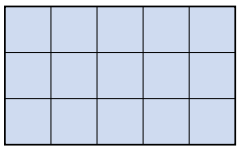
Rectangle *B* has **3** rows of squares.

There are **5** squares in each row.

6 How can you skip-count to find the area of Rectangle *B*? Write the area.

Possible answer: The rectangle has 3 rows with 5 squares in each row. Skip-count by fives 3 times to find the area: 5, 10, 15. The area is 15 square units.

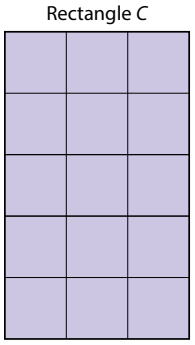
Rectangle *B*



7 What is the area of Rectangle *C*? How does this compare to the area of Rectangle *B*? Are the rectangles the same size? Explain.

Possible answer: The area of Rectangle *C* is 15 square units. The area of Rectangle *B* is also 15 square units. Rectangle *C* is larger because the square units are larger.

Rectangle *C*



ELL English Language Learners: Differentiated Instruction

Prepare for Session 3
Use with *Apply It*.

Levels 1–3	Levels 2–4	Levels 3–5
Listening/Speaking Use before ***Apply It*** problem 3. Give students a slip of dot paper with three rows of six dots. Ask: *What unit is used to measure area?* [square units] *How can we make squares, all the same size, using all the dots?* [Draw lines.] Say: *Remember there can be no space between the squares. The squares cannot overlap either.* Model how to draw another square from an existing square. Have students form pairs and complete the squares. Ask: *How many squares did you make?* [10] *Do you agree or disagree with 10?* Address any disagreement students may express.	**Listening/Speaking** Use before ***Apply It*** problem 3. Give students a slip of dot paper with three rows of six dots. Ask: *What unit is used to measure area?* [square units] *How can we make squares, all the same size, using all the dots?* [Draw lines.] Say: *Remember there can be no space between the squares. The squares cannot overlap either.* Have students draw the squares and then form pairs. Say: *Compare your paper to a partner's.* Ask: *Do your papers look the same? How many squares did you make?* [10] *Do you agree or disagree with 10?* Address any disagreement students may express.	**Listening/Speaking** Complete before students read ***Apply It*** problem 3. Give a slip of dot paper with three rows of six dots to each student. Ask: *What unit do you use to measure area?* [square units] *How can we make squares, all the same size, using all the dots?* [Draw lines.] Ask: *When you make squares, can the squares have gaps or overlap?* [No.] Have students draw the squares and then form pairs. Say: *Compare your paper to a partner's. Do your papers look the same? How many squares did you make?* [10] *Do you agree or disagree with 10?* Call on students to explain their reasoning.

LESSON 14

SESSION 3 Refine

Purpose In this session students demonstrate their understanding of area as they talk through three problems. Then they use a dot grid to draw and compare rectangles that have a specified area.

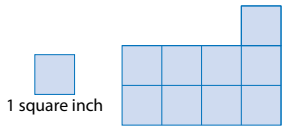
Start

Connect to Prior Knowledge

Why Reinforce the concept of finding area using the units given.

How Have students find the area of a non-rectangular shape by counting the square units that cover it.

What is the area of the shape?



Area = ... square inches

Solution
9 square inches

APPLY IT

Have students work independently or with a partner.

1 COMPARE

Look for understanding that the area of a shape is found by counting the square units the shape is covered by and that the areas of these two shapes are measured in different units.

Use the following to start a discussion:

- *How did you find the area of each rectangle?*
- *How did you know what units to use?*

Common Misconception **If** students do not include units in their answers, or if they use incorrect units, **then** ask them why the area of the second rectangle is 4 times the area of the first even though they appear to be about the same size. Prompt students to explain which unit they used to find the area of each rectangle and how they can indicate that in their answers.

LESSON 14 SESSION 3 ● ● ●

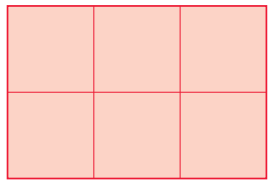
Refine Ideas About Finding Area

APPLY IT

Complete these problems on your own.

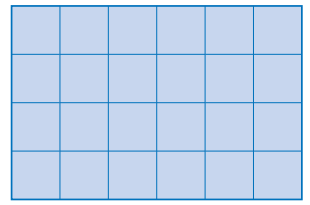
1 COMPARE

Find the area of each shape below.



Each  has an area of 1 square meter.

Area = 6 square meters



Each  has an area of 1 square foot.

Area = 24 square feet

2 EXAMINE

Anna says the area of this rectangle is 12 square units because each of the small rectangles is 1 unit long. Why is Anna wrong?

Because the rectangles are not square, the area of one rectangle cannot be 1 square unit, so the area of the larger rectangle cannot be 12 square units.

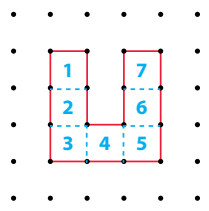
1	2	3
4	5	6
7	8	9
10	11	12

3 RELATE

Think about how you could find the area of this shape.

First, draw the square units.

Then number the square units to find the area of the shape.



Area = 7 square units

PAIR/SHARE
Discuss your solutions to these three problems with a partner.

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2 EXAMINE

Look for understanding that the area of each smaller rectangle cannot be 1 square unit because the rectangles do not measure 1 unit on all sides.

Prompt discussion with questions such as:

- *Is the rectangle divided into equal-sized units? What shape is each of these units?*
- *Can this shape be described as a square unit? Why or why not?*
- *What is useful about always describing area with square units rather than rectangular units?*

Have students work in pairs to come up with a correct statement about the area of the rectangle.

3 RELATE

Look for understanding of how to divide the shape into square units.
It may help to have students first shade the shape in order to better distinguish the square units formed by the dots.

Have students discuss how or if they approach finding the area of a rectangle differently than the area of a non-rectangular shape.

4 **Before students begin,** read through problem 4 as a class. Make sure students understand that their task is to draw two rectangles, one with an area of 8 square units and one with an area greater than 8 square units.

As students work on their own, walk around to assess their progress and understanding, to answer their questions, and to give additional support, if needed.

Have students share their drawings with a partner and compare their strategies for drawing rectangles with the appropriate area.

Scoring Rubrics

Parts A and B

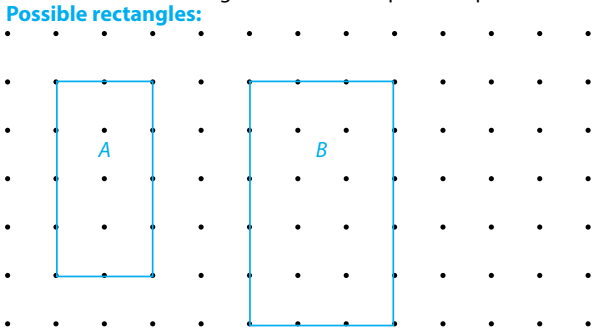
Points	Expectations
2	Student draws a rectangle with the correct area.
1	Student draws a non-rectangular shape with the correct area.
0	Student draws a shape that does not have the correct area.

Part C

Points	Expectations
2	Student provides a complete explanation of using length and width or counting methods to draw a rectangle with an area greater than 8 square units.
1	Student provides an incomplete explanation of using length and width or counting methods.
0	Student provides little or no explanation.

Use what you have learned to complete problem 4.

4 Use a ruler and the dot grid below to complete the problems.
Possible rectangles:



Part A Draw a rectangle with an area of 8 square units on the grid. Label it with an *A*.

Part B Draw a rectangle with an area greater than 8 square units on the same grid. Label it with a *B*.

Part C How did you know how to draw your rectangle *B* with an area that is greater than 8 square units?

Possible answer: I knew the rectangle had to be covered by more than 8 square units, so I chose a length and width that would give me a rectangle that big.

5 MATH JOURNAL

Explain how you can find the area of a rectangle drawn on a dot grid.

Possible answer: On a dot grid, I would draw in the square units that cover the rectangle. I can then count the square units that cover the rectangle. I like to number the squares so I do not count any twice. The total number of these square units is the area of the rectangle.

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Close: Exit Ticket

5 MATH JOURNAL

Students should define a square unit on the dot grid as the smallest square formed by connecting dots and then describe counting the square units inside the rectangle.

Error Alert **If** students do not identify a square unit on the dot grid, **then** draw a larger square on the dot grid and ask whether that is the square unit they would use to find the area of the rectangle.

Lesson Overview

LESSON 15

Multiply to Find Area

Lesson Objectives

Content Objectives

- Understand that multiplying side lengths of a rectangle provides the same results as tiling it and counting the units.
- Use the area formula for rectangles to solve mathematical problems.
- Use the area formula for rectangles to solve real-world problems.

Language Objectives

- Write an equation for the area of a given rectangle.
- Label area measurements with square units.
- Draw a picture to represent and solve a word problem about area.

Prerequisite Skills

- Recall basic multiplication facts.
- Understand how to use square units to measure area.

Standards for Mathematical Practice (SMP)

SMPs 1, 2, 3, 4, 5, and 6 are integrated in every lesson through the *Try-Discuss-Connect* routine.*

In addition, this lesson particularly emphasizes the following SMPs:

4 Model with mathematics.

5 Use appropriate tools strategically.

7 Look for and make use of structure.

8 Look for and express regularity in repeated reasoning.

*See page 1i to see how every lesson includes these SMPs.

Lesson Vocabulary

There is no new vocabulary. Review the following key terms.

- **area** the amount of space inside a closed two-dimensional figure. Area is measured in square units such as square centimeters.
- **multiplication** an operation used to find the total number of items in a given number of equal-sized groups.
- **square unit** the area of a square with side lengths of 1 unit.

Learning Progression

Students were formally introduced to the concept of area **in the previous lesson** and measured the area of a rectangle by tiling, or covering, it with square units and counting the square units.

In this lesson students formally explore the multiplicative relationship between a rectangle's length and width and its area. Students apply their understanding of decomposing a rectangle into rows and columns of same-sized square units to find the number of square units and, thus, the rectangle's area. Students come to understand that a rectangle's area can also be found by multiplying its length and its width. They label the area in square units, such as square centimeters or square feet.

In the next lesson students will use area models to find areas of combined rectangles and will decompose shapes into rectangles to find area. In a later Grade 3 lesson students will relate area and perimeter of a rectangle.

In Grade 4 students will begin to develop an abstract understanding of area as they use the area formula to find an unknown side measure of a rectangle given its area and another side measure. Students in Grades 4 and 5 will also use rectangular area models to develop a conceptual understanding of multiplication and division based on place value and the distributive property when they will multiply and divide with multi-digit whole numbers and decimals.

Lesson Pacing Guide

Whole Class Instruction

SESSION 1
Explore
45–60 min

Interactive Tutorial* *(Optional)*
Prerequisite Review:
Understand Area

Multiplying to Find Area
- Start *5 min*
- Try It *10 min*
- Discuss It *10 min*
- Connect It *15 min*
- Close: Exit Ticket *5 min*

Additional Practice
Lesson pages 317–318

SESSION 2
Develop
45–60 min

Multiplying to Find Area
- Start *5 min*
- Try It *10 min*
- Discuss It *10 min*
- Picture It & Model It *5 min*
- Connect It *10 min*
- Close: Exit Ticket *5 min*

Additional Practice
Lesson pages 323–324

Fluency
Multiplying to Find Area

SESSION 3
Develop
45–60 min

Solving Word Problems About Area
- Start *5 min*
- Try It *10 min*
- Discuss It *10 min*
- Picture It & Model It *5 min*
- Connect It *10 min*
- Close: Exit Ticket *5 min*

Additional Practice
Lesson pages 329–330

Fluency
Solving Word Problems About Area

SESSION 4
Refine
45–60 min

Multiplying to Find Area
- Start *5 min*
- Example & Problems 1–3 *15 min*
- Practice & Small Group Differentiation *20 min*
- Close: Exit Ticket *5 min*

Lesson Quiz
or **Digital Comprehension Check**

Lesson Materials

Lesson *(Required)*	*Per student:* 20 inch tiles
Activities	*Per student:* inch ruler, 3-inch by 5-inch index card *Per pair:* 1 rectangular object, 100 inch tiles, 81 unit tiles, inch ruler *Activity Sheets:* Multiplication Table, 1-Centimeter Grid Paper**
Math Toolkit	square tiles, counters, grid paper, dot paper
Digital Math Tools	Perimeter and Area Tool, Number Line, Multiplication Models

**Used for more than one activity.

*We continually update the Interactive Tutorials. Check the Teacher Toolbox for the most up-to-date offerings for this lesson.

Teacher Toolbox

Small Group Differentiation

PREPARE

Ready Prerequisite Lesson
Grade 2
- Lesson 30 Partition Rectangles

RETEACH

Tools for Instruction
Grade 2
- Lesson 30 Fill a Rectangle with Squares

Grade 3
- Lesson 15 Multiply to Find Area

REINFORCE

Math Center Activity
Grade 3
- Lesson 15 Area Problems

EXTEND

Enrichment Activity
Grade 3
- Lesson 15 Designing a Garden

i-Ready

Independent Learning

PERSONALIZE

i-Ready Lesson*
Grade 3
- Add and Multiply to Find Area

LESSON 15

Connect to Family, Community, and Language Development

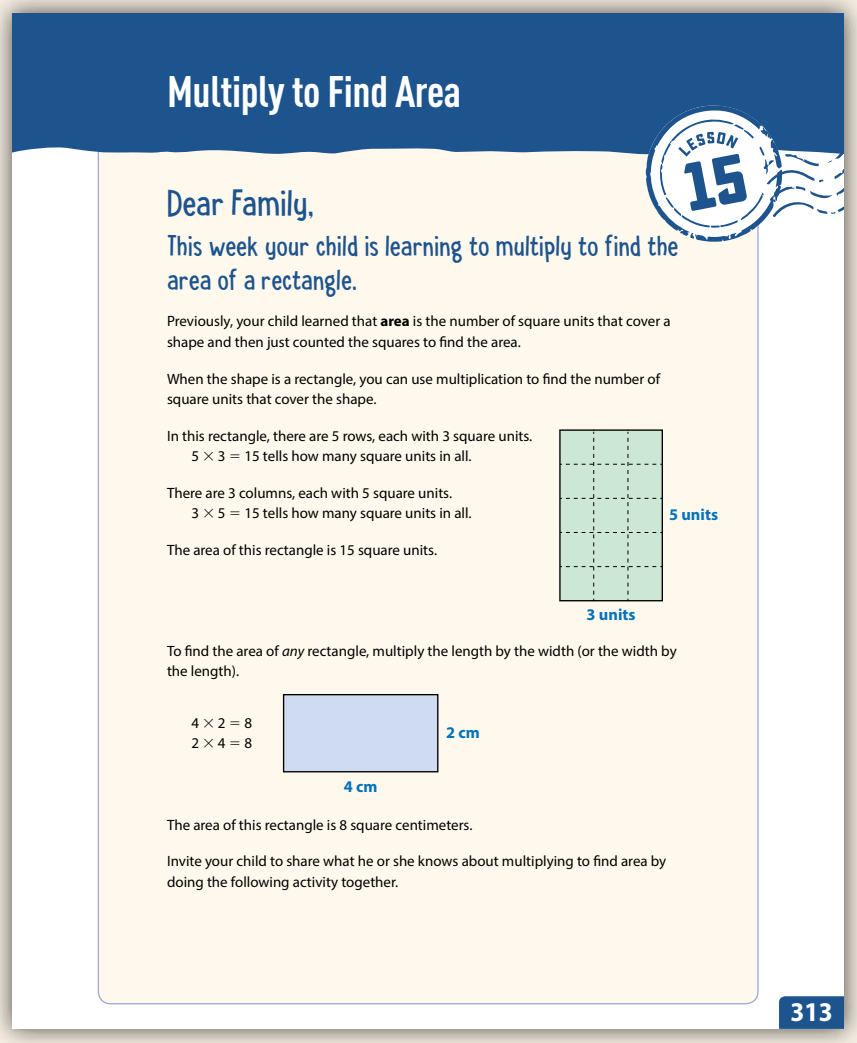
The following activities and instructional supports provide opportunities to foster school, family, and community involvement and partnerships.

Connect to Family

Use the **Family Letter**—which provides background information, math vocabulary, and an activity—to keep families apprised of what their child is learning and to encourage family involvement.

Available in Spanish

Teacher Toolbox



Multiply to Find Area

LESSON 15

Dear Family,

This week your child is learning to multiply to find the area of a rectangle.

Previously, your child learned that **area** is the number of square units that cover a shape and then just counted the squares to find the area.

When the shape is a rectangle, you can use multiplication to find the number of square units that cover the shape.

In this rectangle, there are 5 rows, each with 3 square units.
$5 \times 3 = 15$ tells how many square units in all.

There are 3 columns, each with 5 square units.
$3 \times 5 = 15$ tells how many square units in all.

The area of this rectangle is 15 square units.

5 units

3 units

To find the area of *any* rectangle, multiply the length by the width (or the width by the length).

$4 \times 2 = 8$
$2 \times 4 = 8$

2 cm

4 cm

The area of this rectangle is 8 square centimeters.

Invite your child to share what he or she knows about multiplying to find area by doing the following activity together.

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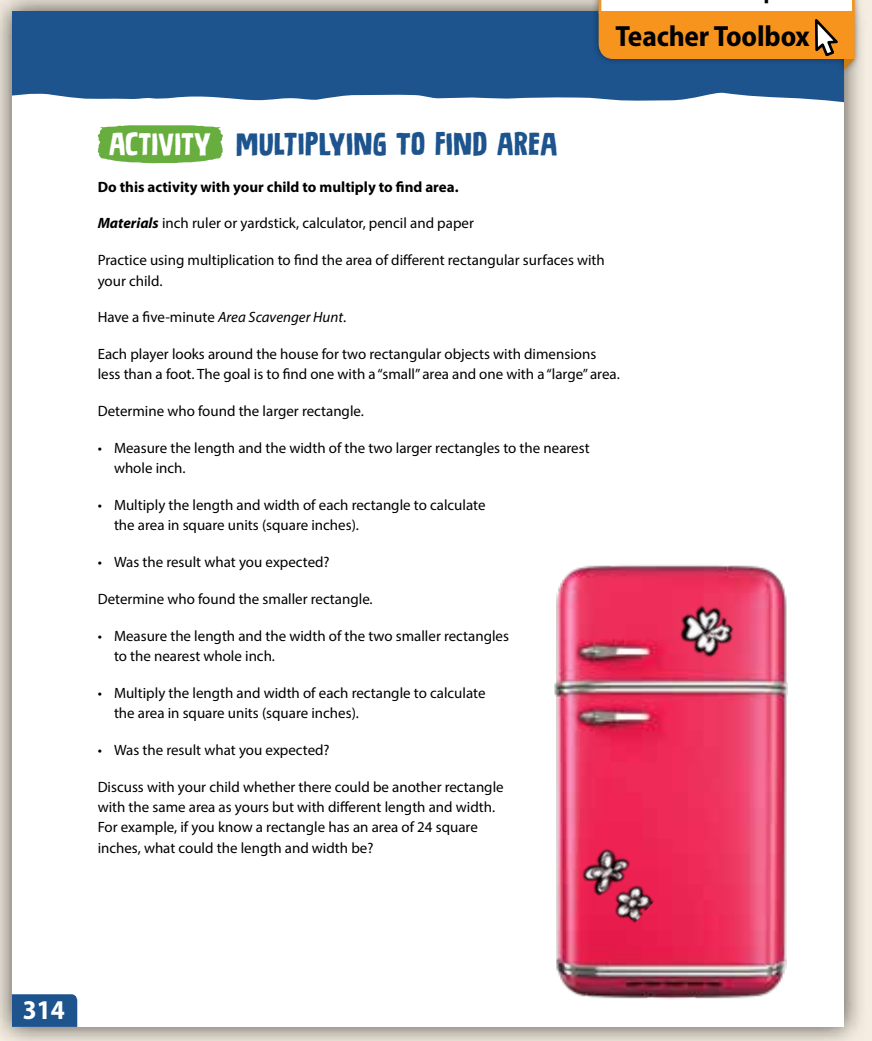

ACTIVITY MULTIPLYING TO FIND AREA

Do this activity with your child to multiply to find area.

Materials inch ruler or yardstick, calculator, pencil and paper

Practice using multiplication to find the area of different rectangular surfaces with your child.

Have a five-minute *Area Scavenger Hunt*.

Each player looks around the house for two rectangular objects with dimensions less than a foot. The goal is to find one with a "small" area and one with a "large" area.

Determine who found the larger rectangle.

- Measure the length and the width of the two larger rectangles to the nearest whole inch.
- Multiply the length and width of each rectangle to calculate the area in square units (square inches).
- Was the result what you expected?

Determine who found the smaller rectangle.

- Measure the length and the width of the two smaller rectangles to the nearest whole inch.
- Multiply the length and width of each rectangle to calculate the area in square units (square inches).
- Was the result what you expected?

Discuss with your child whether there could be another rectangle with the same area as yours but with different length and width. For example, if you know a rectangle has an area of 24 square inches, what could the length and width be?

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Goal

The goal of the Family Letter is to show how the area of a rectangle can be found by using multiplication.

- The length and width of a rectangle are multiplied to find the area in square units.

Activity

Understanding the real-world application of area illustrates the relevance of mathematics for students. Look at the *Multiplying to Find Area* activity and adjust it if necessary to connect with your students.

Math Talk at Home

Encourage students to talk with their family members about area. Connect the concept of area to buying and laying carpet or planning and laying bricks to build a rectangular patio floor.

Conversation Starters Below are additional conversation starters students can write in their Family Letter or math journal to engage family members.

- *Which room in our home has the greatest wall area? How do you know?*
- *How can we figure out the area of a rug in our home?*

Connect to Community and Cultural Responsiveness

Use these activities to connect with and leverage the diverse backgrounds and experiences of all students.

Session 1 **Use anytime during the session.**

- Display a yardstick and a meterstick. Explain that each tool represents a different measurement system. Share that most of the world uses a different system of measurement than the United States. Relate the metric system to the countries of origin of your students. Draw a two-column table for Customary and Metric units. Ask students to think of units that are used to describe familiar areas, for example a carpet, a soccer field, or a garden. [square inch, square foot, square meter] Encourage students to share units they know and guide them to place them in the correct columns.

Connect to Language Development

For ELLs, use the Differentiated Instruction chart to plan and prepare for specific activities in every session.

ELL English Language Learners: Differentiated Instruction

Prepare for Session 1
Use with *Connect It*.

Levels 1–3	Levels 2–4	Levels 3–5
Listening/Speaking Read ***Connect It*** problem 2 and have students follow along. Have students point to and count all the squares in the rectangle. Ask: *How many squares are there?* [15] Next, guide students to identify the dimensions and find the area. Ask: *How long is the rectangle?* [5 squares long] Ask them to show you the corresponding squares. Ask: *How wide is the rectangle?* [3 squares wide] Have students show you the squares. Ask: *What can you do to find the total number of squares without counting?* Have students work with partners to complete the sentence frame: The area of the rectangle is _____ units × _____ units.	**Listening/Speaking** Choral read ***Connect It*** problem 2. Have students point to and count all the squares in the rectangle. Ask: *How many squares are there?* [15] Next, have students identify the dimensions and name other steps to find the area. Ask: *How long is the rectangle? How wide is the rectangle?* Have students point to the squares as they answer. Provide sentence frames: The rectangle is _____ squares long. The rectangle is _____ squares wide. Ask: *What can you do to find the total number of squares without counting?* Have students discuss with partners and complete the sentence frame: To find the area we can multiply the _____ and the _____. [length/width or width/length]	**Listening/Writing** Have students read ***Connect It*** problem 2 with partners. Ask: *How many squares are there?* [15] Next, have partners identify the dimensions and discuss other steps to find the area. Encourage them to use the words *width* and *length* in their conversations. Then ask students to find the area without counting and share their steps. Ask: *Does the answer change if you multiply width first?*

LESSON 15

SESSION 1 Explore

Purpose In this session students draw on the concept of area and the properties of rectangles and arrays to solve a problem. They share strategies to explore how to find area when they cannot count all the square units. They will look ahead to think about how they can use multiplication to find area.

Start

Connect to Prior Knowledge

Why Review the relationship between the dimensions of an array and the total number of items in the array.

How Have students use an array to model and solve a multiplication problem.

Draw an array to model the multiplication problem. Then solve the problem.

$4 \times 6 =$ .....

Solution

24;

Look for an array with 4 rows and 6 columns.

TRY IT

Make Sense of the Problem

To support students in making sense of the problem, have them show that they need to find the area of the rectangle.

DISCUSS IT

Support Partner Discussion

To reinforce the idea that the squares resemble an array, encourage students to use the terms *row* and *column* as they talk to each other.

Look for, and prompt as necessary for, understanding of:

- the same number of squares in each row
- the same number of squares in each column
- the area of the rectangle being equal to the total number of squares, including those hidden

LESSON 15 SESSION 1 ● ○ ○ ○

Explore Multiplying to Find Area

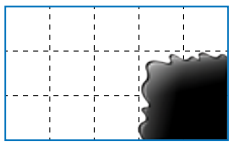
You have already learned how to find the area of a rectangle by counting the number of square units that cover the rectangle. This lesson will help you find the area using multiplication. Use what you know to try to solve the problem below.

Learning Target

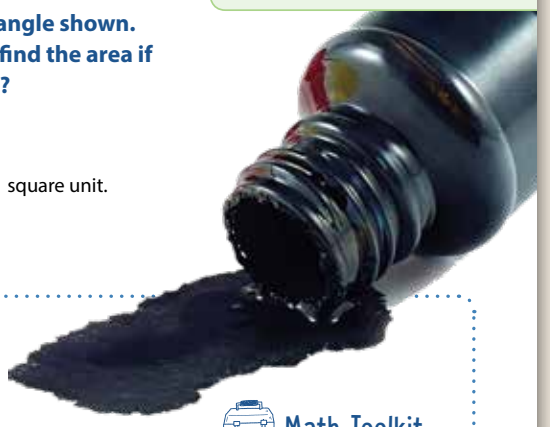
- Find the area of a rectangle with whole-number side lengths by tiling it, and show that the area is the same as would be found by multiplying the side lengths.

SMP 1, 2, 3, 4, 5, 6, 7, 8

Jenny wants to find the area of the rectangle shown. But some ink spilled on it. How can she find the area if she cannot count all of the square units?



Area of ☐ = 1 square unit.



TRY IT

Possible student work:

Sample A

1	2	3	4	5
6	7	8	9	10
11	12	13	14	15

15 square units

Sample B

five columns with 3 squares each
3 + 3 + 3 + 3 + 3 = 15 square units

Math Toolkit

- square tiles
- counters
- grid paper
- perimeter and area tool
- multiplication models

DISCUSS IT

Ask your partner: How did you get started?

Tell your partner: I knew . . . so I . . .

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Common Misconception Look for students who are not comfortable visualizing the square units hidden by the ink. As students present solutions, have them specify how they were able to count those squares without being able to see them.

Select and Sequence Student Solutions

One possible order for whole class discussion:

- concrete models, such as using square tiles to reconstruct the rectangle
- drawings on grid paper
- arrays that represent the rectangle divided into squares
- repeated addition or multiplication

Support Whole Class Discussion

Prompt students to note the relationship between the numbers in each model and the numbers in the problem.

Ask *How do [student name]'s and [student name]'s models show that the hidden squares are included?*

Listen for Manipulatives and drawings should represent the complete grid, including the hidden squares. Repeated addition or multiplication should correctly assume that there are 5 squares in each row and 3 squares in each column.

CONNECT IT

1 LOOK BACK

Look for understanding that the rectangle is made up of equal rows of squares that can be counted or skip-counted.

Hands-On Activity

Decompose a 3-inch by 5-inch rectangle into square inches.

If . . . *students are unsure about the number of squares hidden by the ink,*

Then . . . *use this activity to have them break down the rectangle into squares they can count.*

Materials For each student: inch ruler, 3-inch by 5-inch index card

- Instruct students to mark off the inches along each edge of the index card.
- Have students use the ruler to draw lines connecting the inch marks to show rows and columns of squares.
- Discuss the length, width, and area of one of the square units formed. [length: 1 inch, width: 1 inch, area: 1 square inch]
- Have students describe the length, width, and area of the rectangle/card using appropriate units. [length: 5 inches, width: 3 inches, area: 15 square inches]
- Repeat the activity with a 4-inch by 6-inch index card as time allows.

2 LOOK AHEAD

Point out that the grid on the rectangle resembles an array formed by squares. Because each square has a side length of 1 unit, the number of squares along each side equals the length of that side. Students will spend more time learning about length and width in the Additional Practice.

Students should be able to make the connection to arrays and understand why the total number of squares is the product of the numbers of squares along the red and blue sides.

CONNECT IT

1 LOOK BACK

Explain how you found the area of Jenny's rectangle when you could not see all the squares. What is the area of Jenny's rectangle?

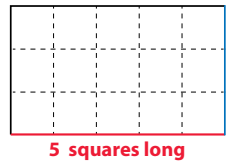
Possible answer: The first row has 5 square units. The next two rows likely also have 5 square units. You can count by fives: 5, 10, 15, to find the area of Jenny's rectangle, 15 square units.

2 LOOK AHEAD

When you know the length and width of a rectangle, you do not have to count the square units to find the area. You can multiply instead.

a. Jenny's rectangle without the ink spill is an array of squares that have been pushed together. What two multiplication equations can you write to describe this array?

3 × 5 = 15 and 5 × 3 = 15



b. Write an equation to multiply the **length** and the **width** of the rectangle. Explain how you can use length and width to find the area of a rectangle.

5 units × 3 units = 15 square units; Possible explanation: I can multiply length and width to find the area of a rectangle.

c. Explain how 5 × 3 gives you the same area as counting all the squares.

Possible answer: When you multiply, you can count or skip-count to find the product. So, you can skip-count 5, 10, 15 square units to find the area or multiply 5 × 3 = 15 square units to find the area.

3 REFLECT

How is finding the area of a rectangle like finding the number of items in an array?

Possible answer: The number of square units that cover a rectangle is its area, and these units also form an array. Multiplying the length and width of the rectangle to find its area is like multiplying the number of columns and the number of rows to find the number of square units in the array.

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Close: Exit Ticket

3 REFLECT

Look for understanding that when a rectangle is divided into squares, the squares will form equal rows similar to the equal rows of an array. The number of squares corresponds to the number of items in an array, so the total of each can be found by multiplying the number of columns by the number of rows.

Common Misconception **If** students are unable to relate finding the number of items in an array with finding the area of a rectangle, **then** use square tiles to model a rectangle. Discuss how to find the area of the rectangle and then separate the tiles to form an array and review how to multiply to find the total number of items in an array.

Real-World Connection

Encourage students to think about reasons they may have for finding the area of a rectangular space. Have volunteers share their ideas. Examples may include determining the size of a carpet for a room, deciding how much paint to buy to paint a bedroom's walls, figuring out how much space there is for a picture in a scrapbook, and so on.

Solutions

Support Vocabulary Development

1 Remind students that this graphic organizer is called a table and that *table* is a multiple-meaning word. Review the two meanings if necessary. Explain that this table has rows and columns and is read from left to right. Say: *This table will help prepare you for multiplying to find area.* Read the column headings of the table and discuss the focus of each column. Point out the first column. Ask: *What words do you need to use to talk about multiplying to find area?*

2 Have students label the number of rows and columns of the array. Ask: *If you skip-count by fours the squares in the array, are you counting the squares in the rows or the columns? What are the first three numbers you say when you skip-count by fours? What multiplication fact is the same as skip-count by fours three times? Are the totals the same? Why?*

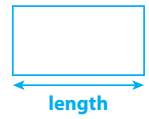
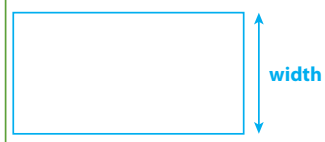
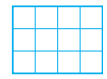
Supplemental Math Vocabulary

- *area*
- *multiplication*
- *square unit*

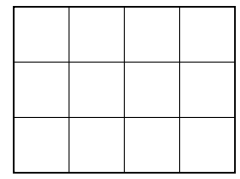
Name: _____ LESSON 15 SESSION 1

Prepare for Multiplying to Find Area

1 Think about what you know about measurement. Fill in each box. Use words, numbers, and pictures. Show as many ideas as you can. **Possible answers:**

Word	In My Own Words	Example
length	**how long something is**	 **length**
width	**how wide something is**	 **width**
area	**the amount of space a flat shape covers**	 **Area = 12 square units**

2 Manny skip-counts by fours 3 times to find the area of the rectangle shown. Lee multiplies the length of the rectangle by the width. They both say the area of the rectangle is 12 square units. Explain why the two methods give the same answer.



Possible answer: Skip-counting by fours 3 times is the same as finding 3 × 4. Both methods give you the total number of square units in a rectangle with 3 rows of 4 squares. The area is 12 square units.

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3 Assign problem 3 to provide another look at solving a problem with multiplying to find area. This problem is very similar to the problem about finding the area of a rectangle with ink spilled on it. In both problems, students cannot count the square units in the picture to find the area of the rectangle. The question asks students to reason about the length and width of a rectangle with ink spilled on it to find the area.

Students may want to use square tiles or square pieces of paper.

Suggest that students read the problem three times, asking themselves one of the following questions each time:

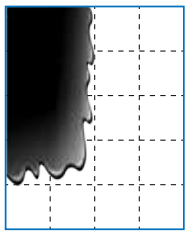
- *What is this problem about?*
- *What is the question I am trying to answer?*
- *What information is important?*

Solution: The rectangle has 4 columns with 5 squares each: 5, 10, 15, 20. The area of the rectangle is 20 square units.
Medium

4 Have students solve the problem another way to check their answer.

3 Solve the problem. Show your work.

Marcos wants to find the area of the rectangle shown. But some ink spilled on it. How can he find the area if he cannot count all of the square units?



Area of ☐ = 1 square unit.

Possible student work using pictures:

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16
17	18	19	20

Solution **20 square units**

4 Check your answer. Show your work.

Possible student work:

4 columns with 5 squares each
5 + 5 + 5 + 5 = 20 square units

ELL English Language Learners: Differentiated Instruction

Prepare for Session 2
Use with *Apply It*.

Levels 1–3

Listening/Speaking Read ***Apply It*** problem 10 aloud. Ask: *What are you trying to find?* [the width] *What do you know?* [The rectangle has an area of 10 square cm and is 5 cm long.] Say: *You know that you can use multiplication to find area.* Display:

length × width = area

Help students add the numbers to the equation. Display:

5 cm × width = 10 square cm

Say: *Discuss with a partner what number and label will make the equation true. Draw an array.*

Levels 2–4

Listening/Speaking Read ***Apply It*** problem 10 aloud. Ask: *What are you trying to find?* [the width of the rectangle] *What do you know?* [The rectangle has an area of 10 square cm and is 5 cm long.] *How do you find the area of a rectangle?* [You can multiply length and width.] Display:

length × width = area

Say: *Discuss with a partner how you can use this equation and the numbers in the problem to find the width of the rectangle. When you are sure, draw a rectangle to show your thinking.*

Levels 3–5

Listening/Speaking Have partners read ***Apply It*** problem 10. Ask: *What are you trying to find?* [the width of the rectangle] *What do you know?* [The rectangle has an area of 10 square cm and is 5 cm long.] *What equation do you use to find area?* [length × width = area] Display the equation. Say: *Discuss with a partner how you can use this equation and the numbers in the problem to find the width of the rectangle. When you are sure, draw a rectangle to show your thinking.* Call on students to explain their thinking.

LESSON 15

SESSION 2 Develop

Purpose In this session students solve a problem that requires finding the area of a rectangle that is not divided into squares for them to count. Students model the problem either on paper or with manipulatives to find the area. The purpose of this problem is to have students develop a strategy for finding area that involves multiplication.

Start

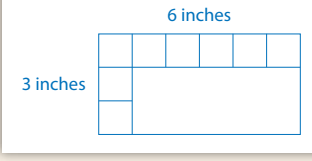
Connect to Prior Knowledge

Materials For each student: 20 inch tiles

Why Prepare students to find the area of rectangles that are not divided into squares.

How Have students model a 6-inch × 3-inch rectangle with square tiles and find its area.

Use inch tiles to model the rectangle and find its area.



Solution
18 square inches;
Look for a rectangle made with 3 rows of 6 tiles.

Develop Language

Why Clarify *centimeter* and its abbreviated form *cm*.

How Write the word *centimeter*. Underline *centi-* in the word and say: *centi- means 100*. Explain that there are 100 centimeters in a meter. Show students a meterstick. Say: *This stick is the length of one meter. One meter equals 100 centimeters.* Isolate a single centimeter and show the length to students. Then write *cm* next to the word *centimeter* and explain to students that *cm* is the abbreviation for *centimeter*.

TRY IT

Make Sense of the Problem

To support students in making sense of the problem, have them describe what the area of the rectangle represents in the picture.

Ask *How long is the rectangle? How wide is it? What units are the sides measured in?*

LESSON 15 SESSION 2 ● ● ○ ○

Develop Multiplying to Find Area

Read and try to solve the problem below.

What is the area of the rectangle?

TRY IT

Possible student work:

Sample A

length = 4 centimeters
width = 2 centimeters
4 × 2 = 8
8 square centimeters

Sample B

1	2	3	4
5	6	7	8

8 square centimeters

Math Toolkit
- square tiles
- grid paper
- dot paper
- perimeter and area tool
- multiplication models

DISCUSS IT

Ask your partner: What strategy did you use?

Tell your partner: The strategy I used to find the answer was . . .

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DISCUSS IT

Support Partner Discussion

Encourage students to use the terms *length* and *width* as they discuss their solutions.

Support as needed with questions such as:

- *Did you draw the rectangle?*
- *Did you cover the rectangle with squares?*

Common Misconception Look for students who are not able to visualize how the rectangle can be divided into square centimeters.

Select and Sequence Student Solutions

One possible order for whole class discussion:

- models that show the rectangle divided into squares for counting
- skip-counting or repeated addition
- multiplication (either 4 × 2 or 2 × 4)

Support Whole Class Discussion

Compare and connect the different representations and have students identify how they are related.

Ask *How is the length represented in each model? How is the width represented?*

Listen for The length (4) and the width (2) are represented by adding four 2s or two 4s together or by multiplying either 4×2 or 2×4.

PICTURE IT & MODEL IT

If no student presented these models, connect them to the student models by pointing out the ways they each represent:

- the length of the rectangle (4 cm)
- the width of the rectangle (2 cm)

Ask *How can you tell the length and width of the rectangle from the diagrams?*

Listen for There are 4 squares along the length of the rectangle and 2 squares along the width.

For a model that shows square tiles, prompt students to recall how they found the area of rectangles in the previous lesson.

- *What units should you use to measure the area?*
- *How can you divide the rectangle into square centimeters?*

For a multiplication equation, prompt students to visualize dividing the rectangle into squares without actually drawing them all.

- *How many square centimeters will fit in a row along the top? How many will fit in a column down the side?*
- *How many rows and columns would there be if you drew all the squares?*
- *How can you use the number of rows and the number of columns to find the total number of squares that would cover the rectangle?*

Explore different ways to understand multiplying to find area.

What is the area of the rectangle?

PICTURE IT

You can use square tiles to find area.

The model below shows the rectangle covered by 1-centimeter squares.

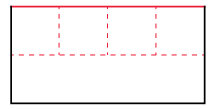
1	2	3	4
5	6	7	8

Area of ☐ = 1 square centimeter.

MODEL IT

You can also use a multiplication equation to find area.

The length of the rectangle is **4 centimeters**.
Using 1-centimeter squares,
4 squares will fill a row.



The width of the rectangle is **2 centimeters**.
Using 1-centimeter squares,
2 squares will fill a column.

Multiply length and width to find the area of the rectangle.

Area = 4×2

Deepen Understanding

Area and the Multiplication Table

SMP 7 Look for structure.

When discussing the multiplication equation, prompt students to think about how using the multiplication table relates to finding area.

Materials For display: Activity Sheet *Multiplication Table*

Ask *Draw a 3-by-4 rectangle in the top left corner of the products in the table. What is the area of the rectangle? Where do you see that number in the table?*

Listen for The area is 12, the number in the lower right corner of the rectangle.

Ask *What if you draw a 2-by-5 rectangle? a 5-by-3 rectangle? a 4-by-1 rectangle?*

Listen for The area is always in the lower right corner of the rectangle. [10, 15, 4]

Generalize *Why does this relationship exist?* The shaded numbers (the factors) correspond to the length and width of the rectangles. The area of the rectangle is the product of these factors, which is written in the square shared by the row of one number and the column of the other.

CONNECT IT

- Remind students that one thing that is alike about all the representations is the numbers.
- Explain that on this page, students will use those numbers to complete an equation for the area of the rectangle.

Monitor and Confirm

1 – 3 Check for understanding that:

- the rectangle can be covered with squares of area 1 square centimeter
- the length and width can help you figure out the number of squares along each side of the rectangle
- you can find the area of a rectangle if you know the length and width

Support Whole Class Discussion

4 – 6 Tell students that these problems will prepare them to provide the explanation required in problem 7.

Be sure students understand that these problems are helping them make a connection between a rectangle's area and its length and width.

Ask *How do you know the unit of measurement to use for the area?*

Listen for The sides of the rectangle are measured in centimeters, so if those units are used to draw squares, each square will be 1 square centimeter.

Ask *Why are the length and width multiplied?*

Listen for The length and width tell how many rows and columns of squares the rectangle can be divided into. Just as with items in arrays, the total number of squares is found by multiplying the number of rows by the number of columns.

7 Look for the understanding that the area of a rectangle is the number of square units it can be divided into or covered by and that this number can be found by multiplying the length and width of the rectangle.

8 REFLECT Have all students focus on the strategies used to solve this problem. If time allows, have students share their preferences with a partner.

CONNECT IT

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

1 How many 1-centimeter squares fit along the length of the rectangle? 4

What is the length of the rectangle? 4 centimeters

2 How many 1-centimeter squares fit along the width of the rectangle? 2

What is the width of the rectangle? 2 centimeters

3 What does the problem ask you to find? the area of the rectangle

4 The unit of measurement for the length and width of the rectangle is centimeters. What is the unit of measurement for the area?

square centimeters

5 Complete the equation below to find the area of the rectangle.

length	×	width	=	area
4 centimeters	×	2 centimeters	=	8 square centimeters

6 The area of the rectangle is 8 square centimeters.

7 Explain how you can use square tiles or multiplication to find the area of a rectangle.

Possible answer: You can place and count square tiles to find area. You can multiply length and width to find area. The two methods give you the same area.

8 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 mulitplying to find the area of a rectangle? Explain.

Students may respond that they like to cover a model with squares because they can count the squares. Other students may prefer multiplying because they know their multiplication facts.

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Hands-On Activity

Use a ruler and tiles to measure length, width, and area.

If . . . *students struggle with relating the length and width of a rectangle to the number of square units it can be divided into or covered by,*

Then . . . *use the activity below to connect length measured with a ruler and area found by counting square units.*

Materials For each pair: 1 rectangular object, 100 inch tiles, inch ruler

- Have each pair of students choose a rectangular object to measure, such as a picture or a book.
- Tell each pair to use the ruler to measure the length of the rectangle to the nearest inch. Have them measure the width of the rectangle the same way.
- Then have students use the tiles to cover the rectangle and count the total number of tiles to find the area. Ask them to verify that the number of tiles along each side of the rectangle corresponds to the length or width as measured with the ruler.
- Invite pairs to show the objects they measured and identify the lengths, widths, and areas they found.

APPLY IT

For all problems, encourage students to draw some kind of model to support their thinking. Allow some leeway in precision; the correct number of square units is more important than whether the drawn units are true squares.

9 9 square units; Students could solve the problem by dividing the square into square units or by multiplying 3 × 3.

10 2 centimeters; Students could solve the problem by finding 10 ÷ 5 or by drawing rows of 5 squares and counting to find out how many rows of 5 make 10.

Close: Exit Ticket

11 48 square inches; Students could solve the problem by dividing a rectangle into 6 rows of 8 squares or by multiplying 8 × 6.

Students' solutions should indicate understanding of:

- how length and width determine the number of square units a rectangle can be divided into
- area = length × width
- when length and width are measured in inches, the area is measured in square inches

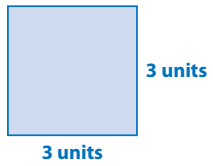
Error Alert **If** students draw 6 rows of 8 squares and make a counting error, **then** review how to skip-count or multiply to find the total number of squares.

APPLY IT

Use what you just learned to solve these problems.

9 What is the area of the square? Show your work.

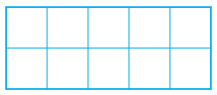
Possible student work:
3 units × 3 units = 9 square units



Solution **9 square units**

10 Sheigh has a rectangle that is 5 centimeters long. The area of the rectangle is 10 square centimeters. What is the width of the rectangle? Show your work.

Possible student work:

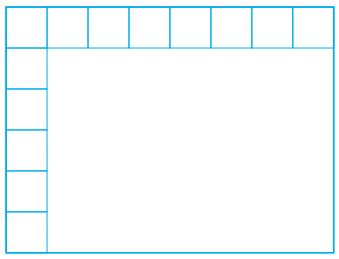


2 × 5 = 10

Solution **2 centimeters**

11 A rectangle has a length of 8 inches and a width of 6 inches. What is the area of the rectangle? Show your work.

Possible student work:



length = 8, width = 6
8 × 6 = 48

Solution **48 square inches**

Solutions

1. 7 units × 6 units = 42 square units or
6 units × 7 units = 42 square units
Basic

2. 56 square inches; 8 × 7 = 56
Medium

3. 16 square centimeters; 4 × 4 = 16
Medium

Name: _____ LESSON 15 SESSION 2

Practice Multiplying to Find Area

Study the Example showing how to multiply to find area.
Then solve problems 1–9.

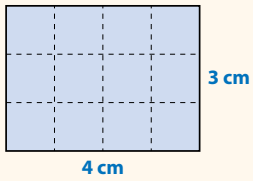
EXAMPLE

A rectangle has a length of 4 centimeters and a width of 3 centimeters. What is the area?

Fill the rectangle with 1-centimeter squares. There are 4 squares in a row and 3 rows.

You can multiply to find the total number of squares: 4 × 3 = 12.

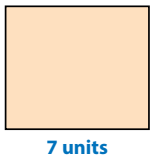
The area is 12 square centimeters.



1. What is the area of this rectangle? Write an equation.

length × **width** = **area**

7 units × 6 units = 42 square units



2. A rectangle has a length of 8 inches and a width of 7 inches. What is the area of the rectangle?

8 × 7 = 56; The area of the rectangle is 56 square inches.

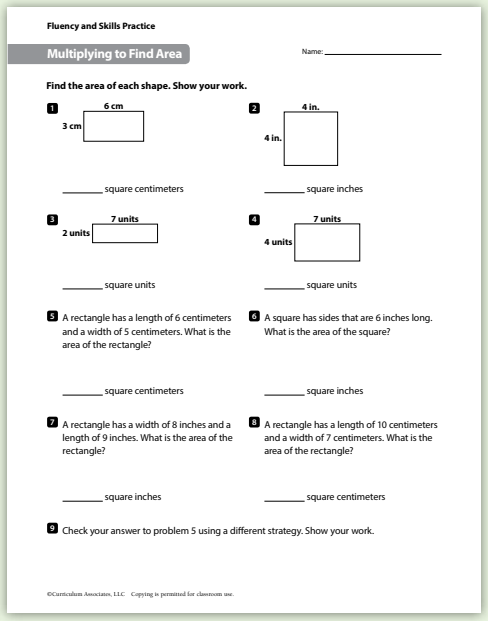
3. A square has sides that are 4 centimeters long. What is the area? Write an equation.

4 × 4 = 16; The area of the square is 16 square centimeters.

Fluency & Skills Practice Teacher Toolbox

Assign *Multiplying to Find Area*

In this activity students practice multiplying side lengths to find the areas of rectangles. Students can use this strategy in real-world situations that involve areas of rectangles. For example, they may wish to calculate the area of a patio, determine the area of a sandbox that would be formed using different lengths of wood, or compare the area of their bedroom to the area of a friend's or sibling's bedroom.



Fluency and Skills Practice

Multiplying to Find Area

Name: _____

Find the area of each shape. Show your work.

1. 6 cm, 3 cm _____ square centimeters
2. 4 in., 4 in. _____ square inches
3. 7 units, 2 units _____ square units
4. 7 units, 4 units _____ square units
5. A rectangle has a length of 6 centimeters and a width of 5 centimeters. What is the area of the rectangle? _____ square centimeters
6. A square has sides that are 6 inches long. What is the area of the square? _____ square inches
7. A rectangle has a width of 8 inches and a length of 9 inches. What is the area of the rectangle? _____ square inches
8. A rectangle has a length of 10 centimeters and a width of 7 centimeters. What is the area of the rectangle? _____ square centimeters
9. Check your answer to problem 5 using a different strategy. Show your work.

4 $9 \times 3 = 27$ or $3 \times 9 = 27$; 27 square units
Medium

5 30 square centimeters; $6 \times 5 = 30$
Medium

6 64 square centimeters; $8 \times 8 = 64$
Medium

7 32 square units; $4 \times 8 = 32$
Medium

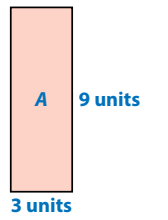
8 See Student Worktext page for possible explanation; The area of the square must be greater than 32 units, so each side must be at least 6 units.
Challenge

9 See Student Worktext page for possible explanation; The missing side length must be at least 9 units.
Medium

4 Write an equation to find the area of Rectangle *A*. Then write the area.

Equation **9 × 3 = 27**

Area **27 square units**



5 A rectangle has a length of 6 centimeters and a width of 5 centimeters. What is the area of the rectangle? Show your work.

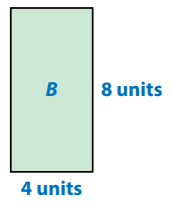
6 × 5 = 30; The area of the rectangle is 30 square centimeters.

6 What is the area of a square with sides that are 8 centimeters long? Show your work.

8 × 8 = 64; The area of the square is 64 square centimeters.

7 What is the area of Rectangle *B*? Show your work.

8 × 4 = 32; The area of the rectangle is 32 square units.

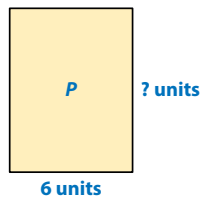


8 Lena draws a square with an area that is greater than the area of Rectangle *B*. What are two possible side lengths of Lena's square? Explain.

Possible answer: The area of the square has to be greater than 32 square units. 6 × 6 = 36, and 7 × 7 = 49. Both 36 and 49 are greater than 32. Lena's square could have sides of 6 units or 7 units.

9 Pablo draws Rectangle *P*. He says that the area is greater than 50 square units. What could the unknown side length be? Explain.

Possible answer: The unknown side length could be 9 units. 6 × 9 = 54, so the area is 54 square units. This is greater than 50 square units.



ELL English Language Learners: Differentiated Instruction

Prepare for Session 3
Use with *Apply It*.

Levels 1–3

Listening/Speaking Read ***Apply It*** problem 10 aloud. Say: *Point to Kayla's rectangle. How long is it?* [9 units] *How wide is it?* [2 units] *What is its area?* [18 sq. units] *How do you know?* [9 × 2 = 18] *What is the same about this rectangle and James' rectangle?* [the area] *What is different?* [the side lengths] Display a nine-by-two array. Say: *Do you agree or disagree that this can be James' rectangle?* Have students use the sentence starters to discuss:

- *I agree because* _____.
- *I disagree because* _____.

Display a three-by-six array. Say: *Do you agree or disagree that this can be James' rectangle? How do you know?*

Levels 2–4

Listening/Speaking Read ***Apply It*** problem 10 aloud. Say: *Point to Kayla's rectangle. What is the rectangle's area?* [18 sq. units] *How do you know?* [9 × 2 = 18] *What is the same about this rectangle and James' rectangle?* [the area] *What is different?* [the side lengths] Display nine rows of two squares. Say: *Do you agree or disagree that this is James' rectangle?* Have students use sentence starters to discuss:

- *I agree because* _____.
- *I disagree because* _____.

Come to a consensus. Have students form pairs and give each pair 18 tiles. Say: *Build a rectangle that has different side lengths than Kayla's.* Call on pairs to explain how their rectangle is different from Kayla's.

Levels 3–5

Speaking/Writing Have partners read ***Apply It*** problem 10. Say: *Point to Kayla's rectangle. What is its area?* [18 sq. units] *How do you know?* [9 × 2 = 18] *What is the same about this rectangle and James' rectangle?* [the area] *What is different?* [the side lengths] Display nine rows of two squares. Say: *Do you agree or disagree that this is James' rectangle?* Display:

- *I agree because* _____.
- *I disagree because* _____.

Form a consensus. Say: *Draw a rectangle/array with an area of 18 sq. units that has different side lengths than Kayla's.* Have students write a sentence that explains how their rectangle or array is different from Kayla's.

LESSON 15

SESSION 3 Develop

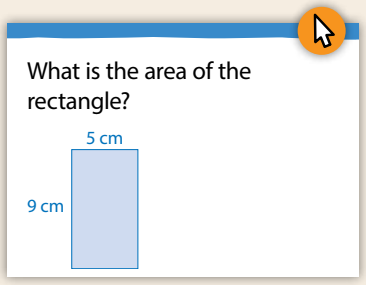
Purpose In this session students solve a problem that requires comparing the areas of a square room and a rectangular room. Students model the rooms either on paper or with manipulatives to find the areas. The purpose of this session is to help students develop strategies for solving word problems involving area.

Start

Connect to Prior Knowledge

Why Practice finding the area of a rectangle by multiplying its length and width.

How Have students find the area of a labeled 5 cm by 9 cm rectangle.



Solution
45 square centimeters

Develop Language

Why Practice using the terms *wide*, *width*, *long*, and *length*.

How Display the words *wide/width* and *long/length*. Ask: *How are these words the same? How are they different?* Provide the sentence frames:

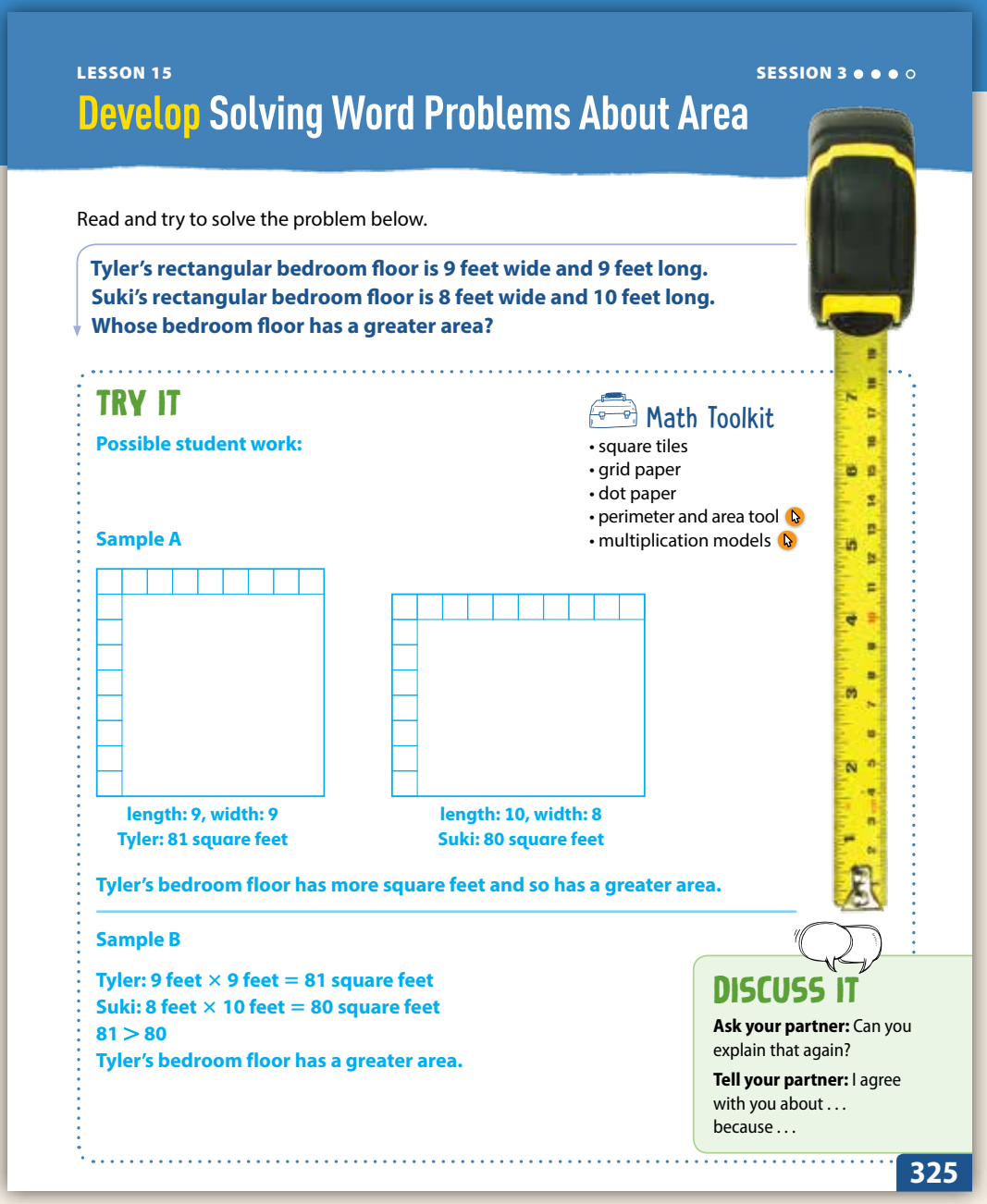
- *The bulletin board is _____ wide.*
- *The bulletin board has a width of _____.*
- *The bulletin board is _____ long.*
- *The bulletin board has a length of _____.*

TRY IT

Make Sense of the Problem

To support students in making sense of the problem, have them identify that they are being asked to compare the areas of two rectangular floors given the length and width of each.

Ask *What is the length and width of Tyler's bedroom floor? What is the length and width of Suki's bedroom floor? What question is the problem asking?*



DISCUSS IT

Support Partner Discussion

Encourage students to use the term *greater than* as they discuss their solutions.

Support as needed with questions such as:

- *Did you draw a picture of the information?*
- *According to your partner, who has the floor with the greater area? Do you agree or disagree?*

Common Misconception Look for students who struggle with finding the relevant information in the word problem without a labeled picture to refer to. Have students draw a rectangle to represent each bedroom floor. Then have them underline the dimensions of each floor in the problem and use those dimensions to label their rectangles.

Select and Sequence Student Solutions

One possible order for whole class discussion:

- drawings or models of rectangles divided into squares
- calculations that do not involve multiplication
- calculations that include the equation area = length × width

Support Whole Class Discussion

Compare and connect the different representations and have students identify how they are related.

Ask *How does each model use the length and width of the floor of each room? How is the area of the floor of each room found?*

Listen for The length and width of each floor are multiplied to find the area. For rectangles divided into squares, the number of squares along the sides corresponds to the length and width.

PICTURE IT & MODEL IT

If no student presented these models, connect them to the student models by pointing out the ways they each represent:

- the length and width of each floor
- the area of each floor

Ask *How are the length and width of Tyler's bedroom floor shown? How are the length and width of Suki's bedroom floor shown? How are the length and width used to find the area of the floor of each room?*

Listen for The dimensions of each floor are labeled in the drawings and listed in words under the headings *Tyler's Bedroom Floor* and *Suki's Bedroom Floor.* The length and width of each floor are multiplied to find the area.

For drawings of the bedrooms, prompt students to think about the shape of each bedroom floor.

- *Is the floor in Tyler's room a rectangle or a square? Is the floor in Suki's room a rectangle or a square?*
- *How do you know how to label the sides of each shape?*

For equations, prompt students to imagine dividing each room into 1-foot squares.

- *If you divide each room into squares that are 1 foot on each side, how many rows and columns of squares will you have?*
- *What operation can you use to find the total number of squares arranged in equal rows and columns?*

Explore different ways to understand solving word problems about area.

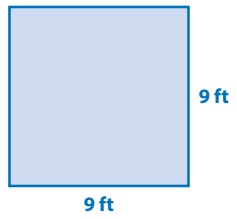
Tyler's rectangular bedroom floor is 9 feet wide and 9 feet long.
Suki's rectangular bedroom floor is 8 feet wide and 10 feet long.
Whose bedroom floor has a greater area?

PICTURE IT

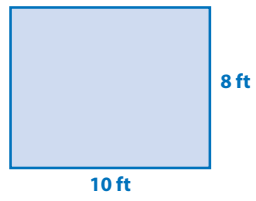
You can use models to help you multiply to find area.

The models below show the length and width of Tyler's and Suki's bedroom floors.

Tyler's Bedroom Floor



Suki's Bedroom Floor



MODEL IT

You can also use multiplication equations to find area.

Use words to describe the measurements of each bedroom floor.

Tyler's room:

The **length** of the floor is **9** feet.
The **width** of the floor is **9** feet.

Suki's room:

The **length** of the floor is **10** feet.
The **width** of the floor is **8** feet.

Multiply **length** and **width** to find the area of each floor.

Tyler's floor: Area = **9** × **9**

Suki's floor: Area = **10** × **8**

Deepen Understanding

Areas of Rectangles

SMP 8 Use repeated reasoning.

When discussing the models, look for a relationship between the dimensions.

Ask *How do the lengths, widths, and areas of the two floors compare?*

Listen for The length of Suki's floor is 1 foot greater and the width is 1 foot less. The area of Suki's floor is 1 square foot less than the area of Tyler's.

Ask *Suppose Tyler's floor was 7 feet by 7 feet and Suki's stays 1 foot greater in length and 1 foot less in width. How would the areas of the floors compare?*

Listen for Suki's floor would be 8 feet long and 6 feet wide, or 48 square feet. This is still 1 square foot less than that of Tyler's floor (49 square feet).

Generalize *Compare the areas of a square with side length 8 feet and a rectangle that is 9 feet by 7 feet. Describe a pattern.* The rectangle's area is 63 square feet, and the square's is 64 square feet. If you increase the length of a square by 1 unit and decrease the width by 1 unit, the area of the resulting rectangle will always be 1 square unit less than the area of the original square.

CONNECT IT

- Remind students that one thing that is alike about all the representations is the numbers.
- Explain that on this page, students they will use those numbers to write and solve equations for the areas of the two bedrooms.

Support Whole Class Discussion

1 – 3 Be sure students understand that these questions are asking them about the units used in the problem about the bedroom floors.

Ask *If you divide Tyler's floor into 9 rows of 9 squares and Suki's floor into 8 rows of 10 squares, how long is the side length of each square? What is the area of each square?*

Listen for When the floors are divided into squares, each square will have a side length of 1 foot and an area of 1 square foot.

Monitor and Confirm

4 – 6 Tell students that in these problems they will write equations that will help them compare the area of the two bedroom floors.

Check for understanding that:

- the area of Tyler's bedroom floor is 9 feet × 9 feet = 81 square feet
- the area of Suki's bedroom floor is 10 feet × 8 feet = 80 square feet
- Tyler's bedroom floor has the greater area because 81 is greater than 80

7 Look for the idea that when the side lengths of a rectangle are given in feet, the area calculated by multiplying those lengths is measured in square feet.

8 REFLECT Have all students focus on the strategies used to solve this problem. If time allows, have students share their preferences with a partner.

CONNECT IT

Now you will use the problem from the previous page to help you understand how to solve word problems about area.

1 What does the problem ask you to find?

the bedroom floor with the greater area

2 What units are used to measure the length and width of the floors? **feet**

3 What unit should you use to record the area of each floor? **square feet**

4 Complete the equation below to find the area of Tyler's bedroom floor.

length	×	width	=	area
9 feet	×	9 feet	=	81 square feet

The area of Tyler's bedroom floor is 81 square feet.

5 Complete the equation below to find the area of Suki's bedroom floor.

length	×	width	=	area
10 feet	×	8 feet	=	80 square feet

The area of Suki's bedroom floor is 80 square feet.

6 So, Tyler has the bedroom floor with the greater area.

7 Explain how you know that the areas of the bedroom floors must have the label "square feet."

Possible answer: The length and the width are given in feet, so the area is in square feet.

8 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 solving word problems about area? Explain.

Some students may say that the visual models help them decide how to multiply to find the area in word problems.

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Hands-On Activity

Use square tiles to model Tyler's and Suki's bedroom floors.

If . . . *students have trouble comparing the areas of the bedroom floors,*

Then . . . *use the activity below to have them model the two rooms and see the difference in areas.*

Materials For each pair: 81 unit tiles

- Have pairs use the tiles to model Tyler's bedroom floor. They should arrange the tiles in 9 rows of 9, forming a square.
- Explain that students are now going to rearrange the tiles to model Suki's bedroom floor. Ask: *How can we make Suki's floor 8 feet wide instead of 9 feet wide?* [remove 1 row] Have them remove one row and set the tiles aside. Ask: *How many tiles did you remove?* [9 tiles]
- Ask: *How can we make Suki's floor 10 feet long instead of 9 feet long?* [Add 1 column.] Have them use the tiles they set aside in the previous step to add another column. Ask: *How many tiles did you add?* [8 tiles]
- Ask: *Did it take more tiles to model Tyler's floor or Suki's floor?* [Tyler's floor] *Which floor has the greater area?* [Tyler's floor]

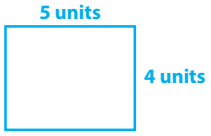
APPLY IT

Use what you just learned to solve these problems.

9 Fran found the area of a rectangle by multiplying 5 units and 4 units. Draw Fran's rectangle. Label the length and the width. What is the area of the rectangle? Show your work.

Possible student work:

5 units × 4 units = 20 square units



Solution **20 square units**

10 Kayla draws the rectangle shown. James draws a rectangle that has the same area as Kayla's rectangle, but it has different side lengths. What are possible side lengths for James's rectangle? Show your work.

Possible student work:

Kayla's length = 9 units, width = 2 units, so area is 9 × 2 = 18 square units.

6 × 3 = 18, so James's side lengths could be 6 units and 3 units.

Solution **Possible answer: side lengths of 6 units and 3 units**

11 Jan has a rectangular photo that is 7 inches long and 5 inches wide. How much space will this photo cover in Jan's photo album? Show your work.

Possible student work:
length × width = area
7 inches × 5 inches = 35 square inches

Solution **35 square inches**

APPLY IT

For all problems, encourage students to draw some kind of model to support their thinking. Allow some leeway in precision; the sides of rectangles do not need to be perpendicular and in exact proportion as long as their dimensions are labeled correctly.

9 See Student Worktext page for possible student work; Look for a rectangle with two adjacent sides labeled "5 units" and "4 units." The area is 20 square units.

10 See Student Worktext page for possible student work; James's rectangle could be 3 units by 6 units or 1 unit by 18 units.

Close: Exit Ticket

11 35 square inches;
7 inches × 5 inches = 35 square inches

Students' solutions should indicate understanding that:

- the length and width of a rectangle can be multiplied to find its area
- when the length and width of a rectangle are given in inches, the area is measured in square inches

Error Alert **If** students add the length and width, **then** have them draw and shade a 7-by-5 rectangle on grid paper. Discuss how each row inside the rectangle can be thought of as an equal group of squares and ask what operation students use with equal groups.

Solutions

1. 4 feet × 2 feet = 8 square feet
Basic

2. 3 feet × 5 feet = 15 square feet or
5 feet × 3 feet = 15 square feet
Medium

3. Vera's rug covers more area; 4 feet × 4 feet = 16 square feet, and 16 is greater than 15.
Challenge

Name: _____ LESSON 15 SESSION 3

Practice Solving Word Problems About Area

Study the Example showing how to solve a word problem about area.
Then solve problems 1–6.

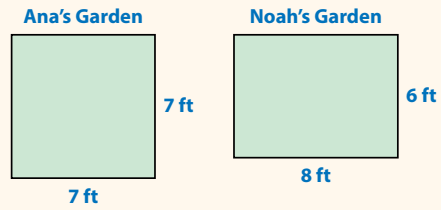
EXAMPLE

Ana's garden is 7 feet long and 7 feet wide. Noah's garden is 8 feet long and 6 feet wide. Which garden has a lesser area?

You can draw a model. Then multiply length and width to find the area of each garden.

Ana: 7 × 7 = 49 square feet
Noah: 8 × 6 = 48 square feet

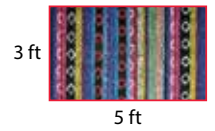
Noah's garden has a lesser area.



1. Roberto's desk is in the shape of a rectangle that is 4 feet long and 2 feet wide. What is the area of Roberto's desktop? Fill in the blanks.

length	×	width	=	area
4 feet	×	2 feet	=	8 square feet

2. Show how to find the area of this rug.
5 feet × 3 feet = 15 square feet



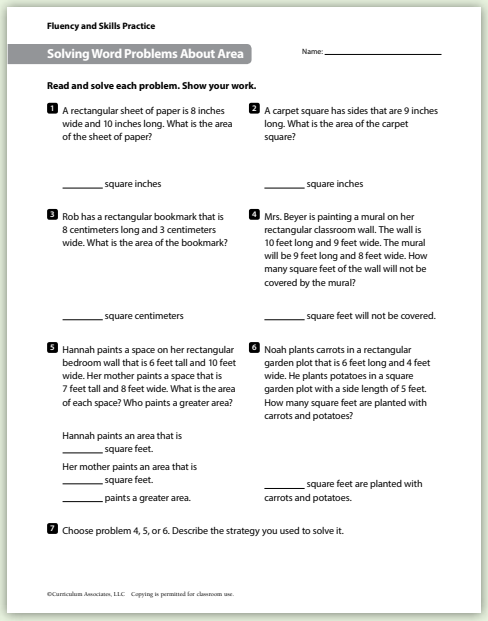
3. Vera buys a rug like the one in problem 2. Vera's rug is square. It has sides that are 4 feet long. Does Vera's rug cover more or less area than the rug in problem 2? Explain.
Possible answer: Vera's rug has an area of 4 × 4 or 16 square feet. Since 16 > 15, her rug covers more area than the one in problem 2.

Fluency & Skills Practice

Teacher Toolbox

Assign *Solving Word Problems About Area*

In this activity students practice solving word problems about area. Students may experience similar real-world situations that involve calculating areas, comparing areas, and adding areas of rectangles. For example, students may want to compare floor areas covered by dog crates or bedroom closets, or wall space covered by murals, to determine which option is the smallest or the largest.



Fluency and Skills Practice

Solving Word Problems About Area

Name: _____

Read and solve each problem. Show your work.

1. A rectangular sheet of paper is 8 inches wide and 10 inches long. What is the area of the sheet of paper?

_____ square inches

2. A carpet square has sides that are 9 inches long. What is the area of the carpet square?

_____ square inches

3. Rob has a rectangular bookmark that is 8 centimeters long and 3 centimeters wide. What is the area of the bookmark?

_____ square centimeters

4. Mrs. Beyer is painting a mural on her rectangular classroom wall. The wall is 10 feet long and 9 feet wide. The mural will be 9 feet long and 8 feet wide. How many square feet of the wall will not be covered by the mural?

_____ square feet will not be covered.

5. Hannah paints a space on her rectangular bedroom wall that is 6 feet tall and 10 feet wide. Her mother paints a space that is 7 feet tall and 8 feet wide. What is the area of each space? Who paints a greater area?

Hannah paints an area that is _____ square feet.
Her mother paints an area that is _____ square feet.
_____ paints a greater area.

6. Noah plants carrots in a rectangular garden plot that is 6 feet long and 4 feet wide. He plants potatoes in a square garden plot with a side length of 5 feet. How many square feet are planted with carrots and potatoes?

_____ square feet are planted with carrots and potatoes.

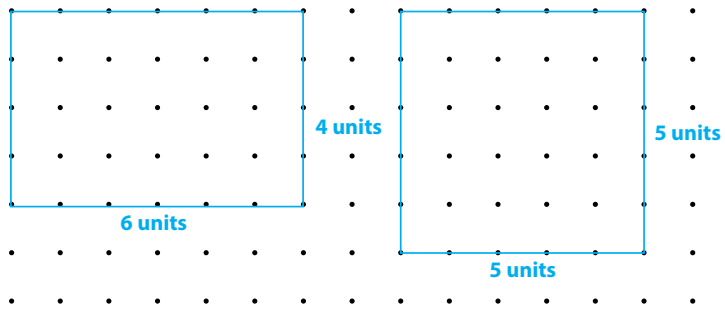
7. Choose problem 4, 5, or 6. Describe the strategy you used to solve it.

4 See Student Worktext page for possible student work; The area of Aiden's rectangle is 24 square units, and the area of Bella's square is 25 square units.
Medium

5 Check students' work for areas less than 9 square feet. Some possible areas: 2 square units (for a 1-by-2 rectangle), 3 square units (for a 1-by-3 rectangle), 4 square units (for a 2-by-2 square or 1-by-4 rectangle), and 6 square units (for a 2-by-3 rectangle).
Medium

6 60 square feet will not be covered by the rug. The area of the floor is 10 feet × 10 feet = 100 square feet, and the area of the rug is 8 feet × 5 feet = 40 square feet.
100 square feet − 40 square feet = 60 square feet
Challenge

4 Aiden prints a rectangular photo that is 4 units wide and 6 units long. Bella prints a square photo. It is 5 units on each side. Draw the photos and label the side lengths. Write the area for each.



Area = 24 square units

Area = 25 square units

5 Draw and label a rectangle that has a lesser area than the area of a square that is 3 units on each side. Write the area of the rectangle.

Possible answer: 3 × 2 = 6
Area = 6 square units

6 Ron buys a rectangular rug for his room. The rug is 8 feet long and 5 feet wide. The floor in his room is shaped like a square that is 10 feet long and 10 feet wide. How much of the floor in Ron's room will NOT be covered by the rug? Show your work.

Possible work:
Area of rug: 8 feet × 5 feet = 40 square feet
Area of floor: 10 feet × 10 feet = 100 square feet
100 − 40 = 60

Solution 60 square feet of Ron's floor will not be covered by the rug.

ELL English Language Learners: Differentiated Instruction

Prepare for Session 4
Use with *Apply It*.

Levels 1–3

Listening/Speaking Read ***Apply It*** problem 6 aloud. Ask: *What do you know about the patio?* [Its area is 24 square yards.] *What measurements will you multiply to find the area of a rectangle?* [the length and width] Have students form pairs and give pairs 24 tiles. Say: *Use all the tiles and make a rectangle that can represent the patio. Write an equation to describe the patio.* Provide sentence frames:

- *The length is _____ yards.*
- *The width is _____ yards.*
- *_____ yards × _____ yards = 24 square yards.*

Have partners explain their rectangle. Have students check to see if their patio matches an answer choice.

Levels 2–4

Listening/Speaking Read ***Apply It*** problem 6 aloud. Ask: *What do you know about the patio?* [Its area is 24 square yards.] *What measurements will you multiply to find the area of a rectangle?* [the length and width] Have students form pairs and give pairs 24 tiles. Say: *Use all the tiles and make a rectangle that can represent the patio. Write an equation to describe the patio.* Call on pairs to explain their rectangle using the following sentence frames:

- *The length of my rectangle is _____ and the width is _____.*
- *I multiply _____ yards by _____ yards to find the area.*
- *The area is _____.*

Levels 3–5

Speaking/Writing Have students form pairs and read and discuss ***Apply It*** problem 6. Have partners discuss what they know about the patio and what they need to do to find the area. Give partners 24 tiles. Say: *Use all the tiles and make a rectangle that can represent the patio. Write an equation to describe the patio.* Provide students with the word bank: *length*, *width*, *yards*, and *square yards*. Say: *Use these words and write two or three sentences to explain your patio.* Select pairs to read their sentences.

LESSON 15

SESSION 4 Refine

Purpose In this session students solve word problems involving finding area of rectangles and then discuss and confirm their answers with a partner.

Before students begin work, use their responses to the *Check for Understanding* to determine those who will benefit from additional support.

As students complete the Example and problems 1–3, observe and monitor their reasoning to identify groupings for differentiated instruction.

Start

Check for Understanding

Why Confirm understanding of multiplying to find area.

How Have students find the area of the lawn in the word problem using any strategy they want.

The rectangular front lawn of a house is 10 meters long and 4 meters wide.

What is the area of the lawn?

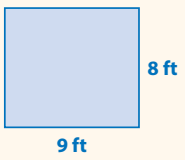
Solution
40 square meters

Refine Multiplying to Find Area

Complete the Example below. Then solve problems 1–8.

EXAMPLE

Ms. Cruz is putting carpet in the living room. The length and width of the room is shown below. How many square feet of carpet does Ms. Cruz need to cover the whole floor?



Look at how you could show your work using multiplication.

length × width = area

9 feet × 8 feet = 72 square feet

Solution 72 square feet

The student multiplies the length and the width to find the area.

PAIR/SHARE
How else could you solve this problem?

APPLY IT

1 Marcia finds the area of a square. The length of one side of the square is 5 centimeters. What is the area of the square? Show your work.

Possible student work:
5 × 5 = 25

Solution 25 square centimeters

The sides of a square are all the same length.

PAIR/SHARE
How did you and your partner solve this problem?

Error Alert

If the error is . . .	Students may . . .	To support understanding . . .
14 square meters	have added the length and width.	Review the meaning of multiplication as finding all the items in a set of equal groups. Show 10 × 4 as 10 rows of 4 squares each for a total of 40 squares.
28 square meters	have added the 4 sides.	Have students draw a rectangle that is 10 squares by 4 squares on grid paper, shade the area, and count the squares to find the area. Have students compare this to the answer they get when they add the lengths of all sides.
40 meters	have used the wrong unit.	Have students draw two squares, one with length 1 inch and the other with length 1 centimeter. Discuss the area of each square as the units "square inch" and "square centimeter," respectively.

2 Ms. Clark is building a rectangular patio that is 4 yards long and 3 yards wide. She has enough bricks to cover an area of 14 square yards. Does Ms. Clark have enough bricks to build the patio? Explain. Show your work.

Possible student work:

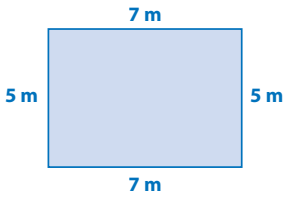
$4 \times 3 = 12$
$12 < 14$

Solution **The area of the patio is 12 square yards. Ms. Clark has enough bricks to cover the patio.**

I think there are at least two different steps you need to do to solve this problem.

PAIR/SHARE
How could you use a picture to solve this problem?

3 What is the area of the rectangle shown below?



Ⓐ 35 square meters
Ⓑ 24 square meters
Ⓒ 12 square meters
Ⓓ 7 square meters

To find the area of the rectangle, do you add or multiply?

Bobby chose Ⓑ as the correct answer. How did he get that answer?

Possible answer: Even though Bobby used the correct area unit, he added the side lengths. He should have multiplied the length and the width.

PAIR/SHARE
Do you need the measure of each side of the rectangle labeled to solve the problem? Why or why not?

EXAMPLE

72 square feet; Multiplying the length and width is shown as one way to solve the problem. Students may also divide the rectangle into square units and count the number of squares.

Look for The length and width are multiplied to find the area.

APPLY IT

1 25 square centimeters; Students could also draw a square and divide it into 5 rows and 5 columns.
DOK 2

Look for Students use 5 centimeters for both the length and width of the square.

2 Yes; The area of the patio is 4 yards × 3 yards, or 12 square yards. Since 12 is less than 14, there are enough bricks for the patio. Students may also draw a rectangle and divide it into 4 rows and 3 columns or 3 rows and 4 columns.
DOK 3

Look for Students find the area of the rectangle first and then compare it with 14 to check that Ms. Clark has enough bricks to cover the area.

3 **A**; Students could solve the problem by multiplying the length (7 meters) by the width (5 meters).

Explain why the other two answer choices are not correct:

C is not correct because even though the correct area unit is used, 12 is the sum of the length and width.

D is not correct because even though the correct area unit is used, 7 is the length of the rectangle.
DOK 3

4 **B**; Multiply 7 feet by 6 feet.
DOK 2

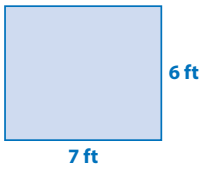
Error Alert Students may choose C because 26 feet is the sum of all side lengths of the rectangle, or they may choose D because 13 feet is the sum of the length and width.

5 **C**; A rectangle with length 6 feet and width 2 feet, because $6 \times 2 = 12$.
DOK 1

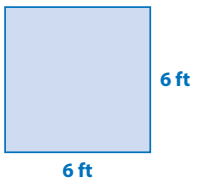
6 **D**; 6 yards $\times$ 4 yards $=$ 24 square yards
E; 8 yards $\times$ 3 yards $=$ 24 square yards
DOK 1

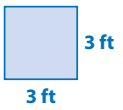
4 Mr. Frank is putting tile on a bathroom wall above the tub. The model shows the length and width of the wall. How many square feet of tile does he need to cover the wall?

Ⓐ 49 square feet
Ⓑ 42 square feet
Ⓒ 26 square feet
Ⓓ 13 square feet

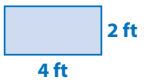


5 Which shape below has an area of 12 square feet?

Ⓐ 

Ⓑ 

Ⓒ 

Ⓓ 

6 The area of a rectangular patio is 24 square yards. Which measurements could be the length and width of the patio?

Ⓐ length: 8 yards, width: 4 yards
Ⓑ length: 5 yards, width: 5 yards
Ⓒ length: 6 yards, width: 3 yards
Ⓓ length: 6 yards, width: 4 yards
Ⓔ length: 8 yards, width: 3 yards

Differentiated Instruction

RETEACH

Hands-On Activity
Use rectangles to explore multiples of 7.

Students struggling with the different applications of multiplication

Will benefit from additional work with using area models to multiply.

Materials For each student: Activity Sheet *1-Centimeter Grid Paper*

- Direct students to draw and shade a rectangle that is 1 unit wide and 7 units long on the grid paper. Ask them how many square units are shaded. [7] Write "$1 \times 7 = 7$" to represent this. Instruct students to expand their rectangle by shading 1 more row of 7. Ask students how many squares are shaded now. [14] Write "$2 \times 7 = 14$" to represent this. Repeat for $3 \times 7 = 21$, $4 \times 7 = 28$, and $5 \times 7 = 35$.
- Ask students to explain what it means to multiply 7 by 6. [Add six 7s; find the area of a rectangle with length 7 units and width 6 units.] Have students choose a method and find the product of 6×7. [42]
- Repeat the activity with multiplication facts for 8.

EXTEND

Challenge Activity
Decompose rectangles and add to find area.

Students who have achieved proficiency

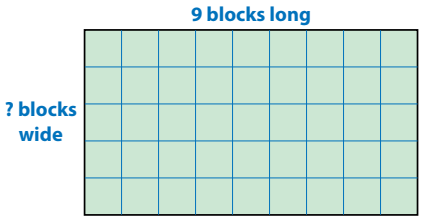
Will benefit from deepening understanding of area.

Materials For each student: Activity Sheet *1-Centimeter Grid Paper*

- Have students draw an 8×6 rectangle and then draw a line to separate it into two equal sections and write an equation adding the areas. [$24 + 24 = 48$] Have them confirm the total area of the rectangle is 48 square units.
- Challenge students to find 9×8 by separating a 9×8 rectangle into two sections with different areas and adding them. [For example: $40 + 32 = 72$] Have students share answers. [Other possible area addend pairs: 8 and 64, 16 and 56, 24 and 48, 9 and 63, 18 and 54, 27 and 45]

7 $9 \times 5 = 45$ or $5 \times 9 = 45$; Multiply 5 blocks by 9 blocks to get an area of 45 square blocks.
DOK 2

7 Rita is making a quilt. It is made with 45 square blocks of fabric and is 9 blocks long.



Complete the equation below to show how many blocks wide the quilt is. Use numbers from the ones listed below.

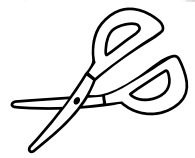
4	5	6	9	45

5 × 9 = 45

8 MATH JOURNAL

Draw a rectangle. Label its length and width. Then explain how to find the area of your rectangle. Use a multiplication equation in your explanation.

Answers will vary. Check that each student's rectangle and solution match. Check that the multiplication equation accurately represents the problem.



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

REINFORCE

Problems 4–8

Use multiplication to find area.

All students will benefit from additional work with using multiplication to find areas by solving problems in a variety of formats.

- Have students work on their own or with a partner to solve the problems.
- Encourage students to show their work.

PERSONALIZE

i-Ready

Provide students with opportunities to work on their personalized instruction path with *i-Ready* Online Instruction to:

- fill prerequisite gaps
- build up grade-level skills

Close: Exit Ticket

8 MATH JOURNAL

Student responses should indicate understanding of multiplying length by width to find area and using square units to represent area. The multiplication equation should be an accurate representation of the rectangle drawn.

Error Alert **If** students do not label the area with square units, **then** discuss the difference between length and area. Draw a square unit and use it to compare units with square units. Ask students which term they should use to measure area.

SELF CHECK Have students consider whether they feel they are ready to check off any new skills on the Unit 3 Opener.