

8.3

Area of Squares and Rectangles

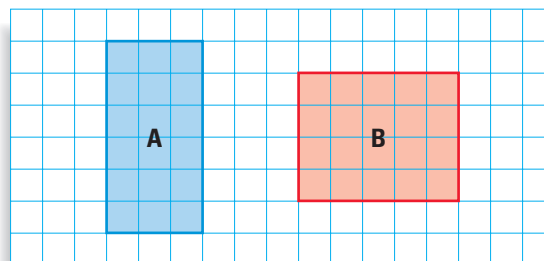
Goal

Find the area of squares and rectangles.

Key Words

- area
- square p. 325
- rectangle p. 325

Can you tell which of the rectangles below covers more surface?



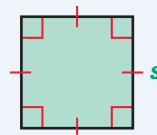
Rectangle A is made up of 18 squares while rectangle B is made up of 20 squares. So, rectangle B covers more *area*. The amount of surface covered by a figure is its **area**.

Area is measured in square units such as square inches (in.²) and square meters (m²).

AREA OF A SQUARE

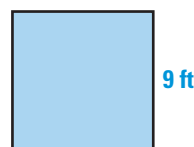
Words Area = (side)²

Symbols $A = s^2$



EXAMPLE 1 Find the Area of a Square

Find the area of the square.



Solution

Use the formula for the area of a square and substitute 9 for s .

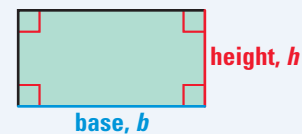
$$\begin{aligned}
 A &= s^2 && \text{Formula for the area of a square} \\
 &= 9^2 && \text{Substitute 9 for } s. \\
 &= 81 && \text{Simplify.}
 \end{aligned}$$

ANSWER ▶ The area of the square is 81 square feet.

AREA OF A RECTANGLE

Words Area = (base)(height)

Symbols $A = bh$



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MORE EXAMPLES

More examples at
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EXAMPLE 2 Find the Area of a Rectangle

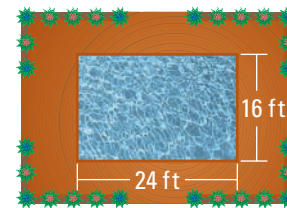
Find the area of the rectangular pool.

Solution

Use the formula for the area of a rectangle. Substitute 24 for b and 16 for h .

$$\begin{aligned} A &= bh && \text{Formula for the area of a rectangle} \\ &= 24 \cdot 16 && \text{Substitute 24 for } b \text{ and 16 for } h. \\ &= 384 && \text{Multiply.} \end{aligned}$$

ANSWER ▶ The area of the pool is 384 square feet.



EXAMPLE 3 Find the Height of a Rectangle

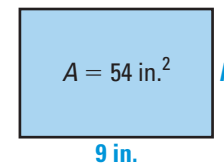
The rectangle has an area of 54 square inches. Find its height.

Solution

Use the formula for the area of a rectangle and substitute 54 for A and 9 for b .

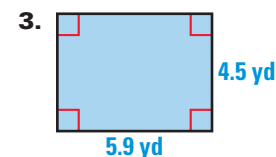
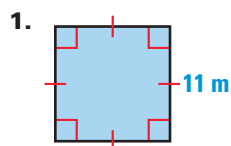
$$\begin{aligned} A &= bh && \text{Formula for the area of a rectangle} \\ 54 &= 9h && \text{Substitute 54 for } A \text{ and 9 for } b. \\ 6 &= h && \text{Divide each side by 9.} \end{aligned}$$

ANSWER ▶ The height of the rectangle is 6 inches.



Checkpoint Area of Squares and Rectangles

Find the area of the quadrilateral.



4. A rectangle has an area of 52 square meters and a height of 4 meters. Find the length of its base.

To find the area of a complex polygon, divide the polygon into smaller regions whose areas you can find.

EXAMPLE 4 Divide a Complex Polygon into Rectangles

Find the dimensions of rectangles A and B.

Solution

Rectangle A

The base is 5 units.

Because rectangle B is 2 units taller than rectangle A, the height of rectangle A is

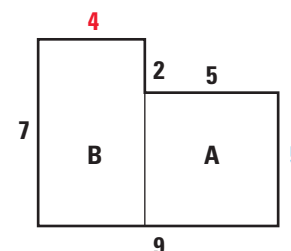
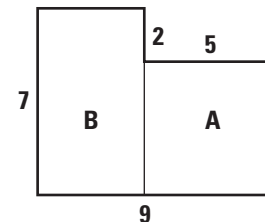
$$7 - 2 = 5 \text{ units.}$$

Rectangle B

The height is 7 units.

The base of rectangle B is the total of both bases minus the base of rectangle A, or

$$9 - 5 = 4 \text{ units.}$$



Visualize It!

Labels on diagrams are centered on the segment with which they correspond. In Example 5, the 9 cm label refers to a side of the polygon, not just the height of rectangle G.

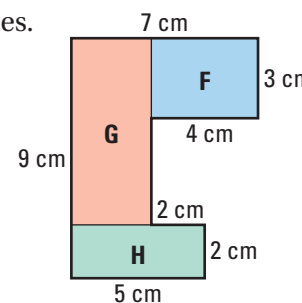
EXAMPLE 5 Find the Area of a Complex Polygon

Find the area of the polygon made up of rectangles.

Solution

Add the areas of the rectangles.

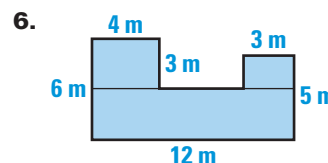
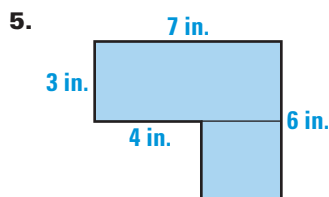
$$\begin{aligned} \text{Area} &= \text{Area of F} + \text{Area of G} + \text{Area of H} \\ &= bh + bh + bh \\ &= 4 \cdot 3 + (7 - 4) \cdot (9 - 2) + 5 \cdot 2 \\ &= 4 \cdot 3 + 3 \cdot 7 + 5 \cdot 2 \\ &= 12 + 21 + 10 \\ &= 43 \end{aligned}$$



ANSWER ▶ The total area of the polygon is 43 square centimeters.

Checkpoint Polygons Made Up of Rectangles

Find the area of the polygon made up of rectangles.



8.3 Exercises

Guided Practice

Vocabulary Check

1. What kind of quadrilateral has opposite sides parallel, opposite sides congruent, and four right angles?

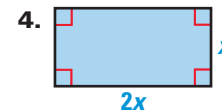
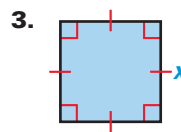
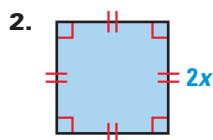
Skill Check

Match the figure with the corresponding area equation.

A. $A = x^2$

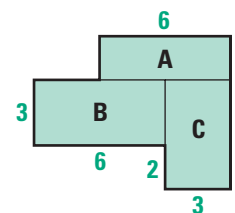
B. $A = 2x^2$

C. $A = 4x^2$



Determine whether the statement about the diagram is *true* or *false*. Explain your answer.

5. To find the area of the entire polygon, add the areas of the three rectangles.
6. The height of rectangle A is 1 unit.
7. The height of rectangle C is 5 units.

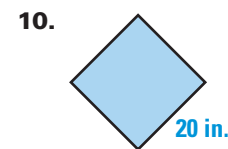
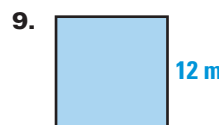
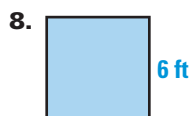


Practice and Applications

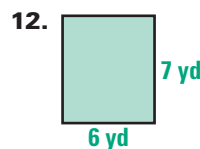
Extra Practice

See p. 689.

Area of a Square Find the area of the square.



Area of a Rectangle Find the area of the rectangle.



Homework Help

Example 1: Exs. 8–10, 14

Example 2: Exs. 11–13,
15, 16

Example 3: Exs. 20–22

Example 4: Exs. 24–26

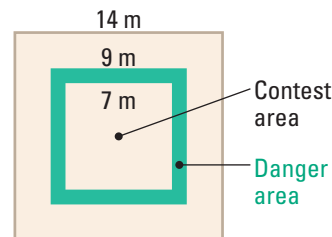
Example 5: Exs. 27–30

Visualize It! Sketch the figure and find its area.

14. A square with side lengths of 2.2 centimeters
15. A rectangle with a base of 4 meters and a height of 11 meters
16. A rectangle with a base of 13 feet and a height of 8 feet

Judo The dimensions of the squares on a judo mat are given in the diagram.

17. Find the area of the entire mat.
18. Find the area of the contest area.
19. Find the area of the contest area including the danger area.



Using Algebra In Exercises 20–22, A gives the area of the rectangle. Find the missing side length.

20. $A = 56 \text{ in.}^2$
8 in. h
21. 18 cm
 b
 $A = 54 \text{ cm}^2$
22. $A = 33 \text{ ft}^2$
6.6 ft h

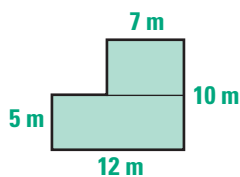
23. **You be the Judge** The perimeter of a square is 28 feet. Can you conclude that the area of the square is 49 square feet? Explain.

Dividing a Polygon Find the dimensions of the rectangle.

24. Rectangle A
 25. Rectangle B
 26. Rectangle C
-

Visualize It!

In Exs. 27–30, the polygons can be divided into rectangles in different ways. For example, Ex. 27 can be divided as follows:



Area of Complex Polygons Find the area of the polygon made up of rectangles.

27. 7 m
5 m 10 m
12 m
28. 3 in.
8 in. 5 in.
4 in.
29. 16 yd
9 yd 5 yd
7 yd
30. 4 cm
12 cm 11 cm
5 cm 10 cm
18 cm

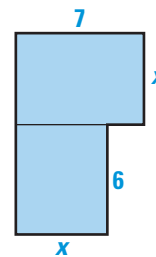
Maize Maze Brett Herbst transforms cornfields into mazes. His maze in Utah, shown at the right, is in the shape of Utah.

31. What is the area covered by the maze, which is made up of two rectangles?
32. How many acres does the maze cover? (1 acre = 43,560 square feet)
33. Suppose corn seed costs \$34 per acre and fertilizer costs \$57 per acre. How much will it cost to seed and fertilize a field with the same dimensions as the maze?



Standardized Test Practice

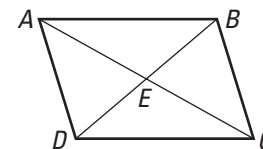
34. **Multi-Step Problem** The polygon below is made up of rectangles.
 - a. Write an expression for the area of the polygon.
 - b. Suppose the area is 65 square units. Find the value of x .
 - c. Using your results from part (b), sketch the figure and label all of its dimensions.



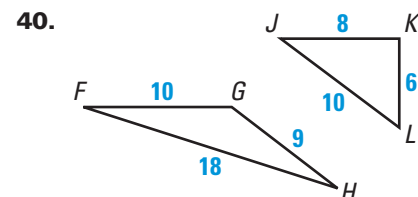
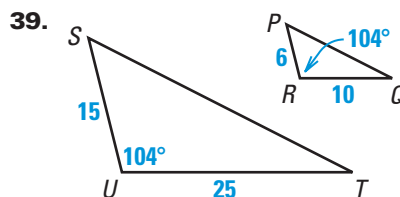
Mixed Review

Congruent Parts Use the diagram of parallelogram $ABCD$. Match the segment or angle with a congruent one. Give a reason for your answer. (Lesson 6.2)

- | | |
|---------------------|--------------------|
| 35. \overline{CE} | A. \overline{AB} |
| 36. \overline{CD} | B. $\angle ADC$ |
| 37. $\angle ABD$ | C. \overline{AE} |
| 38. $\angle CBA$ | D. $\angle CDB$ |



Determining Similarity Determine whether the triangles are similar. If so, state the similarity and the postulate or theorem that justifies your answer. (Lesson 7.4)



Algebra Skills

Comparing Numbers Compare the two numbers. Write the answer using $<$, $>$, or $=$. (Skills Review, p. 662)

- | | | |
|-------------------------|--------------------|------------------------|
| 41. 8 and -18 | 42. 2459 and 2495 | 43. -10 and 0 |
| 44. -1.12 and -1.01 | 45. 2.44 and 2.044 | 46. -0.75 and -0.7 |