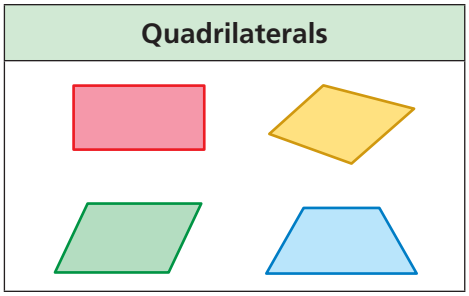
7.4 Quadrilaterals

Essential Question How can you classify quadrilaterals?

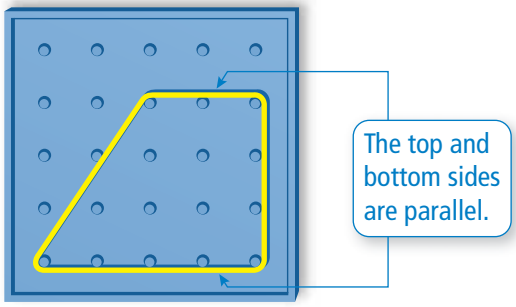
Quad means *four* and *lateral* means *side*. So, *quadrilateral* means a polygon with *four sides*.



1 ACTIVITY: Using Descriptions to Form Quadrilaterals

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

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



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.

Geometry

In this lesson, you will

- understand that the sum of the angle measures of any quadrilateral is 360°.
- find missing angle measures in quadrilaterals.
- construct quadrilaterals.

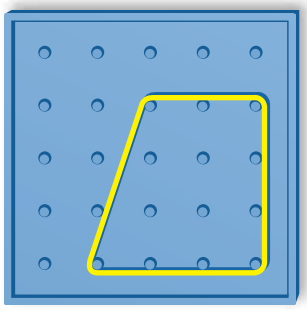
2 ACTIVITY: Naming Quadrilaterals

Work with a partner. Match the names *square, rectangle, rhombus, parallelogram, trapezoid,* and *kite* with your 6 drawings in Activity 1.

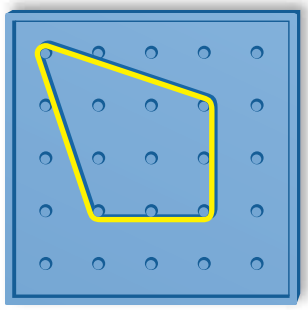
3 ACTIVITY: Forming Quadrilaterals

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)



4 ACTIVITY: Using Technology to Draw Quadrilaterals

Math Practice

Use Technology to Explore

How does geometry software help you learn about the characteristics of a quadrilateral?

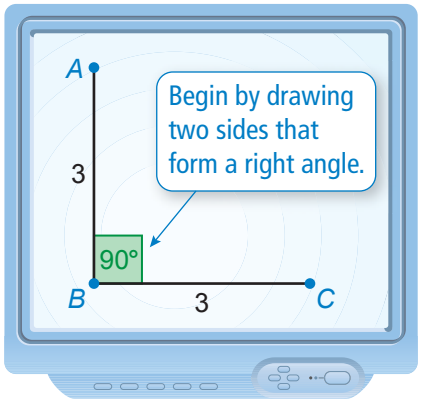
Work with a partner. Use geometry software to draw a quadrilateral that fits the given description.

a. a square with a side length of 3 units

b. a rectangle with a width of 2 units and a length of 5 units

c. a parallelogram with side lengths of 6 units and 1 unit

d. a rhombus with a side length of 4 units



What Is Your Answer?

5. **REASONING** Measure the angles of each quadrilateral you formed in Activity 1. Record your results in a table. Include the sum of the angle measures. Then describe the pattern in the table and write a conclusion based on the pattern.

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 296.

7.4 Lesson

Check It Out
Lesson Tutorials
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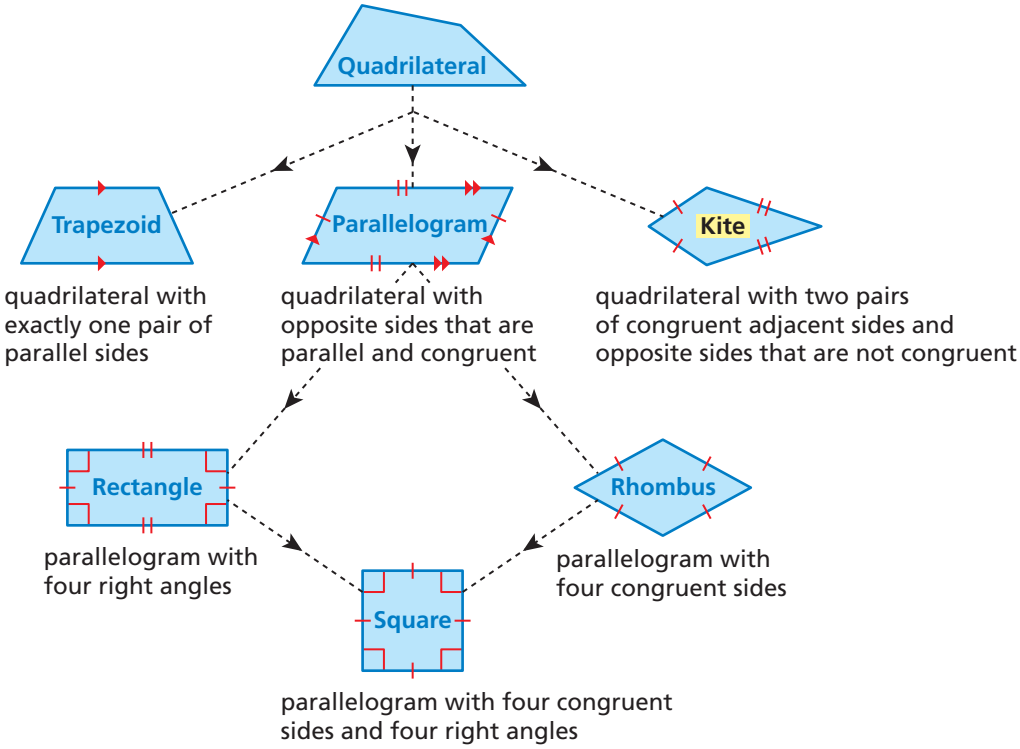
Key Vocabulary
kite, *p. 294*

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.



EXAMPLE 1 Classifying Quadrilaterals

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

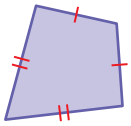
Classify the quadrilateral.

a.

The quadrilateral has four congruent sides and four right angles.

∴ So, the quadrilateral is a square.

b.



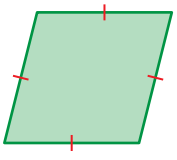
The quadrilateral has two pairs of congruent adjacent sides and opposite sides that are not congruent.

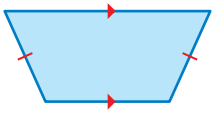
∴ So, the quadrilateral is a kite.

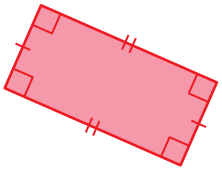
On Your Own

Now You're Ready
Exercises 4–9

Classify the quadrilateral.

1. 

2. 

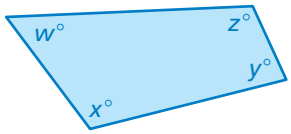
3. 

Key Idea

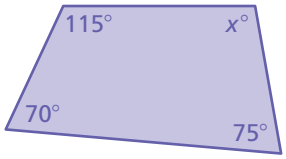
Sum of the Angle Measures of a Quadrilateral

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	Write an equation.
$260 + x =$	360	Combine like terms.
$- 260$	$- 260$	Subtraction Property of Equality
$x =$	100	Simplify.

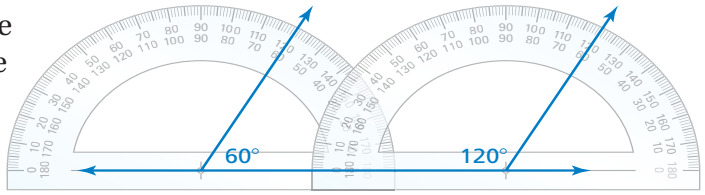
∴ The value of x is 100.

EXAMPLE 3 Constructing a Quadrilateral

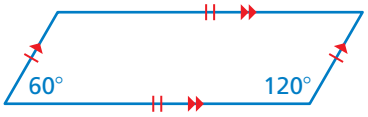
Draw a parallelogram with a 60° angle and a 120° angle.

Step 1: Draw a line.

Step 2: Draw a 60° angle and a 120° angle that each have one side on the line.



Step 3: Draw the remaining side. Make sure that both pairs of opposite sides are parallel and congruent.



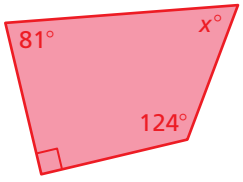
On Your Own

Now You're Ready
Exercises 10–12 and 14–17

Find the value of x.

4.

5.



6. Draw a right trapezoid whose parallel sides have lengths of 3 centimeters and 5 centimeters.

7.4 Exercises

Check It Out
Help with Homework
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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.

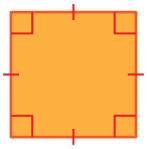
2. **REASONING** Name two types of quadrilaterals with four right angles.

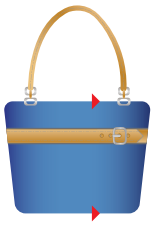
3. **WHICH ONE DOESN'T BELONG?** Which type of quadrilateral does *not* belong with the other three? Explain your reasoning.

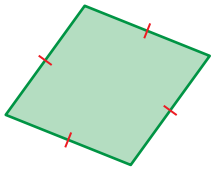
rectangle | parallelogram | square | kite

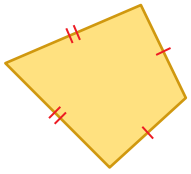
Practice and Problem Solving

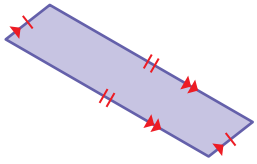
Classify the quadrilateral.

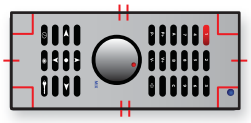
1 4. 

5. 

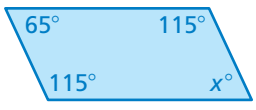
6. 

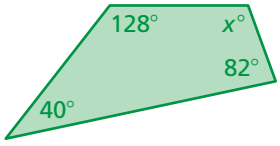
7. 

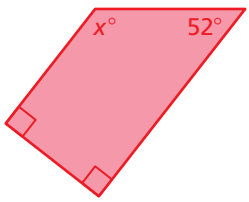
8. 

9. 

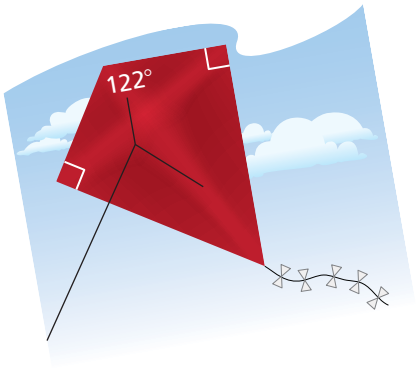
Find the value of x.

2 10. 

11. 

12. 

13. **KITE MAKING** What is the measure of the angle at the tail end of the kite?



Draw a quadrilateral with the given description.

3 **14.** a trapezoid with a pair of congruent, nonparallel sides

15. a rhombus with 3-centimeter sides and two 100° angles

16. a parallelogram with a 45° angle and a 135° angle

17. a parallelogram with a 75° angle and a 4-centimeter side

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

18. A square is __?__ a rectangle.

19. A square is __?__ a rhombus.

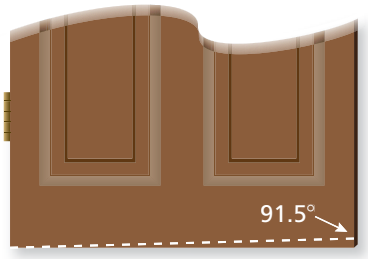
20. A rhombus is __?__ a square.

21. A parallelogram is __?__ a trapezoid.

22. A trapezoid is __?__ a kite.

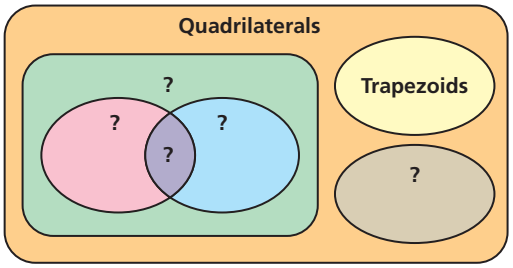
23. A rhombus is __?__ a rectangle.

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



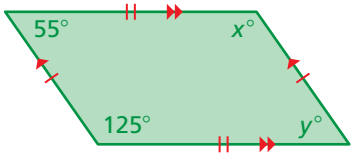
a. Identify the new shape of the door. Explain.

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



25. **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.

26. Structure Consider the parallelogram.



a. Find the values of x and y.

b. Make a conjecture about opposite angles in a parallelogram.

c. In polygons, consecutive interior angles share a common side. Make a conjecture about consecutive interior angles in a parallelogram.

Fair Game Review What you learned in previous grades & lessons

Write the ratio as a fraction in simplest form. *(Section 5.1)*

27. 3 turnovers : 12 assists

28. 18 girls to 27 boys

29. 42 pens : 35 pencils

30. **MULTIPLE CHOICE** Computer sales decreased from 40 to 32. What is the percent of decrease? *(Section 6.5)*

(A) 8% (B) 20% (C) 25% (D) 80%