8.2 Quadrilaterals
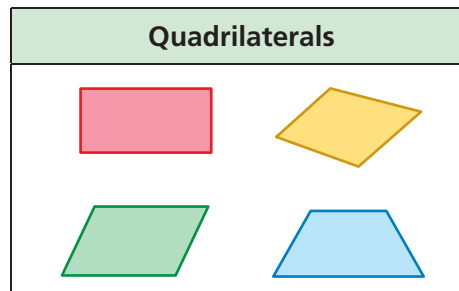
Essential Question How can you classify quadrilaterals?

"Quad" means *four* and "lateral" means *side*. So, quadrilateral means a polygon with *four sides*.

Quadrilaterals

1 ACTIVITY: Using Descriptions to Draw Quadrilaterals

Work with a partner. Use a geoboard to form a quadrilateral that fits the given description. Record your results on geoboard dot paper.

Sample: a. Form a quadrilateral with exactly one pair of parallel sides.

The top and bottom sides are parallel.
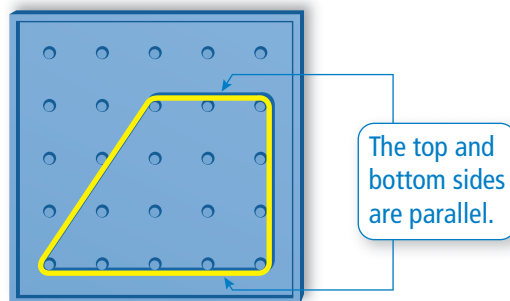
b. Form a quadrilateral with four congruent sides and four right angles.

c. Form a quadrilateral with four right angles that is *not* a square.

d. Form a quadrilateral with four congruent sides that is *not* a square.

e. Form a quadrilateral with two pairs of congruent adjacent sides and whose opposite sides are *not* congruent.

f. Form a quadrilateral with congruent and parallel opposite sides that is *not* a rectangle.

2 ACTIVITY: Naming Quadrilaterals

Work with a partner. Match the names square, rectangle, rhombus, parallelogram, trapezoid, and kite with your 6 drawings in Activity 1.
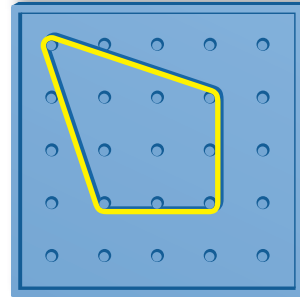
3 ACTIVITY: Forming Quadrilaterals

Work with a partner. Form each quadrilateral on your geoboard. Then move *only one* vertex to create the new type of quadrilateral. Record your results on geoboard dot paper.

a. Trapezoid ➡ Kite
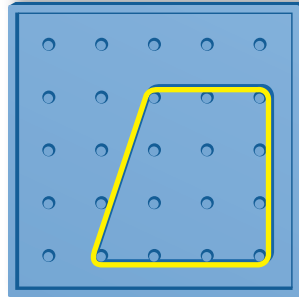
b. Kite ➡ Rhombus (*not* a square)

Inductive Reasoning

4. Work with a partner. Measure the angles of each quadrilateral you formed in Activity 1. Record your results in the table.

	$\angle 1$	$\angle 2$	$\angle 3$	$\angle 4$	$\angle 1 + \angle 2 + \angle 3 + \angle 4$
a.					
b.					
c.					
d.					
e.					
f.					

5. Describe the pattern in the table. Write a conclusion based on the pattern.

What Is Your Answer?

6. **IN YOUR OWN WORDS** How can you classify quadrilaterals? Explain using properties of sides and angles.

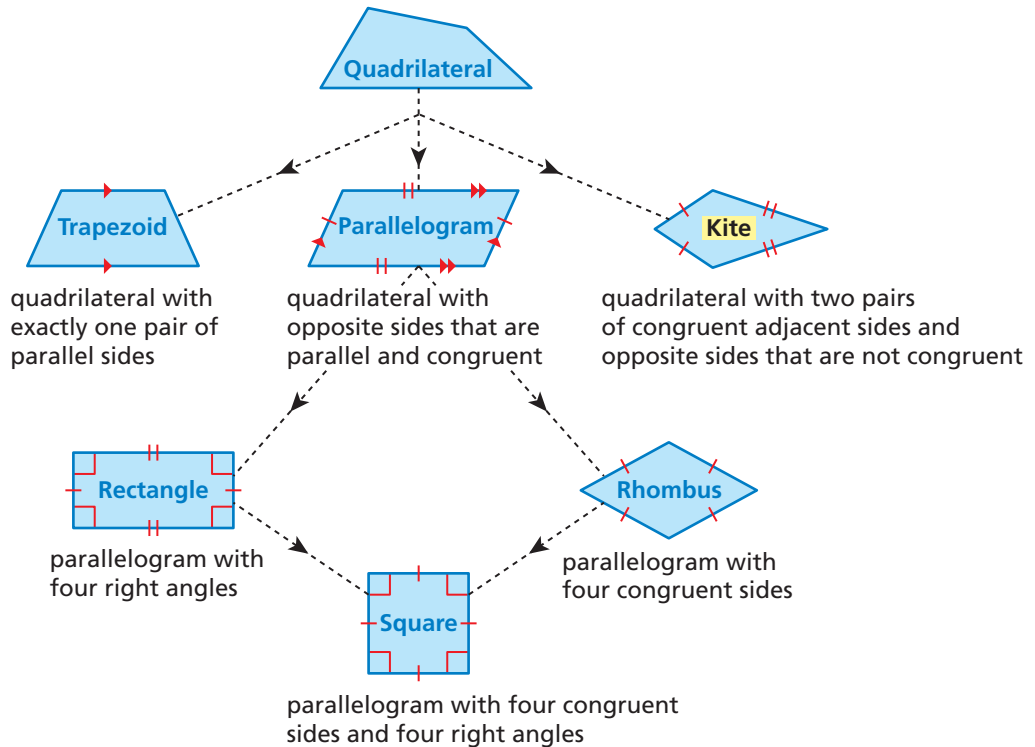**Practice** ➡ Use what you learned about quadrilaterals to complete Exercises 4–6 on page 348.

Key Vocabulary 🔊
kite, *p. 346*

A quadrilateral is a polygon with four sides. The diagram shows properties of different types of quadrilaterals and how they are related. When identifying a quadrilateral, use the name that is most specific.

Reading
Red arrows indicate parallel sides.

Quadrilateral

Trapezoid — quadrilateral with exactly one pair of parallel sides

Parallelogram — quadrilateral with opposite sides that are parallel and congruent

Kite — quadrilateral with two pairs of congruent adjacent sides and opposite sides that are not congruent

Rectangle — parallelogram with four right angles

Rhombus — parallelogram with four congruent sides

Square — parallelogram with four congruent sides and four right angles

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EXAMPLE 1 **Identifying Quadrilaterals**

Study Tip
In Example 1a, the square is also a parallelogram, a rectangle, and a rhombus. Square is the most specific name.
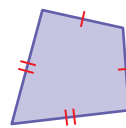
Identify the quadrilateral.

a.
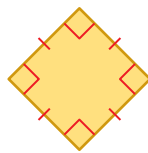
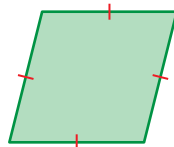⋮ The quadrilateral has four congruent sides and four right angles. So, it is a square.

b.

⋮ The quadrilateral has two pairs of congruent adjacent sides and opposite sides that are not congruent. So, it is a kite.

🔴 **On Your Own**

Now You're Ready
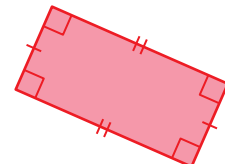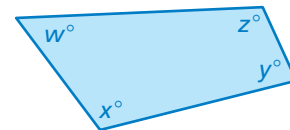Exercises 4–9

Identify the quadrilateral.

1.   **2.**   **3.**
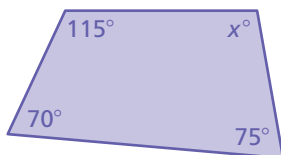
🔑 Key Idea

Sum of the Angle Measures of a Quadrilateral

Words The sum of the angle measures of a quadrilateral is 360°.

Algebra $w + x + y + z = 360$

EXAMPLE ② Finding an Angle Measure of a Quadrilateral

Find the value of x.

$$70 + 75 + 115 + x = 360 \qquad \text{Write an equation.}$$
$$260 + x = 360 \qquad \text{Combine like terms.}$$
$$\underline{-260 \qquad\qquad -260} \qquad \text{Subtract 260 from each side.}$$
$$x = 100 \qquad \text{Simplify.}$$

The value of x is 100.

EXAMPLE ③ Real-Life Application

You cut a wooden block to make a CO_2 racecar. The top right angle of the block is 105°. What is the measure of the top left angle?

Reading

CO_2 is an abbreviated way to refer to carbon dioxide.

$$CO_2$$
carbon dioxide
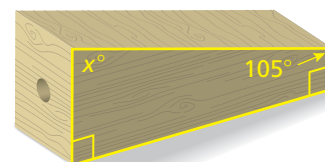
$$90 + 90 + 105 + x = 360 \qquad \text{Write an equation.}$$
$$285 + x = 360 \qquad \text{Combine like terms.}$$
$$\underline{-285 \qquad\qquad -285} \qquad \text{Subtract 285 from each side.}$$
$$x = 75 \qquad \text{Simplify.}$$

The measure of the top left angle is 75°.

On Your Own

Now You're Ready
Exercises 10–12

Find the value of x.

4. 120° 60° $x°$ 120°

5. 81° $x°$ 124°
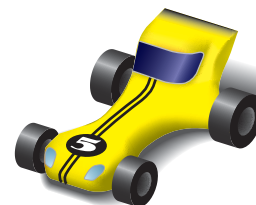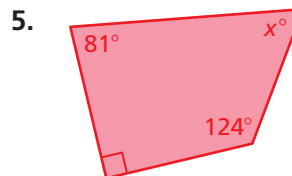
6. **WHAT IF?** In Example 3, the measure of the top right angle is 100°. What is the measure of the top left angle?

✓ Vocabulary and Concept Check

1. **VOCABULARY** Which statements are true?

   a. All squares are rectangles.
   b. All squares are parallelograms.
   c. All rectangles are parallelograms.
   d. All squares are rhombuses.
   e. All rhombuses are parallelograms.

2. **REASONING** Name two types of quadrilaterals with four right angles.

3. **WHICH ONE DOESN'T BELONG?** Which type of quadrilateral does *not* belong with the other three? Explain your reasoning.
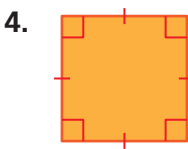
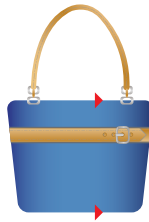 | Rectangle | Parallelogram | Square | Kite |

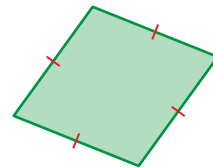## Practice and Problem Solving

Identify the quadrilateral.

❶ 4.

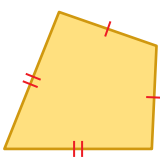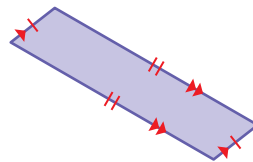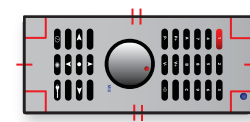5.

6.

7.

8.

9.

Find the value of *x*.

❷ 10.
65°   115°
115°   *x*°

11.
128°   *x*°
82°
40°

12.
x°   52°
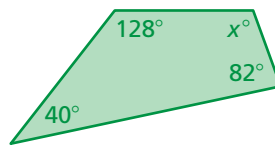
122°

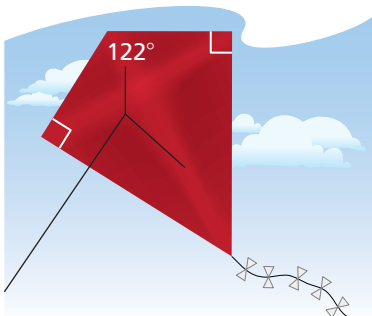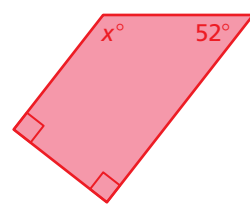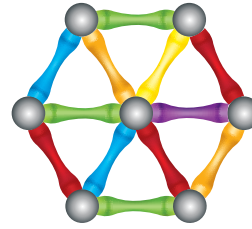13. **KITE MAKING** You make the kite shown. To check your plans, you measure the angle at the tail end of the kite. What should the measure of this angle be?

14. **MAGNETS** Draw a diagram of how to form each quadrilateral using the bars and spheres shown.

    a. Trapezoid

    b. Rhombus

    c. Parallelogram

Copy and complete using *always*, *sometimes*, or *never*.

15. A square is ___?___ a rectangle.

16. A square is ___?___ a rhombus.

17. A rhombus is ___?___ a square.

18. A parallelogram is ___?___ a trapezoid.

19. A trapezoid is ___?___ a kite.

20. A rhombus is ___?___ a rectangle.

21. **DOOR** The dashed line shows how you cut the bottom of a rectangular door so it opens more easily.

    a. Identify the new shape of the door. Explain.

    b. What is the new angle at the bottom left side of the door? Explain.

91.5°
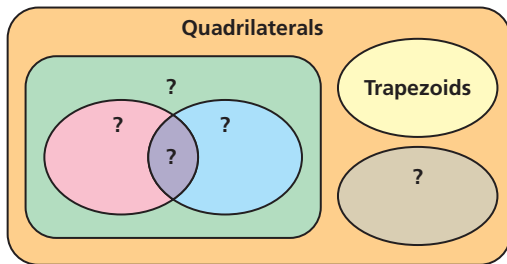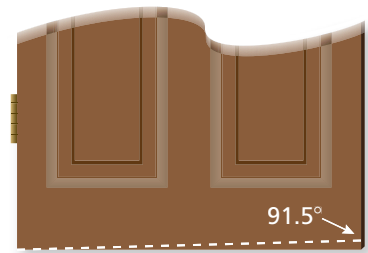
22. **VENN DIAGRAM** The diagram shows that some quadrilaterals are trapezoids and all trapezoids are quadrilaterals. Copy the diagram. Fill in the names of the types of quadrilaterals to show their relationships.

Quadrilaterals

Trapezoids

23. **Open-Ended** You share a rectangular bedroom that is 20 feet long and 10 feet wide with your sibling. You want to divide the room into two congruent figures.

    a. Draw diagrams showing three possible types of congruent figures you can use.

    b. Which design do you like the most? the least? Explain.

Fair Game Review *What you learned in previous grades & lessons*

Decide whether the rates are equivalent. *(Section 6.2)*

24. $\dfrac{48 \text{ blinks}}{3 \text{ minutes}}, \dfrac{80 \text{ blinks}}{5 \text{ minutes}}$

25. $\dfrac{24 \text{ airplanes}}{3 \text{ hours}}, \dfrac{16 \text{ airplanes}}{2 \text{ hours}}$

26. **MULTIPLE CHOICE** Your school spent $539.40 to buy dictionaries at $8.99 each. Which is the best estimate of how many dictionaries were purchased? *(Section 4.1)*

    (A) 40   (B) 50   (C) 60   (D) 70