LESSON
13.1 Area of Quadrilaterals

COMMON CORE 6.G.1
Find the area of... special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; ....

? ESSENTIAL QUESTION
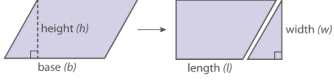How can you find the areas of parallelograms, rhombuses, and trapezoids?

EXPLORE ACTIVITY COMMON CORE 6.G.1

Area of a Parallelogram

Recall that a rectangle is a special type of parallelogram.

A Draw a large parallelogram on grid paper. Cut out your parallelogram.

B Cut your parallelogram on the dashed line as shown. Then move the triangular piece to the other side of the parallelogram.

height (h) | base (b)   →   length (l) | width (w)

C What figure have you formed? _____

Does this figure have the same area as the parallelogram? _____

base of parallelogram = _____ of rectangle

height of parallelogram = _____ of rectangle

area of parallelogram = _____ of rectangle

What is the formula for the area of this figure? $A =$ _____

or _____

D What is the formula for the area of a parallelogram? $A =$ _____

Math Talk
Mathematical Practices
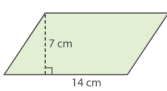How is the relationship between the length and width of a rectangle similar to the relationship between the base and height of a parallelogram?
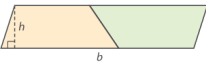
Area of a Parallelogram

The area A of a parallelogram is the product of its base b and its height h.
$$A = bh$$

© Houghton Mifflin Harcourt Publishing Company

Lesson 13.1 **371**

EXPLORE ACTIVITY *(cont'd)*

Reflect

1. Find the area of the parallelogram.

$A =$ _____

7 cm
14 cm

Finding the Area of a Trapezoid

Math On the Spot
my.hrw.com

To find the formula for the area of a trapezoid, notice that two copies of the same trapezoid fit together to form a parallelogram. Therefore, the area of the trapezoid is $\frac{1}{2}$ the area of the parallelogram.
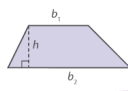
h
b

The height of the parallelogram is the same as the height of the trapezoid. The base of the parallelogram is the sum of the two bases of the trapezoid.

$$A = \quad b \quad \cdot h$$
$$\downarrow$$
$$A = (b_1 + b_2) \cdot h$$

Area of a Trapezoid

The area of a trapezoid is half its height multiplied by the sum of the lengths of its two bases.
$$A = \frac{1}{2}h(b_1 + b_2)$$

b_1
h
b_2

EXAMPLE 1 Real World   COMMON CORE 6.G.1

A section of a deck is in the shape of a trapezoid. What is the area of this section of the deck?

$b_1 = 17 \qquad b_2 = 39 \qquad h = 16$

Use the formula for area of a trapezoid.

$$A = \frac{1}{2}h(b_1 + b_2)$$
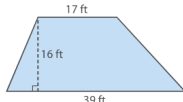$$= \frac{1}{2} \cdot 16(17 + 39) \qquad \text{Substitute.}$$
$$= \frac{1}{2} \cdot 16(56) \qquad \text{Add inside the parentheses.}$$
$$= 8 \cdot 56 \qquad \text{Multiply } \frac{1}{2} \text{ and 16.}$$
$$= 448 \text{ square feet} \qquad \text{Multiply.}$$

17 ft
16 ft
39 ft

Math Talk
Mathematical Practices
Does it matter which of the trapezoid's bases is substituted for b_1 and which is substituted for b_2? Why or why not?

Animated Math
my.hrw.com

372 Unit 6

© Houghton Mifflin Harcourt Publishing Company

YOUR TURN

2. Another section of the deck is also shaped like a trapezoid. For this section, the length of one base is 27 feet, and the length of the other base is 34 feet. The height is 12 feet. What is the area of this section of the deck? $A =$ _____ ft^2

Math On the Spot
my.hrw.com

Finding the Area of a Rhombus

A **rhombus** is a quadrilateral in which all sides are congruent and opposite sides are parallel. A rhombus can be divided into four triangles that can then be rearranged into a rectangle.
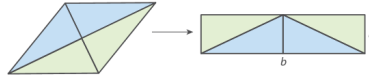
The base of the rectangle is the same length as one of the diagonals of the rhombus. The height of the rectangle is $\frac{1}{2}$ the length of the other diagonal.
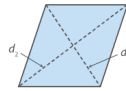
$A = b \cdot h$
$\downarrow \quad \downarrow$
$A = d_1 \cdot \frac{1}{2} d_2$

Area of a Rhombus

The area of a rhombus is half of the product of its two diagonals.

$A = \frac{1}{2} d_1 d_2$

EXAMPLE 2 Real World   COMMON CORE 6.G.1

Cedric is constructing a kite in the shape of a rhombus. The spars of the kite measure 15 inches and 24 inches. How much fabric will Cedric need for the kite?

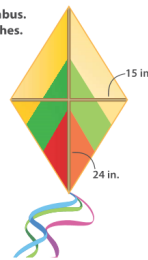To determine the amount of fabric needed, find the area of the kite.

$d_1 = 15$ $d_2 = 24$

Use the formula for area of a rhombus.

$A = \frac{1}{2} d_1 d_2$

$= \frac{1}{2}(15)(24)$ *Substitute.*

$= 180$ square inches   *Multiply.*

15 in.

24 in.

Lesson 13.1 **373**

© Houghton Mifflin Harcourt Publishing Company

YOUR TURN

Find the area of each rhombus.

3. $d_1 = 35$ m; $d_2 = 12$ m
   $A =$ _____ m^2

4. $d_1 = 9.5$ in.; $d_2 = 14$ in.
   $A =$ _____ in^2

5. $d_1 = 10$ m; $d_2 = 18$ m
   $A =$ _____ m^2

6. $d_1 = 8\frac{1}{4}$ ft; $d_2 = 40$ ft
   $A =$ _____ ft^2

Guided Practice

1. Find the area of the parallelogram. (Explore Activity)

   $A = bh$

   $= ($ _____ $)($ _____ $)$

   $=$ _____ in^2

   9 in.

   13 in.
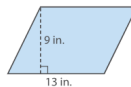
2. Find the area of the trapezoid. (Example 1)

   $A = \frac{1}{2}h(b_1 + b_2)$

   $= \frac{1}{2}(\bigcirc)(\bigcirc + \bigcirc)$

   $=$ _____ cm^2

   9 cm

   14 cm

   15 cm
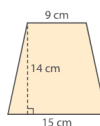
3. Find the area of the rhombus. (Example 2)

   $A = \frac{1}{2} d_1 d_2$

   $= \frac{1}{2}(\bigcirc)(\bigcirc)$

   $=$ _____ in^2

   18 in.   11 in.
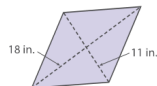
? ESSENTIAL QUESTION CHECK-IN

4. How can you find the areas of parallelograms, rhombuses, and trapezoids?

   _____

   _____

   _____

   _____

© Houghton Mifflin Harcourt Publishing Company
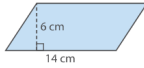
Name _____ Class _____ Date _____
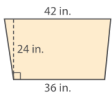
13.1 Independent Practice

COMMON CORE 6.G.1

Personal Math Trainer
Online Assessment and Intervention
my.hrw.com

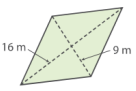**5.** Find the area of the parallelogram.

6 cm
14 cm

_____

6. What is the area of a parallelogram that has a base of $12\frac{3}{4}$ in. and a height of $2\frac{1}{2}$ in.?

7. Find the area of the trapezoid.

42 in.
24 in.
36 in.

_____

8. The bases of a trapezoid are 11 meters and 14 meters. Its height is 10 meters. What is the area of the trapezoid?

_____

9. Find the area of the rhombus.
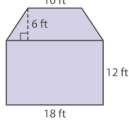
16 m   9 m

_____

10. The diagonals of a rhombus are 21 m and 32 m. What is the area of the rhombus?

11. The seat of a bench is in the shape of a trapezoid with bases of 6 feet and 5 feet and a height of 1.5 feet. What is the area of the seat?

_____

12. A kite in the shape of a rhombus has diagonals that are 25 inches long and 15 inches long. What is the area of the kite?

_____

13. A window in the shape of a parallelogram has a base of 36 inches and a height of 45 inches. What is the area of the window?

_____

14. **Communicate Mathematical Ideas** Find the area of the figure. Explain how you found your answer.

10 ft
6 ft
12 ft
18 ft

_____
_____
_____
_____
_____
_____
_____

© Houghton Mifflin Harcourt Publishing Company

Lesson 13.1 **375**

---

15. **Multistep** A parking space shaped like a parallelogram has a base of 17 feet and a height is 9 feet. A car parked in the space is 16 feet long and 6 feet wide. How much of the parking space is not covered by the car?

_____

H.O.T. **FOCUS ON HIGHER ORDER THINKING**

Work Area

16. **Critique Reasoning** Simon says that to find the area of a trapezoid, you can multiply the height by the top base and the height by the bottom base. Then add the two products together and divide the sum by 2. Is Simon correct? Explain your answer.

_____
_____
_____
_____

17. **Multistep** The height of a trapezoid is 8 in. and its area is 96 in.² One base of the trapezoid is 6 inches longer than the other base. What are the lengths of the bases? Explain how you found your answer.

_____
_____
_____
_____
_____
_____
_____

18. **Multiple Representations** The diagonals of a rhombus are 12 in. and 16 in. long. The length of a side of the rhombus is 10 in. What is the height of the rhombus? Explain how you found your answer.

_____
_____
_____
_____
_____
_____
_____

© Houghton Mifflin Harcourt Publishing Company

376 Unit 6

3