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LESSON 30 Understanding Area

CCLS: 3.MD.5.a, b; 6

1 Introduction

A **plane figure** is a flat surface. The size of the space inside the plane figure is its **area**. One way to measure area is to count the number of square units that cover a figure. A **square unit** is a square with a side of 1 unit. As long as the square units do not have gaps between them or overlap, the number of square units is the area of the figure.

Area is always measured in square units.

Look at the figure in red on the grid below.

The red figure is made up of 6 square units. Its area is 6 square units.

A unit can be any measurement used for length. A square unit may stand for a square inch, square foot, or another square unit.

What is the area of the figure in red?

Look at the key on the right. It shows that 1 square unit is equal to 1 square centimeter. The red figure is made up of 12 square units. So, its area is 12 square centimeters.

Think About It

Why might it be important to measure the area of something? What might area help you understand?

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Objective

To find the area of plane figures by counting unit squares

1 Introduction

Review area as the amount of space inside a plane figure, as measured in square units. Students should recognize that a square unit is a square that measures 1 unit on each side, and that unit can be any unit of length, such as a centimeter or inch. Guide students to see that the area of a figure is the number of square units that cover the figure when the units are placed adjacent to each other without overlapping or leaving gaps.

Think About It

Students should recognize that area is a necessary measurement when they want to cover something, such as a floor with carpet or a wall with paint. Knowing area would tell them how much carpet or paint to buy.

2 Focused Instruction Lesson 30

When figures are drawn on grids, you can see the square units inside. Always look at the key to see what each square unit shows.

Two students are each asked to draw a figure with an area of 8 square inches. Which student, if either, is correct?

What is the area of each square unit? 1 square inch

How can you find the area of each figure?
Count the square units.

How many squares cover the figure student A made? 11

What is the area of student A's figure? 11 square inches

How many squares cover the figure student B made? 7

What is the area of student B's figure? 7 square inches

Did either student make a figure with an area of 8 square inches? no

How can student A correct the figure to make it have the correct area?
Take away 3 squares

How can student B correct the figure to make it have the correct area?
Add 1 square

Count the squares inside the figures.

Is the area greater than 8 square inches or less?

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Common Core Learning Standards

3.MD.5 Recognize area as an attribute of plane figures and understand concepts of area measurement.

- A square with side length 1 unit, called "a unit square," is said to have "one square unit" of area, and can be used to measure area.
- 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.

3.MD.6 Measure areas by counting unit squares (square cm, square m, square in., square ft, and improvised units).

Vocabulary

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

plane figure: a flat shape

square unit: a unit of measure for area that is 1 unit long and 1 unit wide, such as square inches, square centimeters, or square meters

2 Focused Instruction

Students use figures drawn on grids to determine and compare the areas of two plane figures. The questions help students determine the area in square units of each figure, neither of which is 8 square units. Students then suggest changes to correct the figures.


Next, students use a grid to draw a figure of specified area. They should understand that the figure may have any shape as long as the squares are adjacent.

Conclude the Focused Instruction section by having students answer two questions about the area of a given rectangle.

2 Focused Instruction Lesson 30

Use a grid to draw a figure with a certain area.

► Draw a figure with an area of 15 square units.



Figures on grid will vary but should have an area of 15 square units.

What is the area of each square on the grid? 1 square unit


How can you show a figure with an area of 15 square units?
Count 15 squares next to each other. Draw a line around them.

Can the squares in the figure overlap? no

Can you leave spaces between the squares in the figure? no

Draw a figure with an area of 15 square units.

Use what you know about area to answer these questions about the figure below.



1 What is the area of each square unit? 1 square foot

2 What is the area of the rectangle? 10 square feet

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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.

3 Guided Practice Lesson 30

Solve the following problems.


1 On the grid below, draw a figure that has an area of 40 square units.



Figures will vary but should have an area of 40 square units.

Remember that unit squares cannot have gaps or overlap.

2 What is the area of the figure?




■ = 1 square unit

Count the number of unit squares that make up the figure.

Answer 13 square units

3 What is the area of the figure?



■ = 1 square centimeter

How many rows of squares are there? How many squares are in each row?

Answer 30 square centimeters

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Connections to Standards for Mathematical Practice

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

4 Independent Practice

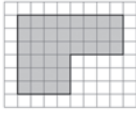
Lesson 30

Solve the following problems.

- 1 Pablo is measuring the area of a plane figure. He is using a unit square with a side length of 1 yard. What is the area of 1 square unit? **DOK 1**
3.MD.5.a

Answer 1 square yard

- 2 What is the area of the shaded figure?



- DOK 2**
3.MD.5.b

- A 12 square units
B 24 square units
C 36 square units
D 48 square units

- 3 What is the area of the figure?



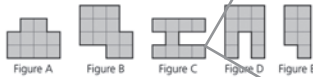
- DOK 2**
3.MD.5.b

Answer 19 square units

4 Independent Practice

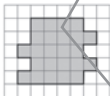
Lesson 30

- 4 Each square in each shape measures 1 square centimeter. Put each shape in the correct part of the table by matching its area. **DOK 3**
3.MD.6



Area Is Smaller Than 10 Square Centimeters	Area Is 10 Square Centimeters	Area Is Larger Than 10 Square Centimeters
C, E	A, D	B

- 5 Each square unit on the grid has a side of 1 meter.

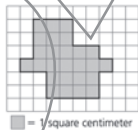


- DOK 2**
3.MD.6

What is the area of the shaded figure?

- A 20 square meters
B 22 square meters
C 24 square meters
D 26 square meters

- 6 Look at the figure on the grid at the right. What is the area of this figure?



- DOK 2**
3.MD.6

Answer 26 square centimeters

4 Independent Practice Answer Rationales

- The student should recognize that the side length of a unit square names the square unit. So a unit square with a side length of 1 yard is 1 square yard.
- Choices A and B only give the area of one part of the figure. Choice D gives the area of a rectangle that is 8 units by 6 units, which are the longest sides of the given figure. Choice C is the correct area. The figure is made up of two rectangles with areas of 12 and 24 square units. So the total area is $12 + 24 = 36$ square units.
- Count the red squares that make up the figure to find its area. The area of the figure is 19 square units.
- Find the area of each figure by counting the squares. The area of Figure A is 10 square centimeters, the area of Figure B is 12 square centimeters, and the area of Figure C is 9 square centimeters. The area of Figure D is 10 square centimeters, and the area of Figure E is 7 square centimeters. So Figures C and E have areas less than 10 square centimeters. Figures A and D have areas equal to 10 square centimeters. Figure B has an area greater than 10 square centimeters.
- Choice A gives the area of the rectangular part of the figure without the additional square units. Choice B adds on the area of two of the additional square units. Choice D adds six additional square units instead of four. Choice C is correct. This figure is a 4-by-5 meter rectangle with 4 additional square meters added. The area is 24 square meters.
- The figure is made up of 26 square units. The key shows that each square unit is 1 square centimeter. So the area is 26 square centimeters.

- 7 The student should recognize that the situation describes finding the area. Each photograph represents 1 square foot. So the area of the wall is 50 square feet because the photographer covered it with 50 photographs.
- 8 The student must recognize that area can be measured with unit squares only when they are placed so there are no gaps or overlaps. Tiana left gaps when she covered the figure with square units. So she did not correctly find the area.


Lesson 30

4 Independent Practice

7 A photographer made a display of photographs. She covered a wall with 50 square photographs. The entire wall was covered without gaps or overlaps. Each photograph is 1 foot long on each side. What is the area of the wall? Explain how you know. **DOK 3**
3.MD.6

The wall is 50 square feet. It is covered completely by 50 squares that are each 1 square foot.

8 Tiana measured the area of a piece of paper shaped like a plane figure as shown. She placed squares units on the paper. Tiana found the area to be 6 square units. **DOK 2**
3.MD.5.b



□ = 1 square unit

What error did Tiana make?

Tiana left gaps between the unit squares. She can count unit squares only if there are no gaps or overlaps.

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Extension Activity

Divide the class into two groups. Have each group cut unit squares out of paper. One group should make one-foot unit squares and the other should make one-inch unit squares. Tape off a rectangle on the classroom floor. The dimensions of the rectangle should be small enough that it can be measured easily in both square feet and square inches, for example, two feet long and three feet wide. Have each group find the area by tiling the rectangle using their unit squares. Discuss the difference in measurement. Have the groups try to tile it using both types of unit squares and discuss how area is always given in one measurement unit.