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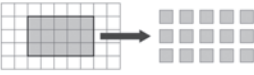
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LESSON **31** Finding Area MGSE3.MD.7a, 7b, 7c

1 Introduction

A **plane figure** is a flat shape. **Area** is a measure of the space inside the figure. In Lesson 30, you learned to measure area by covering the plane figure with unit squares. For rectangles and squares, you can use another method as well. You can multiply the length by the width.

What is the area of the rectangle?



Count the unit squares that cover the rectangle. There are 15 in all. So the area is 15 square units.

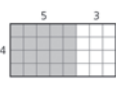
Now look again at the unit squares. There are 3 rows of 5 unit squares. Multiply:

$$3 \times 5 = 15$$

The area is 15 square units. Both methods give the same result.

Most of the time, you will not see the square units in a figure. You will only know the measurements. The **distributive property** can help you find the area.

Find the area of the large rectangle.



The length of the rectangle in units is $5 + 3$. The width of the rectangle is 4 units. In order to find the area, you multiply the length by the width.

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Objective

To find the area of rectangles by using the area formula and the distributive property

1 Introduction

Review finding the area of a rectangle by multiplying the length by the width. Students should recognize that a rectangle can be tiled in equal rows, and this can be represented as r rows of n squares. Guide students to see that the square units are not always shown, but the linear measurements of the length and width provide these numbers.

Review the distributive property with students. Then use the given example to discuss how a rectangle can be divided into smaller rectangles. Apply the distributive property to find the area of the rectangle.

Think About It

Students should recognize that there many situations in which area might need to be known, such as the area of a window in order to cover it with a curtain or the area of a garden bed in order to buy enough mulch to cover it.

$4 \times (5 + 3) =$
 $(4 \times 5) + (4 \times 3) = 20 + 12$
 $= 32$ square units

The area is the sum of the areas of the two rectangles (shaded and not shaded).

Think About It

What is something someone might need to know the area of in real life? Why?

2 Focused Instruction

You can use square tiles to help you understand area. Work with a partner.

- ▶ Cut a piece of paper so that you have a rectangle that measures 6 inches long and 5 inches wide.
 - What is the length of the rectangle? 6 inches
 - Label the length on your rectangle.
 - What is the width of the rectangle? 5 inches
 - Label the width on your rectangle.
 - Use your square tiles. Cover your rectangle with unit squares.
 - How many unit squares can you use to cover the rectangle? 30
 - What is the area of the rectangle? 30 square inches
 - How else can you find the area without using unit squares?
Multiply length times width.
 - Use the other method to find the area. Show your work.
 $6 \times 5 = 30$
 - Did you find the same area using both methods? yes

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Georgia Standards of Excellence

MGSE3.MD.7 Relate area to the operations of multiplication and addition.

- 7a.** 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.
- 7b.** Multiply the side lengths to find areas of rectangles with whole-number side lengths in the context of solving real world and mathematical problems, and represent whole-number products as rectangular areas in mathematical reasoning.
- 7c.** Use tiling to show in a concrete case that the area of a rectangle with whole-number side lengths a and $b + c$ is the sum of $a \times b$ and $a \times c$. Use area models to represent the distributive property in mathematical reasoning.

2 Focused Instruction

Provide students with construction paper, rulers, scissors, and 1-inch square tiles. Students work in pairs to find the area of a 6- \times -5-inch rectangle by two methods. The questions guide students to find area by tiling with 1-inch unit squares and then by multiplying the length by the width.

Next, students draw a picture to help understand an area problem. They overlay the rectangle with a grid and determine area by counting square units and by multiplying.

Conclude the Focused Instruction section by having students determine the area of three rectangles, using only the given measurements.

2 Focused Instruction Lesson 31

Sometimes it helps to draw a picture. Use a picture to help you solve this problem.

► Samson is painting the roof of a birdhouse. The roof is 8 inches long and 7 inches wide. He has enough craft paint left to cover 50 square inches.

On a separate piece of paper, draw the roof of the birdhouse. Label the length and width.

Draw grid lines on the roof to divide it into equal squares. Make the side of each square 1 inch.

How many inches long is the roof? 8

How many inches wide is the roof? 7

How many squares did you draw on the roof? 56

What operation can you use to find the area? multiplication

Find the area using this operation.

$8 \times 7 = 56$ square inches

Did you get the same area as when you counted squares? yes

Use what you know about area to answer these questions.

- Keaton's poster is 15 inches long and 10 inches wide. How many square-inch tiles could he cover it with? 150
- Mariah drew a rectangle on the playground with chalk. It is 5 feet long and 4 feet wide. What is the area of the rectangle? 20 square feet
- A rectangle is 2 meters wide and 5 + 3 meters long. What is the area of the rectangle? 16 square meters

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3 Guided Practice

Students should complete the Guided Practice section on their own. Offer assistance as needed, pointing out the reminder and hint boxes along the right side of the page.

Vocabulary

area: the amount of space inside a figure, measured in square units

distributive property: allows a number to be multiplied by a sum or each addend to be multiplied separately and the products added: $a(b + c) = ab + ac$

plane figure: a flat shape


Connections to Standards for Mathematical Practice

- Model with mathematics.
- Use appropriate tools strategically.
- Look for and make use of structure.

3 Guided Practice Lesson 31

Solve the following problems.

- Fill in the equation to show the area of the rectangle below.



Use the distributive property to solve.

Answer 6 \times (5 + 2) = 42 square units

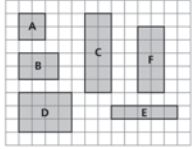
- Alex has a rectangular office that is 7 feet wide and 9 feet long. He wants to cover the floor with carpet. What is the area of Alex's office floor? Show your work.

$7 \times 9 = 63$

You can draw a picture to help you solve a problem.

Answer 63 square feet

- Which two rectangles have the same area?



Figures can have the same area but not look the same.

Answer C and D


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4 Independent Practice Lesson 31


Solve the following problems.

1 Which expression can you use to find the area of the rectangle shown? **DOK 2**
MGSE3.MD.7b







A 8×8
B $8 + 2$
C 8×2
D $8 + 8 + 2 + 2$

2 Draw a unit grid to find the area of the rectangle at the right. How does the area you found compare with the area found by multiplying? Explain. **DOK 2**
MGSE3.MD.7a



The area is the same either way. I counted the squares I drew. There were 24. I multiplied $3 \times 8 = 24$. The area is 24 square units.

3 Which area model shows that $5 \times (2 + 1) = (5 \times 2) + (5 \times 1)$ is true? **DOK 2**
MGSE3.MD.7c

A  C 
B  D 

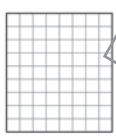
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4 Independent Practice Answer Rationales

- To find the area of a rectangle, multiply the length (8 inches) by the width (2 inches). The only choice that shows this is choice C. Choice A shows the length times the length. Choice B shows the sum of the length and width. Choice D shows the perimeter of the figure.
- The area is the same whether found through tiling or multiplication. In both cases, the area of this rectangle is 24 square units. A unit grid will show 3 rows of 8 squares: $8 + 8 + 8 = 3 \times 8 = 24$. Multiplying length and width is the same: $3 \times 8 = 24$.
- The model described by the equation should show a figure made of two rectangles. One rectangle measures 2 units by 5 units and the other measures 1 unit by 5 units. The correct answer is choice D.
- The tabletop is made up of 9 rows of 8 squares, so it has an area of $9 \times 8 = 72$ square centimeters.
- The area of one rectangle is 8×3 . The area of the other rectangle is 8×4 . Add the two areas to find the total area. The expression in choice A shows this. Find the area by finding the total length of the figure ($3 + 4$) and multiplying it by the width: $8 \times (3 + 4)$. The expression in choice D shows this. Choices B and F are incorrect because the operations were reversed. Choice C is incorrect because it shows all multiplication. Choice E is incorrect because it shows all addition. Choices A and D are correct.

4 Independent Practice Lesson 31

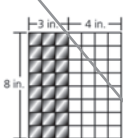
4 Archie wants to cover the top of his model table with colored paper. The top of the table is shown. **DOK 1**
MGSE3.MD.7a, 7b



How many square centimeters of paper does Archie need if each square equals 1 square centimeter?

Answer 72 square centimeters

5 Ronit is covering a table with tiles to make the design shown. **DOK 2**
MGSE3.MD.7c



Which expressions could be used to find the area, in square inches? Select the two correct answers.

A $(8 \times 3) + (8 \times 4)$
B $(8 + 3) \times (8 + 4)$
C $3 \times 4 \times 8$
D $8 \times (3 + 4)$
E $3 + 4 + 8$
F $8 + (3 \times 4)$

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- 6 The number of tiles is equal to the area because the tiles are the square unit. Multiply to find the area: $6 \times 9 = 54$ square feet, so 54 tiles are needed.
- 7 The student should name a combination of length and width that would result in the given area. The area is 42 square units. So possible dimensions are 6 and 7, 21 and 2, 14 and 3, or 42 and 1.
- 8 **PART A** Multiply the height of the wall and the length of the wall to get the area: $9 \times 18 = 162$ square feet.

PART B The area of the wallpaper on one roll is $3 \times 24 = 72$ square feet. Students should find how many rolls of 72 square feet are needed to cover 162 square feet. They should recognize that they need at least 162 square feet, but that they might have more because the rolls only come as whole rolls. Since $72 + 72 = 144$, which is less than 162, two rolls are not enough. Since $72 + 72 + 72 = 216$, three rolls will be enough to cover the wall.

Lesson 31

4 Independent Practice

6 Celia is covering her kitchen floor with tiles that are each 1 square foot. The floor is in the shape of a rectangle that is 6 feet wide and 9 feet long. How many tiles does she need to cover the entire kitchen floor? **DOK 2**
MGSE3.MD.7a, 7b

Answer 54 tiles

7 Sally built a puzzle using 42 square units. What are possible dimensions of the puzzle? **DOK 2**
MGSE3.MD.7b

Answer 6 × 7, 21 × 2, 14 × 3, 42 × 1

8 Alyssa wants to wallpaper one wall of her living room. The wall is 9 feet high and 18 feet long. **DOK 3**
MGSE3.MD.7b

Part A How many square feet of wallpaper will Alyssa need to cover the wall? Show your work.

$9 \times 18 = 162$

Answer 162 square feet

Part B The wallpaper Alyssa has chosen comes in rolls that are 3 feet wide and 24 feet long. How many rolls of wallpaper will Alyssa need to cover the wall? Explain.

She needs 3 rolls. One roll has an area of $3 \times 24 = 72$ square feet. She needs to cover 162 square feet. Two rolls will cover $72 + 72 = 144$ square feet, and three rolls will cover $144 + 72 = 216$ square feet. She needs more than 2 rolls, so she must buy 3 rolls.

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Extension Activity

Working with sidewalk chalk on a sidewalk or playground surface, have students work in small groups to accurately draw rectangles with side lengths that are whole number measurements. Mix up measurement units by having some students use rulers, some use meter sticks and some use yardsticks. Have the groups rotate around to each rectangle, measuring the sides and finding the area.