

Polygons and Transformations

BEFORE

In previous chapters you've...

- Solved equations
- Plotted points in a coordinate plane

Now

In Chapter 8 you'll study...

- Solving equations to find angle measures
- Classifying angles and triangles
- Reflecting, translating, and rotating figures in a coordinate plane

WHY?

So you can solve real-world problems about...

- weaving, p. 378
- referees, p. 384
- geodesic domes, p. 393
- origami, p. 412



Internet Preview

CLASSZONE.COM

- eEdition Plus Online
- eWorkbook Plus Online
- eTutorial Plus Online
- State Test Practice
- More Examples

Chapter Warm-Up Game

Review skills you need for this chapter in this quick game. Work with a partner.

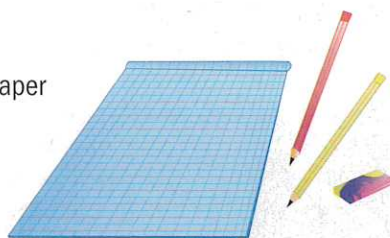
Key Skill:

Plotting points on a coordinate plane

FIND THE FLAGS

MATERIALS

- 2 sheets of grid paper for each player
- Pencils



PREPARE Each player draws a coordinate graph on both sheets of grid paper. Each player draws squares along the grid lines passing through the points $(7, 0)$, $(0, -7)$, $(-7, 0)$, and $(0, 7)$. A player secretly marks 4 flags on one graph. A flag is three consecutive points with integer coordinates, either horizontally or vertically. Flags cannot touch the outside borders. On each turn, a player should follow the steps on the next page.

Geometry and Measurement

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Chapter 8 Polygons and Transformations

- Classify angles, triangles, and other polygons.
- Use properties of congruent and similar polygons to solve problems.
- Describe transformations and symmetry of geometric figures.

Chapter 9 Real Numbers and Right Triangles

- Use square roots and the Pythagorean theorem to solve problems.
- Identify rational and irrational numbers.
- Use special relationships in right triangles to solve problems.

Chapter 10 Measurement, Area, and Volume

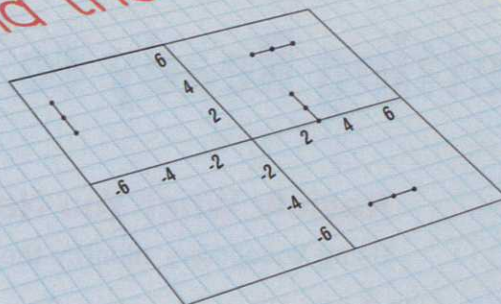
- Find areas of parallelograms, trapezoids, and circles.
- Find surface areas and volumes of prisms, cylinders, pyramids, and cones.
- Classify and sketch solids.



From Chapter 9, p. 444

How high can you parasail?

Find the Flags



- 1 CALL** out a point. The other player lets you know if you hit or missed one of their flags.



- 2 MARK** a hit with an "X" and a miss with an "O" on your second graph where your flags are not marked. If you hit a flag, you get to go again.



HOW TO WIN Be the first player to hit all the points in the other player's flags.

Stop and Think



- 1. Writing** How did you decide where to put your flags? Did it work? Explain. What strategy did you use when trying to find the other player's flags? Did it work? Explain.
- 2. Critical Thinking** How many points are there (not including any on the border) in each graph? Explain how you got your answer.

CHAPTER 8

Getting Ready to Learn

Word Watch

Review Words

point, p. 718
line, p. 718
ray, p. 718
plane, p. 718
angle, p. 719
vertex, p. 719
degree, p. 721

Review What You Need to Know



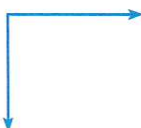
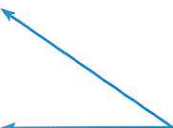




Using Vocabulary Identify the object with a review word. (p. 718)

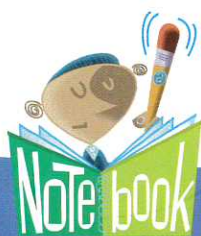
1.  2.  3. 

4. Copy and complete with a review word: An angle is measured in ?.

Use a protractor to measure the angle. (p. 721)

5.  6.  7. 
8.  9.  10. 

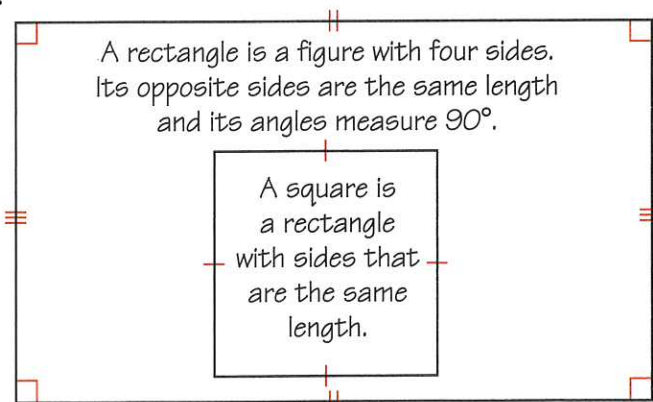
11. You have a giant crayon that is a scale model of a regular crayon. A regular crayon is about 0.25 inch wide and 3.5 inches long. The giant crayon is 6 inches wide. How long is it? (p. 322)



You should include material that appears on a notebook like this in your own notes.

Know How to Take Notes

Making a Concept Map You will often learn new concepts that are related to each other. It is helpful to organize these concepts in your notes with a map or chart.



In Lesson 8.3, you can use a concept map to organize information about special four-sided shapes.

LESSON 8.1

Angle Pairs

BEFORE

You solved equations to find the value of a variable.

Now


You'll solve equations to find angle measures.

WHY?

So you can design stationery, as in Ex. 13.

Word Watch

straight angle,
right angle, p. 375
supplementary,
complementary angles,
p. 375
vertical angles, p. 376
perpendicular lines, p. 376
parallel lines, p. 377

A **straight angle** measures 180° . A **right angle** measures 90° . The mark  tells you that an angle measures 90° .

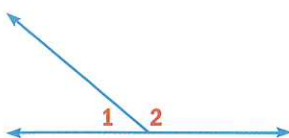


Straight angle

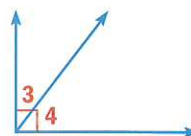


Right angle

Two angles are **supplementary** if the sum of their measures is 180° . Two angles are **complementary** if the sum of their measures is 90° . You can write "the measure of angle 1" as $m\angle 1$.



$\angle 1$ and $\angle 2$ are supplementary.
 $m\angle 1 + m\angle 2 = 180^\circ$



$\angle 3$ and $\angle 4$ are complementary.
 $m\angle 3 + m\angle 4 = 90^\circ$

EXAMPLE 1 Finding an Angle Measure

$\angle 1$ and $\angle 2$ are complementary, and $m\angle 2 = 32^\circ$. Find $m\angle 1$.

Solution

$$m\angle 1 + m\angle 2 = 90^\circ$$

$$m\angle 1 + 32^\circ = 90^\circ$$

$$m\angle 1 = 58^\circ$$

Definition of complementary angles

Substitute 32° for $m\angle 2$.

Subtract 32° from each side.



Your turn now Tell whether $\angle 1$ and $\angle 2$ are **complementary**, **supplementary**, or **neither**.

1. $m\angle 1 = 79^\circ$
 $m\angle 2 = 101^\circ$

2. $m\angle 1 = 64^\circ$
 $m\angle 2 = 36^\circ$

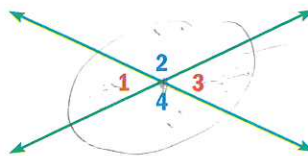
3. $m\angle 1 = 52^\circ$
 $m\angle 2 = 38^\circ$

4. $m\angle 1 = 44^\circ$
 $m\angle 2 = 46^\circ$

5. $m\angle 1 = 53^\circ$
 $m\angle 2 = 47^\circ$

6. $m\angle 1 = 95^\circ$
 $m\angle 2 = 85^\circ$

Vertical Angles When two lines intersect at a point, they form two pairs of angles that do not share a side. These pairs are called **vertical angles**, and they always have the same measure.

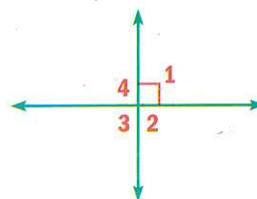


$\angle 1$ and $\angle 3$ are vertical angles.
 $m\angle 1 = m\angle 3$

$\angle 2$ and $\angle 4$ are vertical angles.
 $m\angle 2 = m\angle 4$

EXAMPLE 2 Using Vertical Angles

Find $m\angle 2$, $m\angle 3$, and $m\angle 4$.



Solution

The diagram shows that $m\angle 1 = 90^\circ$.

$\angle 1$ and $\angle 3$ are vertical angles. Their measures are equal, so $m\angle 3 = 90^\circ$.

$\angle 1$ and $\angle 2$ are supplementary.

$$m\angle 1 + m\angle 2 = 180^\circ \quad \text{Definition of supplementary angles}$$

$$90^\circ + m\angle 2 = 180^\circ \quad \text{Substitute } 90^\circ \text{ for } m\angle 1.$$

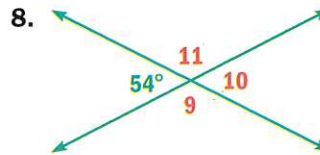
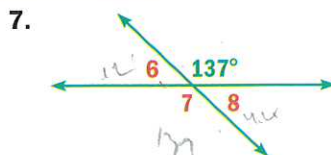
$$m\angle 2 = 90^\circ \quad \text{Subtract } 90^\circ \text{ from each side.}$$

$\angle 2$ and $\angle 4$ are vertical angles. Their measures are equal, so $m\angle 4 = 90^\circ$.

ANSWER $m\angle 2 = m\angle 3 = m\angle 4 = 90^\circ$

Perpendicular Lines You saw in Example 2 that when two lines intersect to form one right angle, they form four right angles. Two lines that intersect at a right angle are called **perpendicular lines**.

Your turn now Find the measures of the numbered angles.



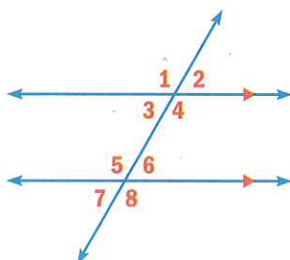
Parallel Lines Two lines in the same plane that do not intersect are called **parallel lines**. When a line intersects two parallel lines, several pairs of angles that are formed have equal measures.



Triangles on lines indicate that lines are parallel.



Angles and Parallel Lines



Corresponding Angles

$$m\angle 1 = m\angle 5 \quad m\angle 2 = m\angle 6 \\ m\angle 3 = m\angle 7 \quad m\angle 4 = m\angle 8$$

Alternate Interior Angles

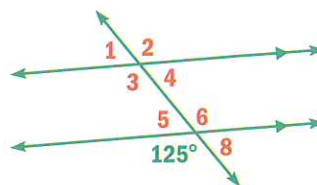
$$m\angle 3 = m\angle 6 \quad m\angle 4 = m\angle 5$$

Alternate Exterior Angles

$$m\angle 1 = m\angle 8 \quad m\angle 2 = m\angle 7$$

EXAMPLE 3 Using Parallel Lines

Use the diagram to find $m\angle 1$.



Solution

$\angle 1$ and $\angle 5$ are corresponding angles, so they have equal measures. Find $m\angle 5$.

The angle with measure 125° and $\angle 5$ are supplementary.

$$m\angle 5 + 125^\circ = 180^\circ \quad \text{Definition of supplementary angles}$$

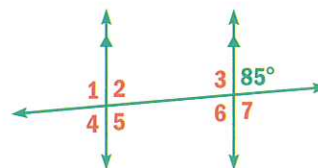
$$m\angle 5 = 55^\circ \quad \text{Subtract } 125^\circ \text{ from each side.}$$

$\angle 1$ and $\angle 5$ have equal measures.

ANSWER $m\angle 1 = 55^\circ$

Your turn now Find the angle measure.

- | | |
|-----------------|-----------------|
| 9. $m\angle 2$ | 10. $m\angle 3$ |
| 11. $m\angle 4$ | 12. $m\angle 6$ |





Getting Ready to Practice

Vocabulary Copy and complete the statement.

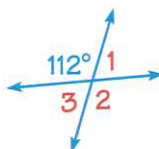
- The sum of the measures of two ? angles is 180° .
- Two lines that intersect to form a right angle are called ?.

Tell whether the angles are **complementary**, **supplementary**, or **neither**.

- $m\angle 1 = 62^\circ$, $m\angle 2 = 118^\circ$
- $m\angle 1 = 51^\circ$, $m\angle 2 = 39^\circ$
- Find the Error** Describe and correct the error in the solution.



$m\angle 2 = 68^\circ$,
because
vertical angles
add up to 180° .



HELP

with Homework

Example Exercises

- | | |
|---|---------|
| 1 | 6-7, 13 |
| 2 | 8-11 |
| 3 | 14 |



Online Resources
CLASSZONE.COM

- More Examples
- eTutorial Plus

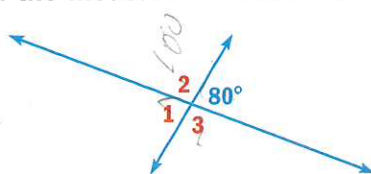
Practice and Problem Solving

Find the angle measure.

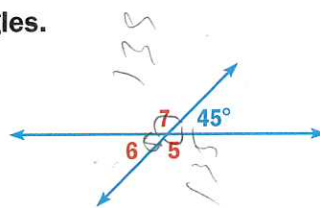
- $\angle 1$ and $\angle 2$ are complementary, and $m\angle 1 = 56^\circ$. Find $m\angle 2$.
- $\angle 3$ and $\angle 4$ are supplementary, and $m\angle 4 = 71^\circ$. Find $m\angle 3$.

Find the measures of the numbered angles.

8.



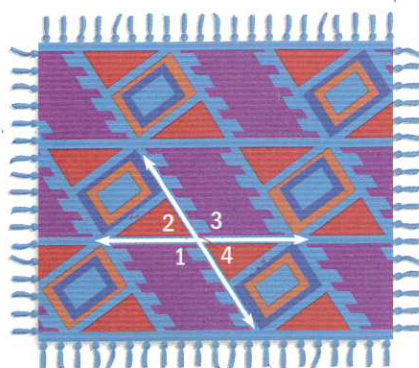
9.



- Weaving** Find the angle measures in the weaving if $m\angle 1 = 122^\circ$.

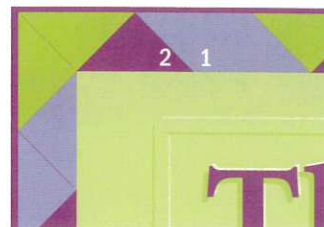
- Intersecting Streets** Two streets intersect to form a 75° angle. Sketch the intersection and find the measure of each angle formed.

- Writing** Can parallel lines form vertical angles? Explain.

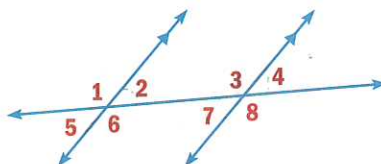




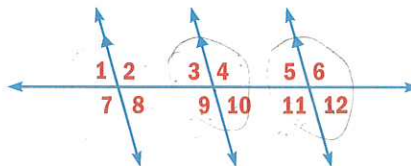
13. **Stationery** A student designed the stationery border shown here. Explain how to find $m\angle 2$ if $m\angle 1 = 135^\circ$.



14. In the diagram, $m\angle 4 = 44^\circ$. Find the measure of each angle.

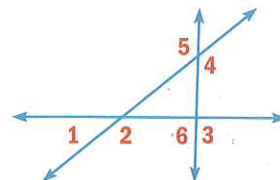


15. **Challenge** Find the measure of each angle if $m\angle 9 = 106^\circ$.



Algebra Find the value of the variable and the angle measures.

16. $m\angle 1 = (5x + 15)^\circ$ and $m\angle 2 = 28x^\circ$
 17. $m\angle 6 = (100 - 10y)^\circ$ and $m\angle 3 = 45y^\circ$
 18. $m\angle 4 = (7n + 39)^\circ$ and $m\angle 5 = (11n - 13)^\circ$



Mixed Review

Write the percent as a fraction in simplest form. (Lesson 7.4)

19. 22.6% 20. 6.5% 21. 0.45% 22. 602%

Basic Skills Find the area of a triangle with the given base and height.

23. $b = 3$ in., $h = 2$ in. 24. $b = 9$ cm, $h = 4$ cm 25. $b = 13$ ft, $h = 5$ ft

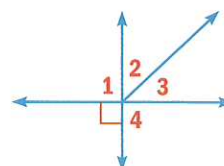
Test-Taking Practice



26. **Multiple Choice** Which angles are complementary?

- A. $\angle 1$ and $\angle 2$ B. $\angle 2$ and $\angle 3$
 C. $\angle 3$ and $\angle 4$ D. $\angle 4$ and $\angle 1$

27. **Short Response** In the diagram, $m\angle 3 = 43^\circ$. Explain how to find $m\angle 2$.



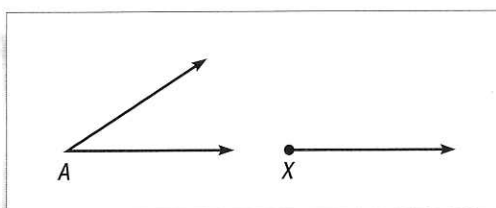
Constructions

GOAL Copy an angle and construct perpendicular lines and parallel lines.

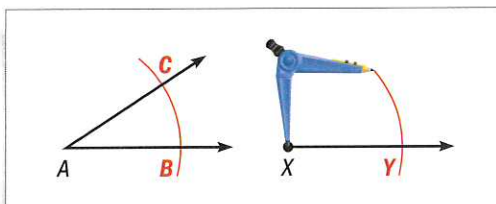
You can *construct* geometric figures using special tools. A *compass* is used to draw parts of circles called *arcs*. A *straightedge* is used to draw a straight line.

EXAMPLE 1 Copying an Angle

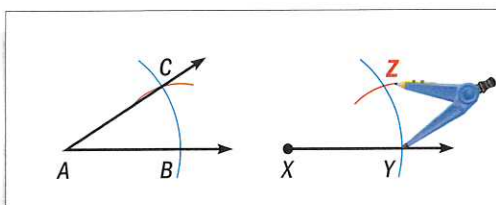
- 1 Draw an angle. Label its vertex A . Then draw a ray with endpoint X .



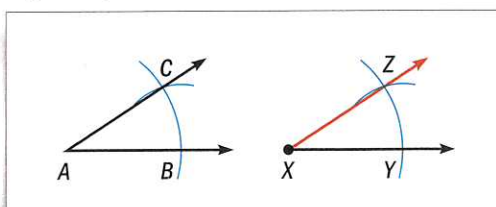
- 2 Draw an arc with center A . Label B and C on $\angle A$. Use the same compass setting to draw an arc with center X . Label point Y .



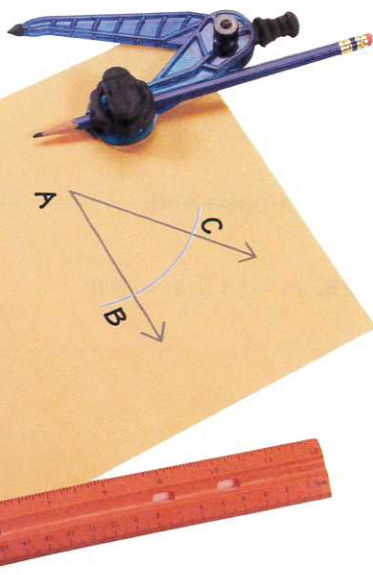
- 3 Draw an arc with center B that passes through C . Use the same compass setting to draw an arc with center Y . Label point Z .



- 4 Use a straightedge to draw a ray with endpoint X through Z .



✓ **CHECK** Use a protractor to check that $m\angle A = m\angle X$.

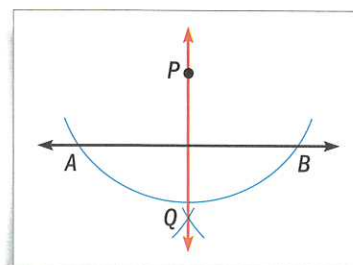
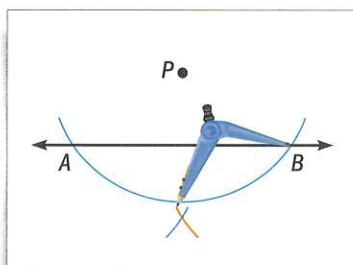


HELP with Solving

The method of construction shown in Example 2 can also work when P is on the line through points A and B . For the last two arcs, use a compass setting greater than half the distance from A to B .

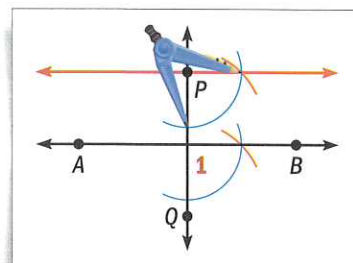
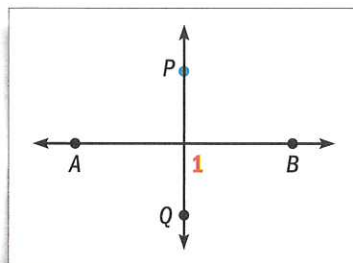
EXAMPLE 2 Constructing a Perpendicular Line

- 1 Draw a line and a point P not on the line. Draw an arc with center P that intersects the line twice. Label A and B . Using the same compass setting, draw arcs with centers A and B .
- 2 Where the last two arcs intersect label point Q . Draw a line through P and Q . The two lines are perpendicular.



EXAMPLE 3 Constructing a Parallel Line

- 1 Follow the steps in Example 2 to construct perpendicular lines. Label $\angle 1$.
- 2 Follow the steps in Example 1 to copy $\angle 1$ at point P as shown.



Exercises

Use a protractor to draw an angle with the given measure. Then use a compass and straightedge to copy the angle.

1. 45°
2. 120°
3. 135°
4. 60°
5. Use a compass and a straightedge to construct three parallel lines.
6. Use a compass and straightedge to construct one right triangle.
7. Use a compass and straightedge to construct a rectangle.

LESSON 8.2

Angles and Triangles

BEFORE

You identified pairs of angles.

Now

You'll classify angles and triangles.

WHY?

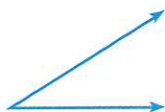
So you can classify referee signals, as in Exs. 6–8.

Word Watch

acute, right, obtuse angle,
p. 382
acute, right, obtuse triangle,
p. 382
equilateral, isosceles,
scalene triangle, p. 382

Classifying Angles An angle can be classified by its measure.

Acute angle



Measure is less than 90° .

Right angle



Measure is exactly 90° .

Obtuse angle



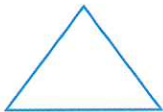
Measure is greater than 90° and less than 180° .



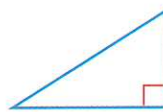
Classifying Triangles

By Angles

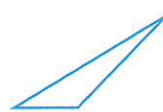
An **acute triangle** has three acute angles.



A **right triangle** has one right angle.

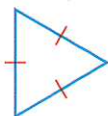


An **obtuse triangle** has one obtuse angle.

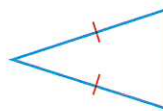


By Sides

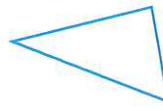
An **equilateral triangle** has three sides of equal length.



An **isosceles triangle** has at least two sides of equal length.



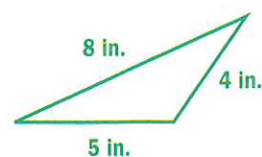
A **scalene triangle** has no sides of equal length.



EXAMPLE 1 Classifying a Triangle

Classify the triangle by its side lengths.

ANSWER The triangle has no sides of equal length. So, it is a scalene triangle.



HELP with Reading

Tick marks in a drawing show that side lengths are equal. Arc marks show that angle measures are equal.

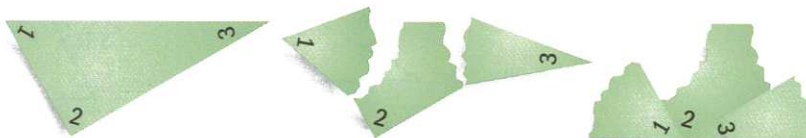
EXAMPLE 2 Classifying a Triangle

Classify the triangle by its angles and by its side lengths.

ANSWER The triangle has one right angle and two sides of equal length. So, it is a right isosceles triangle.

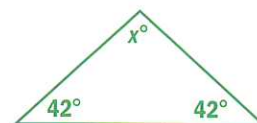


Angles in a Triangle From the figures below, you can see that the sum of the angle measures in the triangle is 180° . This is true for all triangles.



EXAMPLE 3 Finding an Unknown Angle Measure

Find the value of x . Then classify the triangle by its angles.



Solution

The sum of the angle measures in a triangle is 180° .

$$x^\circ + 42^\circ + 42^\circ = 180^\circ \quad \text{Write an equation.}$$

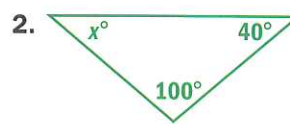
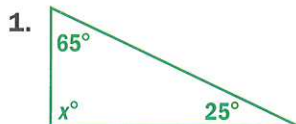
$$x + 84 = 180 \quad \text{Add.}$$

$$x + 84 - 84 = 180 - 84 \quad \text{Subtract 84 from each side.}$$

$$x = 96 \quad \text{Simplify.}$$

ANSWER The triangle has one obtuse angle, so it is an obtuse triangle.

Your turn now Find the value of x . Then classify the triangle by its angles.

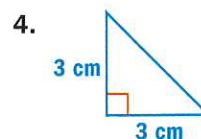
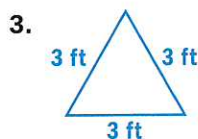
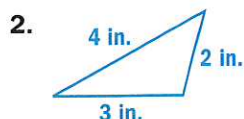


Getting Ready to Practice

Vocabulary Copy and complete the statement.

1. A(n)
- ?
- triangle has no sides of equal length.

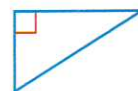
Classify the triangle by its side lengths.



- 5.
- Find the Error**
- Describe and correct the error in the solution.



The triangle has an acute angle, so it is an acute triangle.



Practice and Problem Solving

HELP

with Homework

Example Exercises

- | | |
|---|----------|
| 1 | 9-11, 15 |
| 2 | 9-11 |
| 3 | 12-14 |

Online Resources
CLASSZONE.COM

- More Examples
- eTutorial Plus

Estimation The referee is making calls during a hockey game. Classify the angle made by his arms as *acute*, *obtuse*, or *right*.

6. Cross Checking



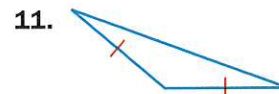
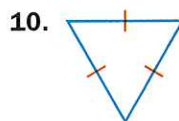
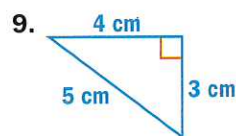
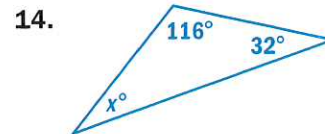
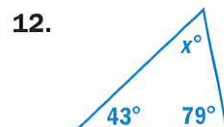
7. Roughing



8. Delayed calling of penalty



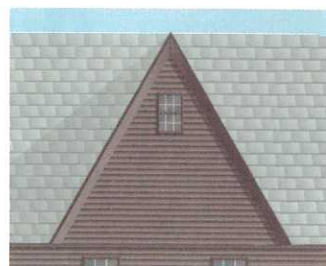
Classify the triangle by its side lengths.

**Measurement** Find the value of x . Classify the triangle by its angles.



House of Seven Gables
in Salem, Massachusetts

15. **House of Seven Gables** If the two side edges of this gable are the same length, what kind of triangle is formed? Explain.



Writing Can the angles in a triangle have the measures given? Explain.

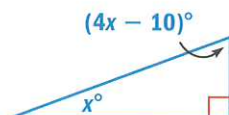
16. $43^\circ, 48^\circ, 90^\circ$

17. $1.5^\circ, 0.5^\circ, 178^\circ$

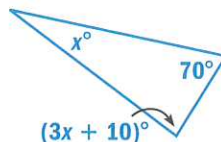
18. $21.3^\circ, 56.7^\circ, 102^\circ$

Algebra Find the measure of each angle in the triangle.

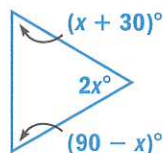
19.



20.

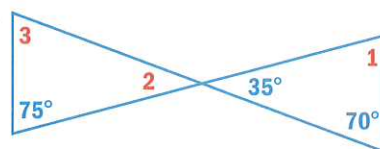


21.



22. **Mental Math** An *equiangular* triangle has three angles with equal measures. Find the measures of those angles.

23. **Measurement** Find the measures of the numbered angles



24. **Challenge** Can two angles of a triangle be supplementary? Explain.

Mixed Review



Find the perimeter and area of the rectangle. (Lesson 1.6)

25. $l = 2$ yd, $w = 0.6$ yd

26. $l = 13$ m, $w = 12$ m

27. **Geography** Earth's surface is 29.2% land. The total surface area is 510,072,000 square kilometers. Find the total land area. (Lesson 7.3)

28. $\angle 3$ and $\angle 4$ are supplementary and $m\angle 4 = 19^\circ$. Find $m\angle 3$. (Lesson 8.1)

Test-Taking Practice



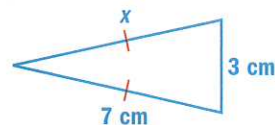
29. **Multiple Choice** Find the value of x .

A. 3 cm

B. 4 cm

C. 7 cm

D. 10 cm



30. **Multiple Choice** The angles of a triangle measure 110° , 40° , and x° . Find the value of x .

F. 30

G. 60

H. 70

I. 80

LESSON 8.3

Quadrilaterals

BEFORE

You classified angles and triangles.

Now

You'll classify quadrilaterals.

WHY?

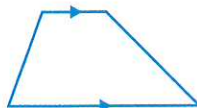
So you can analyze a design, as in Ex. 17.

Word Watch

quadrilateral, p. 386
trapezoid, p. 386
parallelogram, p. 386
rhombus, p. 386

Quadrilaterals A **quadrilateral** is a closed figure with four sides that are line segments. The figures below are special types of quadrilaterals.

Trapezoid



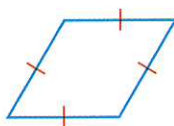
A **trapezoid** is a quadrilateral with exactly 1 pair of parallel sides.

Parallelogram



A **parallelogram** is a quadrilateral with both pairs of opposite sides parallel.

Rhombus



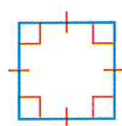
A **rhombus** is a parallelogram with 4 sides of equal length.

Rectangle



A rectangle is a parallelogram with 4 right angles.

Square



A square is a parallelogram with 4 sides of equal length and 4 right angles.

HELP with Notetaking

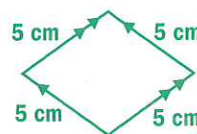
You can organize the definitions of quadrilaterals in your notebook using a concept map.

EXAMPLE 1 Classifying a Quadrilateral

Classify the quadrilateral.

Solution

The quadrilateral is a parallelogram with 4 sides of equal length. So, it is a rhombus.

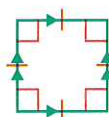


Your turn now Classify the quadrilateral.

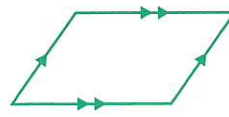
1.



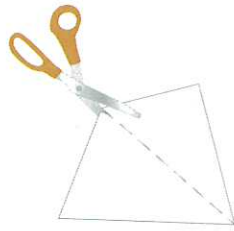
2.



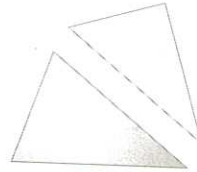
3.



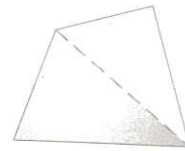
Angle Measures The figures below show that the sum of the angle measures in a quadrilateral is 360° .



Cut a quadrilateral into 2 triangles.



The sum of the angle measures in each triangle is 180° .



The sum of the angle measures in a quadrilateral is $180^\circ + 180^\circ = 360^\circ$.

EXAMPLE 2 Finding an Unknown Angle Measure

Find the value of x .

Solution

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

$$x^\circ + 51^\circ + 129^\circ + 129^\circ = 360^\circ$$

Write an equation.

$$x + 309 = 360$$

Add.

$$x = 51$$

Subtract 309 from each side.



8.3

Exercises

More Practice, p. 734



INTERNET

eWorkbook Plus
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Getting Ready to Practice

Vocabulary Copy and complete the statement.

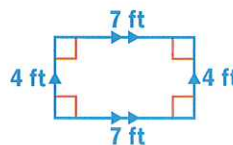
1. A ? is a quadrilateral with both pairs of opposite sides parallel.
2. A ? is a quadrilateral with exactly 1 pair of parallel sides.
3. A parallelogram with 4 right angles is a ?.

Classify the quadrilateral.

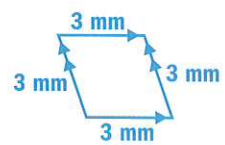
4.



5.



6.



7. The angles of a quadrilateral measure 85° , 74° , 110° , and x° . Find the value of x .



Example Exercises

1 8-10

2 11-16

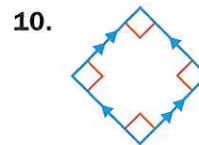
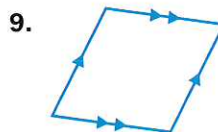
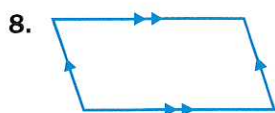


Online Resources
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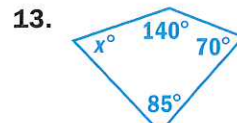
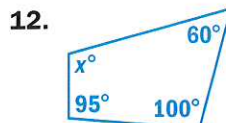
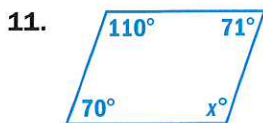
- More Examples
- eTutorial Plus

Practice and Problem Solving

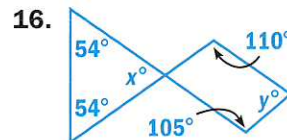
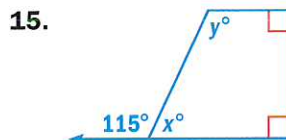
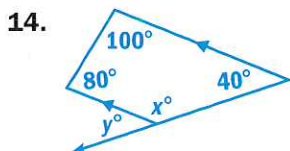
Measurement Measure the side lengths. Then classify the quadrilateral.



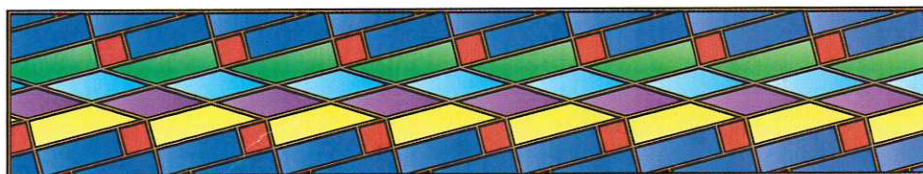
Find the value of x .



Find the values of x and y .



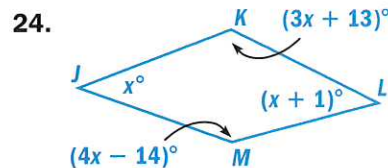
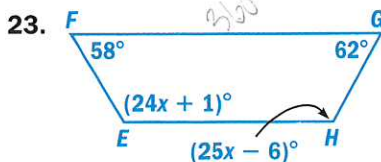
17. Classify each of the quadrilaterals in the design shown below.



Tell whether the statement is *always*, *sometimes*, or *never* true.

- A rhombus is also a parallelogram.
- A rectangle is also a square.
- A square is also a parallelogram.
- A triangle is also a quadrilateral.
- A quadrilateral is also a rectangle.

Find the value of x and the unknown angle measures.



25. **Critical Thinking** What is the greatest number of obtuse angles that a quadrilateral can have? Explain your answer.

26. **Challenge** Find the value of x and y in the diagram. Explain your reasoning.



Mixed Review

In Exercises 27–29, solve the equation. (Lesson 6.2)

27. $3x + 12 = 7x - 8$ 28. $5x + 9 = 3x + 19$ 29. $-6x + 3 = 4x - 7$

30. Two lines intersect to form a 47° angle. Sketch the lines. Find the measure of each angle in the intersection. (Lesson 8.1)

Tell whether the statement is *always*, *sometimes*, or *never* true. (Lessons 8.1, 8.2)

31. The measures of complementary angles have a sum of 180° .
 32. An obtuse angle measures more than 90° .
 33. An isosceles triangle has three sides of equal length.

Test-Taking Practice

34. **Multiple Choice** Which word can describe two sides of a rectangle?
 A. vertical B. right C. acute D. perpendicular
35. **Multiple Choice** Three angles in a quadrilateral are acute. Classify the fourth angle.
 F. acute G. right H. obtuse I. straight



Buy Oval Car

Rearrange the letters to make a review word.

- | | |
|------------------|-------------------|
| 1. prizetoad | 2. bustoe |
| 3. brushmo | 4. tauce |
| 5. allgrapemolar | 6. cleanse |
| 7. allearquiet | 8. girth |
| 9. catliver | 10. includerapper |



LESSON 8.4

Polygons and Angles

BEFORE

You found angle measures in triangles and quadrilaterals.

Now

You'll find angle measures in polygons.

WHY?

So you can explore a dome, as in Ex. 24.

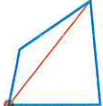

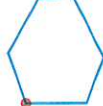
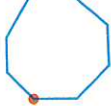
Word Watch

polygon, p. 390
 regular polygon, p. 390
 pentagon, p. 390
 hexagon, p. 390
 heptagon, p. 390
 octagon, p. 390

Activity

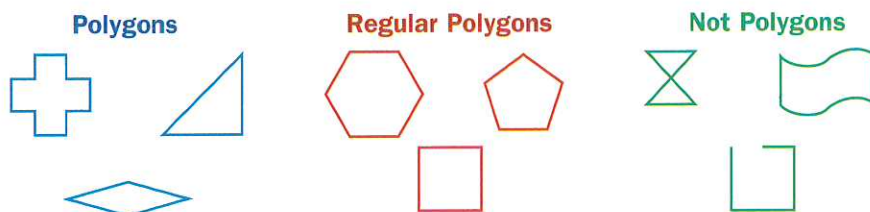
You can use triangles to find the sum of the angle measures in other figures.

- Copy the table. Divide each figure into triangles by drawing as many diagonal lines as you can that begin at the point marked.
- Use your drawings to complete the table.

Shape	Quadrilateral	Pentagon	Hexagon	Octagon
				
Number of Sides	4	?	?	?
Number of Diagonal Lines	1	?	?	?
Number of Triangles Formed	2	?	?	?
Sum of Angle Measures	360°	?	?	?

- Use your results to complete a column for a figure with 10 sides.

Polygons A **polygon** is a closed figure whose sides are line segments that intersect only at their endpoints. In a **regular polygon**, all the angles have the same measure and all the sides have the same length.



HELP with Reading

You can use n -gon, where n is the number of sides, to identify a polygon if you haven't learned its name. A 13-gon is a 13-sided polygon.

Polygons can be identified by the number of their sides.

Pentagon	Hexagon	Heptagon	Octagon	12-gon
5 sides	6 sides	7 sides	8 sides	12 sides



EXAMPLE 1 Identifying Figures

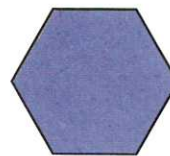
Is the figure a *polygon*, a *regular polygon*, or *not a polygon*? Explain.

a.



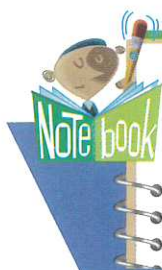
Not a polygon. The figure does not have line segments as sides.

b.



Regular polygon. Its angles have equal measures, and its sides have equal lengths.

Angles In the activity on page 390, you used triangles to find the sum of the angle measures in polygons. In a regular polygon, the measure of one angle is the sum of the angle measures divided by the number of sides.



Angle Measures in a Polygon

Sum of angle measures in an n -gon: $(n - 2) \cdot 180^\circ$

Measure of one angle in a *regular* n -gon: $\frac{(n - 2) \cdot 180^\circ}{n}$

EXAMPLE 2 Finding an Angle Measure

Find the measure of one angle in a regular octagon.

A regular octagon has 8 sides, so use $n = 8$.

$$\frac{(n - 2) \cdot 180^\circ}{n} = \frac{(8 - 2) \cdot 180^\circ}{8}$$

Substitute 8 for n .

$$= \frac{1080^\circ}{8}$$

Simplify numerator.

$$= 135^\circ$$

Divide.



ANSWER The measure of one angle in a regular octagon is 135° .

Your turn now Complete the exercise.

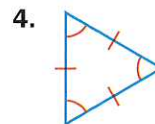
- Find the sum of the angle measures in a pentagon.
- Find the measure of one angle in a regular heptagon. Round to the nearest tenth of a degree.



Getting Ready to Practice

1. **Vocabulary** Copy and complete: A ? is a closed figure with sides that are line segments that intersect only at their endpoints.

Tell whether the figure is a *polygon*, a *regular polygon*, or *not a polygon*.



Find the sum of the angle measures in the polygon.

5. 10-gon 6. 9-gon 7. 11-gon 8. 20-gon

9. **Table** A table has 7 sides of equal length and 7 equal angles. Find the measure of one angle to the nearest tenth of a degree.

10. **Find the Error**
Describe and correct the error in the solution.

$$\begin{aligned} \text{Sum of Angles} &= 6 \cdot 180^\circ \\ &= 1080^\circ \end{aligned}$$



Practice and Problem Solving

HELP

with Homework

Example Exercises

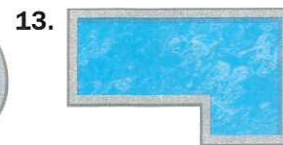
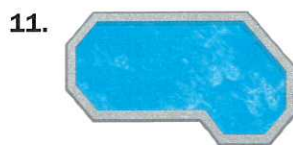
- 1 11-13
2 14-17



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- More Examples
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Tell whether the swimming pool design is a polygon.

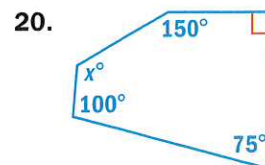
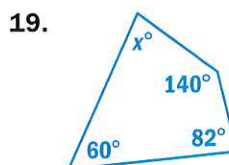
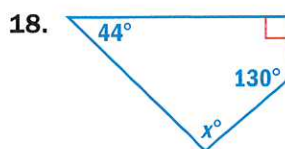


Find the measure of one angle in the polygon.

14. regular 10-gon 15. regular 14-gon 16. regular 15-gon

17. **Calculate** Find the measure of one angle in a regular 115-gon.

Algebra Find the value of x .



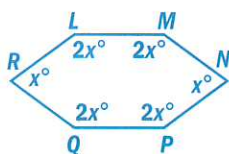


Geodesic Dome

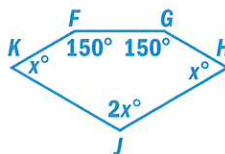
The Eden Project is an environmental center in England made of connected geodesic domes. Its largest dome is 240 meters long. How many feet is this? (1 meter is equal to 3.281 feet.)

Critical Thinking Find the value of x and the unknown angle measures.

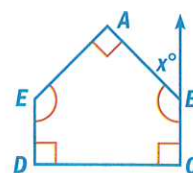
21.



22.



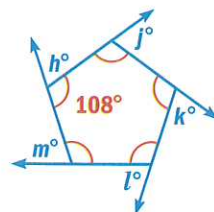
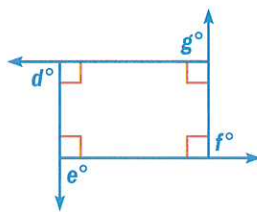
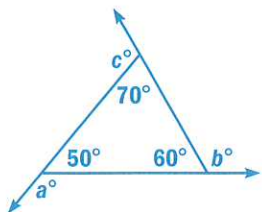
23.



24. **Geodesic Dome** A geodesic dome has some panels that are hexagons. Sketch a regular hexagon, and find the measure of one angle.

25. **Challenge** The sum of the angle measures in a polygon is 1980° . How many sides does it have?

Extended Problem Solving In Exercises 26–28, the angles marked with letters are called *exterior angles*.



26. **Evaluate** Find the measures of the exterior angles of each polygon.

27. **Calculate** Find the sum of the exterior angle measures for each polygon.

28. **Patterns** Describe a pattern in the sums you found in Exercise 27.

Mixed Review

Write the percent as a fraction in simplest form. (Lesson 7.4)

29. 98%

30. 141.3%

31. 0.14%

32. 82.5%

33. The wholesale price of a pair of shoes is \$12.75. The retail price of the shoes is \$25.95. Find the percent markup. (Lesson 7.6)

34. $m\angle 1 = 56^\circ$ and $m\angle 2 = 34^\circ$. Are the angles supplementary? Explain your answer. (Lesson 8.1)

Test-Taking Practice

35. **Multiple Choice** Find the measure of one angle in a regular 12-gon.

A. 30°

B. 60°

C. 120°

D. 150°

36. **Multiple Choice** Four angles in a pentagon measure 90° , 85° , 120° , and 130° . What is the measure of the fifth angle?

F. 105°

G. 115°

H. 120°

I. 165°

Notebook Review



Review the vocabulary definitions in your notebook.

Copy the review examples in your notebook. Then complete the exercises.

Check Your Definitions

straight angle, right angle, p. 375
supplementary, complementary angles, p. 375
vertical angles, p. 376
perpendicular lines, p. 376
parallel lines, p. 377
acute, right, obtuse angle, p. 382
acute, right, obtuse triangle, p. 382

equilateral, isosceles, scalene triangle, p. 382
quadrilateral, p. 386
trapezoid, parallelogram, rhombus, p. 386
polygon, regular polygon, p. 390
pentagon, hexagon, heptagon, octagon, p. 390

Use Your Vocabulary

- Vocabulary** How many obtuse angles are in an obtuse triangle?

8.1–8.2 Can you find and use angle measures?

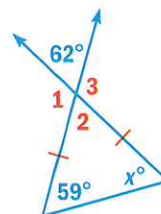


EXAMPLE Refer to the diagram to answer parts (a) and (b).

- Find $m\angle 2$.

The angle with measure 62° and $\angle 2$ are vertical angles, so their measures are equal.

ANSWER $m\angle 2 = 62^\circ$



- Find the value of x . Then classify the triangle.

$$x^\circ + 59^\circ + 62^\circ = 180^\circ$$

Sum of angle measures is 180° .

$$x + 121 = 180$$

Add.

$$x = 59$$

Subtract 121 from each side.

ANSWER The triangle is acute and isosceles.

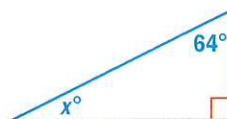


Find the value of x . Classify the triangle by its angles.

2.



3.



8.3–8.4 Can you find angle measures in polygons?

Review

EXAMPLE Find the measure of one angle in a regular pentagon.

$$\frac{(n - 2) \cdot 180^\circ}{n}$$

Write the formula for measure of one angle in regular polygon.

$$= \frac{(5 - 2) \cdot 180^\circ}{5}$$

Substitute 5 for n .

$$= 108^\circ$$

Simplify.



Find the angle measure.

4. Three angles in a quadrilateral measure 203° , 15° , and 90° . Find the measure of the fourth angle.
5. Find the sum of the angle measures in a hexagon.

Stop and Think

about Lessons 8.1–8.4



6. **Writing** Can a hexagon have two right angles? Draw a diagram and explain your answer.
7. **Illustrate** How many pairs of vertical angles do two intersecting lines form? Draw a diagram and explain your answer.

Review Quiz 1

Tell whether the angles are **complementary**, **supplementary**, or **neither**.

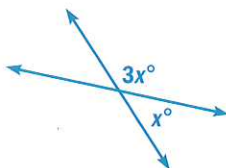
1. $m\angle 1 = 32^\circ$, $m\angle 2 = 148^\circ$
2. $m\angle 3 = 59^\circ$, $m\angle 4 = 41^\circ$
3. $m\angle 5 = 12^\circ$, $m\angle 6 = 78^\circ$
4. $m\angle 7 = 116^\circ$, $m\angle 8 = 64^\circ$

Can the angles in a triangle have the measures given? Explain.

5. 23° , 57° , 95°
6. 64.6° , 77.3° , 38.1°
7. 155° , 24.9° , 0.1°

Find the value of x .

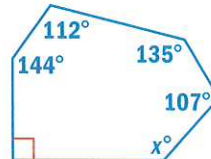
8.



9.



10.



11. Two angles in a triangle measure 75° and 30° . Find the measure of the third angle.

GOAL

Copy a triangle.

MATERIALS

- compass
- straightedge
- protractor

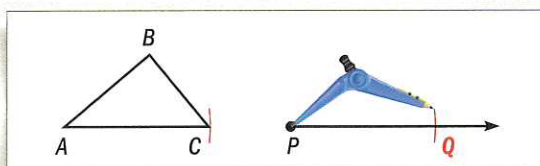
Copying a Triangle

You can use a compass and a straightedge to copy a triangle.

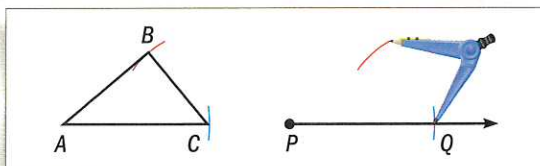
Explore

Use a compass and straightedge to copy a triangle.

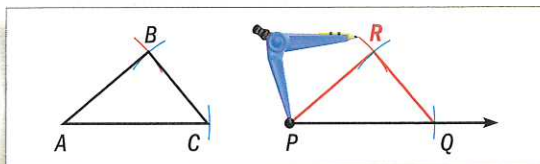
- 1** Draw a triangle with vertices A , B , and C . Draw a ray with endpoint P . Draw an arc with center A through point C . Use the same compass setting to draw an arc with center P . Label point Q .



- 2** Draw an arc with center C through point B . Use the same compass setting to draw an arc with center Q .



- 3** Draw an arc with center A through point B . Use the same compass setting to draw an arc with center P . Label point R . Connect P and R . Connect R and Q .



Your turn now

Draw a triangle that fits the description. Then use a compass and straightedge to copy the triangle.

1. acute

2. obtuse

3. right

Stop and Think

- 4. Critical Thinking** Measure the angles of each triangle you copied in Exercises 1–3. What do you notice? Explain.
- 5. Writing** When you use a compass and straightedge to copy a triangle, what measures of the new triangle are identical to the old triangle?

LESSON 8.5

Congruent Polygons

BEFORE

You identified polygons.

Now

You'll identify and name congruent polygons.

WHY?

So you can measure kites, as in Exs. 13 and 14.

Word Watch

congruent sides, p. 397
congruent angles, p. 397
corresponding parts, p. 397

Congruent sides have equal lengths. **Congruent angles** have equal measures. The symbol \cong means "is congruent to."

Congruent polygons have the same shape and size. Polygons are congruent if their *corresponding* angles and sides are congruent.

Corresponding parts are in the same position in different figures. To name congruent polygons, list their corresponding vertices in the same order. In the diagram $\triangle KLM \cong \triangle PQR$.



Corresponding angles are congruent.

$$\angle K \cong \angle P \quad \angle L \cong \angle Q \quad \angle M \cong \angle R$$

Corresponding sides are congruent.

$$\overline{LM} \cong \overline{QR} \quad \overline{KL} \cong \overline{PQ} \quad \overline{KM} \cong \overline{PR}$$

The side with endpoints P and R

EXAMPLE 1 Naming Corresponding Parts

In the frame below, quadrilateral $ABCD \cong$ quadrilateral $JKLM$. Name all pairs of corresponding angles and sides.

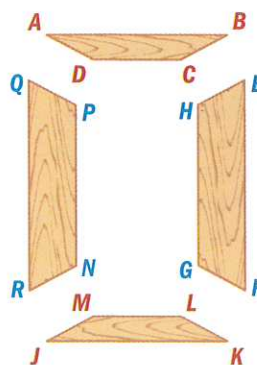
Solution

Corresponding angles are congruent.

$$\begin{array}{ll} \angle A, \angle J & \angle B, \angle K \\ \angle C, \angle L & \angle D, \angle M \end{array}$$

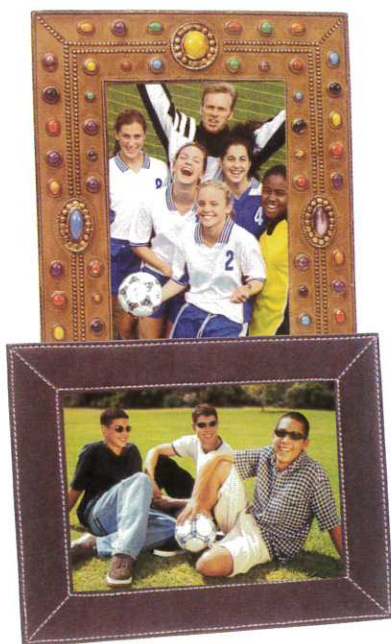
Corresponding sides are congruent.

$$\begin{array}{ll} \overline{AB}, \overline{JK} & \overline{BC}, \overline{KL} \\ \overline{CD}, \overline{LM} & \overline{DA}, \overline{MJ} \end{array}$$



Your turn now In Example 1, quadrilateral $EFGH \cong$ quadrilateral $QRNP$.

1. Name all pairs of corresponding angles and sides.



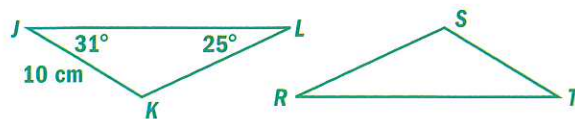
HELP**with Reading**

$\triangle JKL$ is read "triangle JKL" and refers to the triangle with vertices J, K, and L.

EXAMPLE 2 Using Congruent Polygons

$$\triangle JKL \cong \triangle TSR$$

Find $m\angle S$.

**Solution**

$\angle K$ and $\angle S$ are corresponding angles, so they have the same measure. Find $m\angle K$.

$$m\angle J + m\angle K + m\angle L = 180^\circ$$

Sum of angle measures is 180° .

$$31^\circ + m\angle K + 25^\circ = 180^\circ$$

Substitute given values.

$$m\angle K + 56^\circ = 180^\circ$$

Combine like terms.

$$m\angle K = 124^\circ$$

Subtract 56° from each side.

ANSWER Because $m\angle K = m\angle S$, $m\angle S = 124^\circ$.

Your turn now Find the measure using the triangles in Example 2.

2. length of \overline{ST}

3. $m\angle T$

4. $m\angle R$

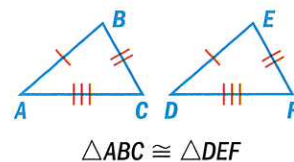
Congruent Triangles You can use the special rules in the chart to tell whether triangles are congruent.

HELP**with Reading**

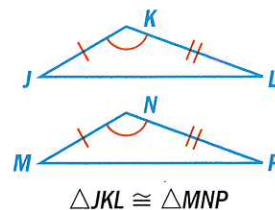
The angle between two sides is sometimes called the *included* angle. The side between two angles is sometimes called the *included* side.

Side-Side-Side (SSS)

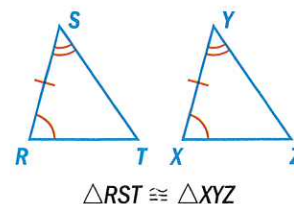
If three sides of one triangle are congruent to three sides of another triangle, then the triangles are congruent.

**Side-Angle-Side (SAS)**

If two sides and the angle between them in one triangle are congruent to two sides and the angle between them in another triangle, then the triangles are congruent.

**Angle-Side-Angle (ASA)**

If two angles and the side between them in one triangle are congruent to two angles and the side between them in another triangle, then the triangles are congruent.

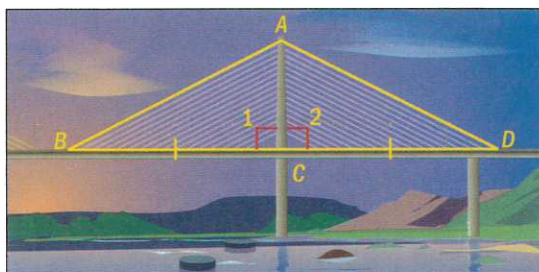




Dames Point Bridge
Jacksonville, Florida

EXAMPLE 3 Identifying Congruent Triangles

Name the congruent triangles formed by the bridge cables, and explain how you know that they are congruent.



$$\overline{CB} \cong \overline{CD}$$

Sides are congruent.

$$\overline{AC} \cong \overline{AC}$$

Side is congruent to itself.

$$\angle 1 \cong \angle 2$$

Right angles are congruent.

ANSWER $\triangle ACB \cong \triangle ACD$ by Side-Angle-Side.

8.5

Exercises

More Practice, p. 734



INTERNET

eWorkbook Plus
CLASSZONE.COM

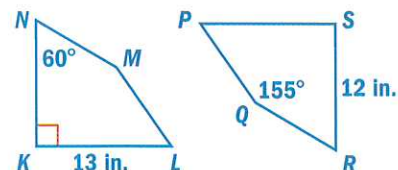
Getting Ready to Practice

Vocabulary Copy and complete the statement.

- Two angles with the same measure are ?.
- ? are in the same position in different figures.

In the diagram, quadrilateral $KLMN \cong$ quadrilateral $SPQR$.

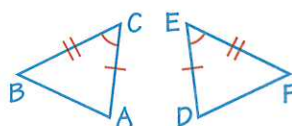
- Name four pairs of congruent angles.
- Find $m\angle S$.
- Find the length of \overline{NK} .
- Find $m\angle R$.



- Find the Error** Describe and correct the error in the solution.



$\triangle ABC \cong \triangle DEF$
by Side-Angle-Side.



HELP with Homework

Example Exercises

- 1 8-11
- 2 8-11
- 3 12-14



- More Examples
- eTutorial Plus

Practice and Problem Solving

Measurement Quadrilateral $ABEF \cong$ quadrilateral $DGHC$. Find the unknown measure.

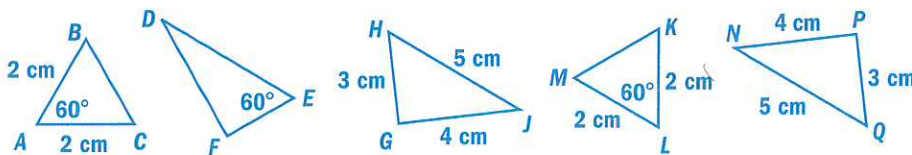
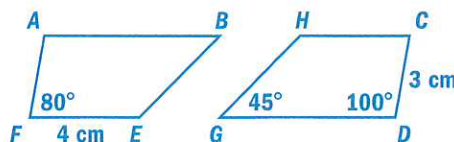
8. length of \overline{AF}

9. $m\angle C$

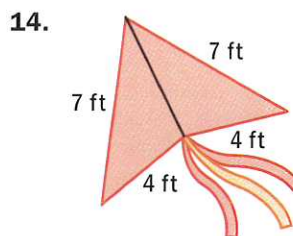
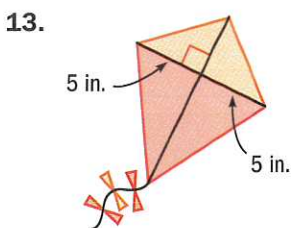
10. length of \overline{HC}

11. $m\angle A$

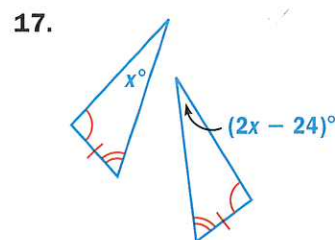
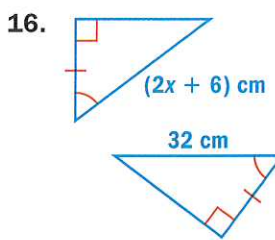
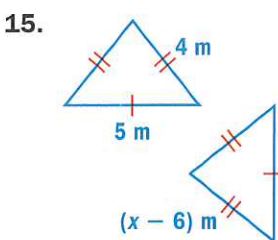
12. Name all the congruent triangles shown. Justify your answer.



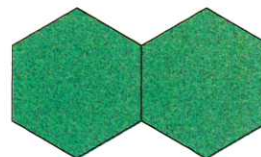
Kites Explain how you know the red triangles in the kite are congruent.



Critical Thinking Explain how you know the triangles are congruent. Then write an equation and solve for x .



18. **Soccer Field** Some pieces of sod on a field are regular hexagons like the ones shown here. Explain how you know the regular hexagons are congruent.



19. **Pockets** Two back pockets on a pair of jeans are congruent. Find $m\angle 1$.



What do you think?

Sports



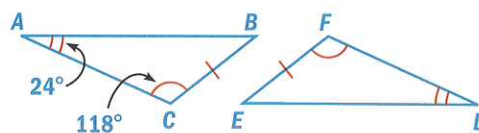
Soccer Field

In 1994, Michigan State University covered the floor of the Silverdome with natural grass for the World Cup tournament. Why do you think hexagons were used in the design?

20. **Pod Shelters** The panels of the pod shelter shown are equilateral triangles. The sides of each triangle are 7 feet long. Explain how you know the panels are congruent triangles.



21. **Challenge** Name the congruent triangles, and explain how you know that they are congruent.



Mixed Review

22. Find 1.25% of 400. 23. Find 65% of 91. (Lesson 7.7)
24. If you pick a whole number at random from 1 to 100, what is the probability that the number is a multiple of 5? (Lesson 7.8)

Find the value of x . (Lessons 8.3, 8.4)

25.



26.



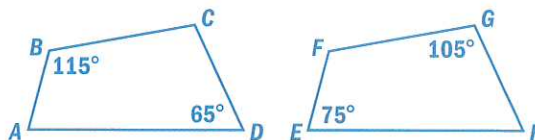
Basic Skills Plot the point in a coordinate plane.

27. $A(-9, 6)$ 28. $B(-3, -5)$ 29. $C(0, -4)$ 30. $D(4, -1)$

Test-Taking Practice

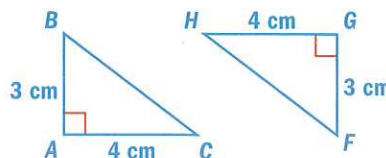


31. **Multiple Choice** Polygon $ABCD \cong$ polygon $EFGH$. Find $m\angle C$.



- A. 65° B. 75° C. 105° D. 115°

32. **Short Response** Name the congruent triangles and explain how you know that they are congruent.



8.6

Problem Solving Strategies

Make a Model

Guess, Check, and Revise

Look for a Pattern

Draw a Diagram

Write an Equation

Make a Model

Act It Out

Work Backward

Problem You are looking at a picture of a kaleidoscope image. The image includes six red shapes. Tell which red shapes are mirror images of shape 1.

1 Read and Understand

Read the problem carefully.

You need to decide which red shapes are mirror images of shape 1.

2 Make a Plan

Decide on a strategy to use.

You can identify the mirror images by making a model. Trace the kaleidoscope image. Then fold your tracing paper to see if two shapes are mirror images.

3 Solve the Problem

Reread the problem and make a model of the kaleidoscope image using tracing paper.

Trace the outline of the kaleidoscope image and the six red shapes. Also trace the lines that divide the image into six equal parts. Cut out the circle.

Fold the paper once so that shape 1 lies on top of shape 2. You can see that shape 1 and shape 2 line up with each other exactly when you fold the paper. So, shape 2 is a mirror image of shape 1.

Unfold the paper. Now fold it once so that shape 1 lies on top of shape 3. You can see that shape 1 and shape 3 do not line up with each other exactly when you fold the paper. So, shape 3 is not a mirror image of shape 1. Continue to test shapes around the circle



4 Look Back

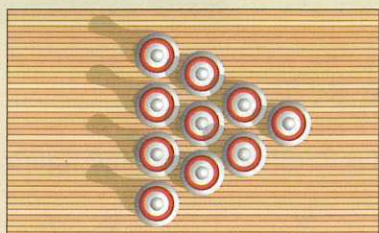
Which shapes are a mirror images of shape 1? Did you do everything asked in the problem?



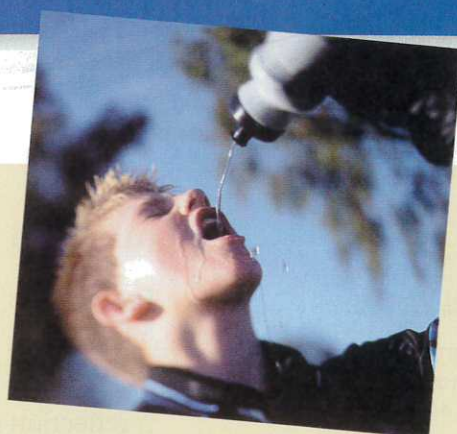
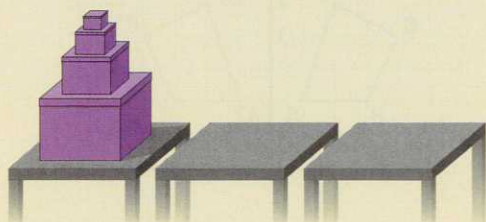
Practice the Strategy

Use the strategy *make a model*.

- Design** Sketch a kaleidoscope design that includes mirror images of a shape. Divide a circle into six equal parts to make your design. Identify the mirror images.
- Bowling Pins** Ten bowling pins are arranged in a triangle, as shown. Explain how you can make the triangle point to the left by moving only three pins.



- Seating Arrangements** Alan, David, Mary, Peter, and Scott are sitting on a bench. Alan is between Scott and David. Mary is next to Peter. There is only one person between Mary and Alan, but Mary is not next to Scott. Find two possible seating arrangements.
- Boxes** Four boxes of different sizes are stacked on a table, with the largest box on the bottom and the smallest box on the top. You need to move the entire stack of boxes to another table, but you can only move one box at a time. No box can touch the floor, and no box can support a larger box without breaking. You have one extra table to help you. List the moves it takes you to transfer the stack of boxes.



Mixed Problem Solving

Use any strategy to solve the problem.

- Hiking** You bring water on a hike. You drink a quarter of the water in the morning and a third of the remaining water at lunch time. In the afternoon, you drink two thirds of the water left in your container. When you get home, there are 16 fluid ounces of water. How much water did you bring on the hike?
- Club Planning** The Spanish Club meets every other week. The members decided to have a party during the fifth meeting. The first meeting took place on October 2. Find the date of the party.
- Test Scores** John has earned 92, 70, 95, 89, and 90 on his math tests this semester. What score must John receive on his next test to have a mean of 88?
- Numbers** You are helping your little sister with her math homework, but you can't read her writing very well. Her sevens and ones look exactly the same. She solved the problem below correctly. Decide which numerals are sevens and which are ones.

$$\begin{array}{r} 211 \\ + 546 \\ \hline 811 \end{array}$$

LESSON 8.6

Reflections and Symmetry

BEFORE

You plotted points in a coordinate plane.

Now

You'll reflect figures and identify lines of symmetry.

WHY?

So you can find symmetry in starfish, as in Example 4b.

Word Watch

reflection, p. 404
transformation, p. 404
image, p. 404
line symmetry, p. 406

In the Real World

Reflections The photo illustrates a reflection. A **reflection** creates a mirror image of each point of a figure.

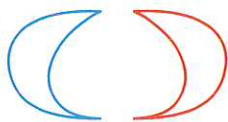
A reflection is a **transformation**, an operation that changes a figure into another figure. The new figure created is called the **image**.



EXAMPLE 1 Identifying a Reflection

Tell whether the red figure is a reflection of the blue figure.

a.



The figure is a reflection.

b.



The figure is *not* a reflection.

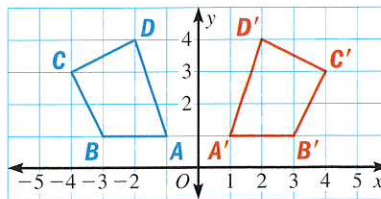
You can describe reflections of figures in a coordinate plane using coordinate notation. The notation $A \rightarrow A'$ is read "A goes to A prime."

EXAMPLE 2 Reflecting in the y-Axis

Quadrilateral $ABCD$ has been reflected in the y -axis. Write the coordinates of each vertex of quadrilateral $ABCD$ and its image, quadrilateral $A'B'C'D'$.

Solution

Original	Image
$A(-1, 1)$	$\rightarrow A'(1, 1)$
$B(-3, 1)$	$\rightarrow B'(3, 1)$
$C(-4, 3)$	$\rightarrow C'(4, 3)$
$D(-2, 4)$	$\rightarrow D'(2, 4)$



You may have noticed in Example 2 that when a point is reflected in the y -axis, its x -coordinate is multiplied by -1 .



Reflections

Reflection in the x -axis

Words To reflect a point in the x -axis, multiply its y -coordinate by -1 .

	Original	Image
Algebra	(x, y)	$\rightarrow (x, -y)$

Reflection in the y -axis

Words To reflect a point in the y -axis, multiply its x -coordinate by -1 .

	Original	Image
Algebra	(x, y)	$\rightarrow (-x, y)$

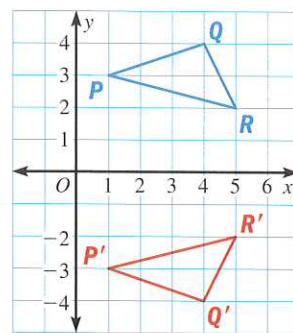
EXAMPLE 3 Reflecting in the x -Axis

Reflect $\triangle PQR$ in the x -axis.

Solution

Multiply each y -coordinate by -1 .

Original	Image
(x, y)	$\rightarrow (x, -y)$
$P(1, 3)$	$\rightarrow P'(1, -3)$
$Q(4, 4)$	$\rightarrow Q'(4, -4)$
$R(5, 2)$	$\rightarrow R'(5, -2)$



The graph shows $\triangle PQR$ and its reflection $\triangle P'Q'R'$.

Your turn now Graph the polygon and its image.

- Graph the triangle with vertices $J(0, 1)$, $K(0, 4)$, and $L(5, 2)$. Reflect the triangle in the y -axis.
- Graph the quadrilateral with vertices $S(-3, 2)$, $T(-1, 4)$, $U(-4, 5)$, and $V(-5, 3)$. Reflect the quadrilateral in the x -axis.

Symmetry A figure has **line symmetry** if one half of the figure is a mirror image of the other half. A line of symmetry divides the figure into two congruent parts that are mirror images of each other.

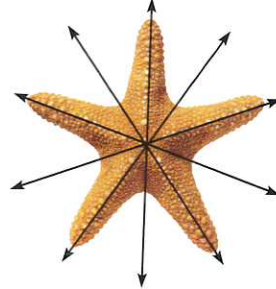
EXAMPLE 4 Identifying Lines of Symmetry

How many lines of symmetry does the picture have?

a. one line of symmetry



b. five lines of symmetry



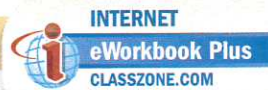
c. no lines of symmetry



8.6

Exercises

More Practice, p. 734

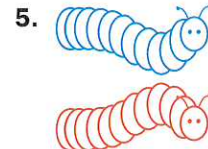
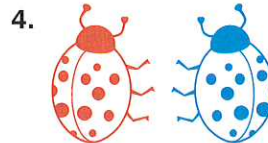


Getting Ready to Practice

Vocabulary Copy and complete the statement.

1. A(n) ? creates a mirror image of the original figure.
2. A(n) ? is an operation that changes a figure into another figure.

Tell whether the red figure is a reflection of the blue figure.



How many lines of symmetry does the design have?



Graph the polygon. Then graph its reflection in the given axis.

9. $K(2, 7)$, $L(3, 3)$, $M(6, 4)$, $N(6, 9)$; x -axis
10. $F(-8, 8)$, $G(-4, 7)$, $H(-3, 3)$, $I(-7, 4)$; y -axis

HELP with Homework

Example Exercises

- | | |
|---|-------|
| 1 | 23 |
| 2 | 13-14 |
| 3 | 11-12 |
| 4 | 15-20 |



Online Resources
CLASSZONE.COM

- More Examples
- eTutorial Plus

Practice and Problem Solving

Graph the polygon. Then graph its reflection in the given axis.

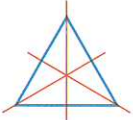
- $A(3, 6)$, $B(6, 3)$, $C(5, 0)$, $D(1, 1)$; x -axis
- $Q(-1, 3)$, $R(-3, 6)$, $S(-6, 4)$, $T(-6, 0)$; x -axis
- $B(2, -1)$, $C(5, 0)$, $D(7, -2)$, $E(0, -6)$; y -axis
- $P(0, 0)$, $Q(4, 1)$, $R(7, -3)$, $S(2, -7)$; y -axis

Sports How many lines of symmetry does the diagram have?

- 
- 

- Illustrate** Draw a quadrilateral with exactly four lines of symmetry. What kind of quadrilateral is this?

Extended Problem Solving For Exercises 18–20, use the table.

Sides	3	4	5	6	8
Regular Polygon		?	?	?	?
Lines of Symmetry	?	?	?	?	?

- Sketch** Copy the table and sketch a regular polygon with the given number of sides in each column. Draw all the lines of symmetry.
- Evaluate** Count the lines of symmetry. Complete the table.
- Look for a Pattern** How is the number of sides related to the number of lines of symmetry?
- Make a Model** Write your name at the top of a piece of tracing paper. Fold the paper and trace your name to create a reflection. Unfold the paper to see your name and its reflection.

Sara Jeanne
2919 769116

- 22. Challenge** Graph the polygon with vertices $S(-6, 0)$, $T(0, 6)$, $V(6, 0)$, $W(2, -4)$, and $X(-2, -4)$. Reflect the polygon in the x -axis and graph its image in the same coordinate plane.
- 23. Critical Thinking** A polygon has vertices $A(1, -2)$, $B(5, -1)$, $C(8, -4)$, $D(7, -7)$, and $E(4, -8)$. Reflect the polygon in the x -axis and find the vertices of its image. Then reflect the image in the y -axis. Graph the new image. Is the third polygon a reflection of the original? Explain.

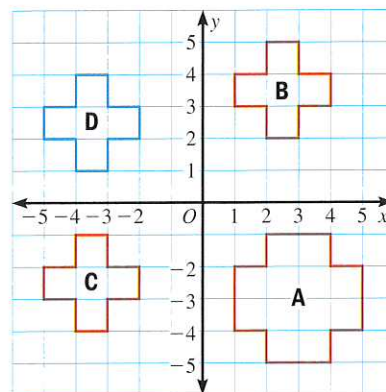
Mixed Review

In Exercises 24 and 25, find the number. (Lesson 7.3)

- 24.** What is 0.8% of 500? **25.** 756 is what percent of 270?
- 26.** Find the sum of the angle measures in a 9-gon. (Lesson 8.4)
- 27.** Find the measure of one angle in a regular 12-gon. (Lesson 8.4)

Test-Taking Practice

- 28. Multiple Choice** Which figure is a reflected image of figure D?
- A. figure A B. figure B
C. figure C D. none
- 29. Short Response** Copy figure A and draw all its lines of symmetry. Where do the lines intersect?



Deep Reflections

Use a mirror to read this quotation from William Shakespeare.

...nd yllreht...
...tstion...
...tstion...
...nd yllreht...



LESSON 8.7

Translations and Rotations

BEFORE

You reflected figures in a coordinate plane.

Now

You'll translate or rotate figures in a coordinate plane.

WHY?

So you can describe origami models, as in Exs. 5–6.

Word Watch

translation, p. 409
rotation, p. 410

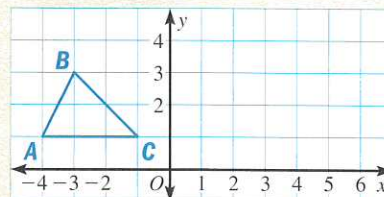
Activity

You can see how moving a triangle changes its vertices.

- Graph an image of A by moving it 7 units to the right and 2 units up. Plot the new vertex and label it A' .

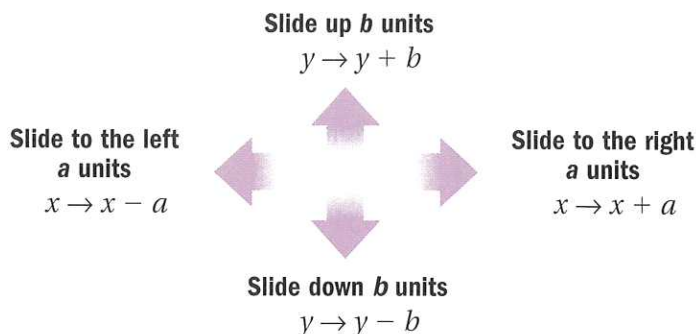
- Repeat Step 1 with B and C . Then connect the vertices to form $\triangle A'B'C'$.

- How are the coordinates of A , B , and C related to A' , B' , and C' ?



In the activity, you transformed $\triangle ABC$ by *sliding* it. A **translation** is a transformation that moves each point of a figure the same distance in the same direction. The image is congruent to the original figure.

To translate a figure in a coordinate plane, you change the coordinates of its points. When a and b are positive, you can use the guidelines below.



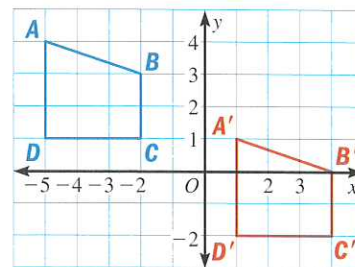
EXAMPLE 1 Using Coordinate Notation

Describe the translation from the blue figure to the red figure.

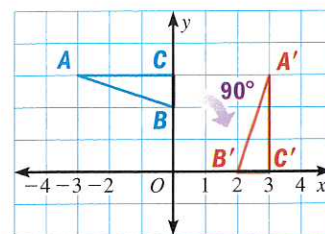
Solution

Each point moves 6 units to the right and 3 units down. The translation is

$$(x, y) \rightarrow (x + 6, y - 3).$$



Rotations A **rotation** is a transformation that turns each point of a figure the same number of degrees around a common point. In this lesson, figures will always be turned around the origin.



90° Rotations

90° Clockwise Rotation

Words To rotate a point 90° *clockwise*, switch the coordinates, then multiply the new y -coordinate by -1 .

Numbers $P(6, 2) \rightarrow P'(2, -6)$ **Algebra** $P(x, y) \rightarrow P'(y, -x)$

90° Counterclockwise Rotation

Words To rotate a point 90° *counterclockwise*, switch the coordinates, then multiply the new x -coordinate by -1 .

Numbers $P(5, 3) \rightarrow P'(-3, 5)$ **Algebra** $P(x, y) \rightarrow P'(-y, x)$

HELP

with Reading

Clockwise is the direction the hands on a clock turn. Counterclockwise is the opposite direction.

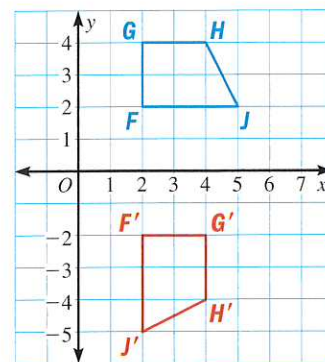
EXAMPLE 2 Rotating 90° Clockwise

Rotate quadrilateral $FGHJ$ 90° clockwise.

Solution

Original	Image
$(x, y) \rightarrow$	$(y, -x)$
$F(2, 2) \rightarrow$	$F'(2, -2)$
$G(2, 4) \rightarrow$	$G'(4, -2)$
$H(4, 4) \rightarrow$	$H'(4, -4)$
$J(5, 2) \rightarrow$	$J'(2, -5)$

The graph shows $FGHJ$ and $F'G'H'J'$.



Your turn now Graph the figure with the given vertices and its image after the rotation.

1. $A(1, 1)$, $B(3, 1)$, $C(3, 3)$, and $D(1, 4)$; 90° clockwise
2. $K(-1, 3)$, $L(1, 5)$, and $M(2, 3)$; 90° counterclockwise



180° Rotation

Words To rotate a point 180°, multiply its coordinates by -1 .

Numbers $P(4, 1) \rightarrow P'(-4, -1)$ **Algebra** $P(x, y) \rightarrow P'(-x, -y)$

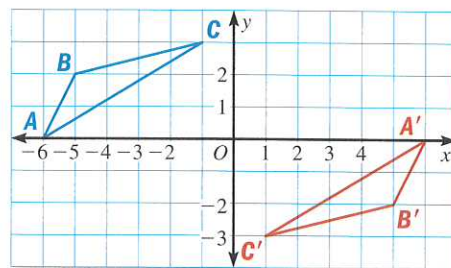
EXAMPLE 3 Rotating 180°

Rotate $\triangle ABC$ 180°.

Solution

Original	Image
(x, y)	$\rightarrow (-x, -y)$
$A(-6, 0)$	$\rightarrow A'(6, 0)$
$B(-5, 2)$	$\rightarrow B'(5, -2)$
$C(-1, 3)$	$\rightarrow C'(1, -3)$

The graph shows $\triangle ABC$ and $\triangle A'B'C'$.



8.7

Exercises

More Practice, p. 734



INTERNET

eWorkbook Plus
CLASSZONE.COM

HELP

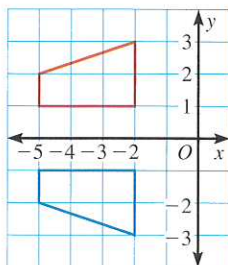
with Vocabulary

Reflection is a **Flip**.
Rotation is a **Turn**.
Translation is a **Slide**.

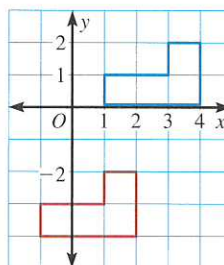
Getting Ready to Practice

Vocabulary Name the transformation shown in the graph.

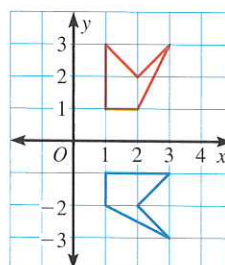
1.



2.



3.



4. **Guided Problem Solving** Rotate $\triangle RST$ 90° counterclockwise.

- 1 Graph $\triangle RST$ with vertices $R(-2, -1)$, $S(-5, -2)$, and $T(-4, 2)$.
- 2 Find the vertices of the triangle's image.
- 3 Graph $\triangle R'S'T'$, the image of $\triangle RST$ after rotation.

HELP with Homework

Example Exercises

- | | |
|---|--------|
| 1 | 15-16 |
| 2 | 20, 23 |
| 3 | 19, 22 |



Online Resources
CLASSZONE.COM

- More Examples
- eTutorial Plus



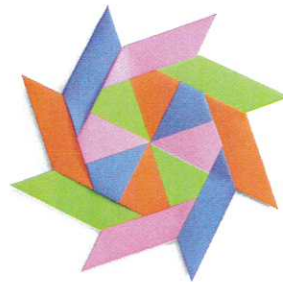
Practice and Problem Solving

Origami Describe the transformation shown in the origami model.

5.



6.

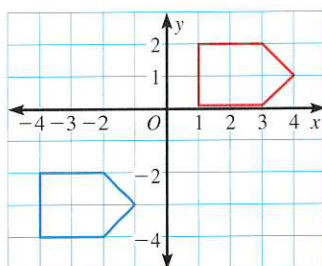


Name the type of transformation modeled by the action.

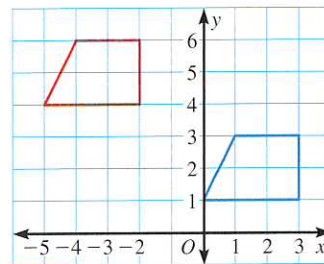
- | | |
|--------------------------------|--------------------------------|
| 7. riding down an escalator | 8. passing food around a table |
| 9. making a handprint in clay | 10. playing checkers |
| 11. opening a combination lock | 12. going down a water slide |
| 13. riding a carousel | 14. looking in a mirror |

Use coordinate notation to describe the translation from the blue figure to the red figure.

15.



16.



17. $\triangle PQR$ has vertices $P(0, -1)$, $Q(3, -1)$, and $R(5, -3)$. Find the vertices of its image after the translation $(x, y) \rightarrow (x - 5, y + 1)$.
18. $\triangle LMN$ has vertices $L(4, 2)$, $M(0, 3)$, and $N(1, 1)$. Find the vertices of its image after the translation $(x, y) \rightarrow (x + 1, y - 6)$.

Graph $\triangle LMN$ with vertices $L(2, 0)$, $M(2, 3)$, and $N(6, 0)$. Then graph its image after the given transformation.

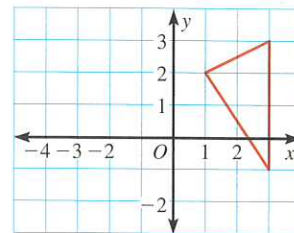
- Rotate 180° .
- Rotate 90° counterclockwise.
- Translate using $(x, y) \rightarrow (x - 3, y - 4)$.
- Rotate 180° then translate using $(x, y) \rightarrow (x + 1, y + 1)$.
- Rotate 90° clockwise three times.
- Translate using $(x, y) \rightarrow (x + 3, y)$ then rotate 180° .

HELP with Review

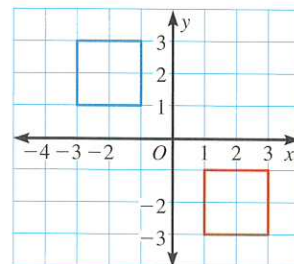
For help with quadrants, see p. 91.

25. **Writing** Point A in Quadrant II is rotated 180° . Find the quadrant of point A' . Point B in Quadrant IV is rotated 90° clockwise. Find the quadrant of point B' . Explain your reasoning.

26. **Challenge** The figure is the image of a triangle rotated 90° clockwise and reflected in the y -axis. Graph the original figure.



27. **Multiple Methods** Describe four different transformations of the blue square to the red square. You may include combinations of transformations.



Mixed Review

Solve the proportion. (Lesson 7.2)

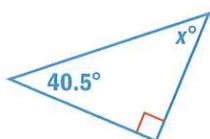
28. $\frac{a}{25} = \frac{24}{200}$

29. $\frac{32}{9} = \frac{c}{108}$

30. $\frac{7}{60} = \frac{154}{d}$

Find the value of x . Classify the triangle by its angles. (Lesson 8.2)

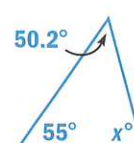
31.



32.



33.



Basic Skills Find the mean, median, and mode(s).

34. 39, 45, 43, 28, 45, 48, 39, 45

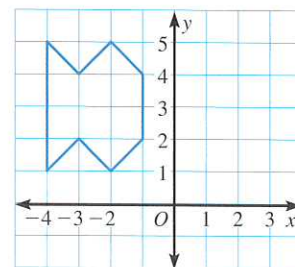
35. 110, 108, 118, 110, 105

Test-Taking Practice

36. **Extended Response** Rotate the figure 90° clockwise. Reflect the image in the y -axis. Graph the final image. Complete the rule for the double transformation you performed.

$(x, y) \rightarrow (\underline{\quad}, \underline{\quad})$

Explain your reasoning.



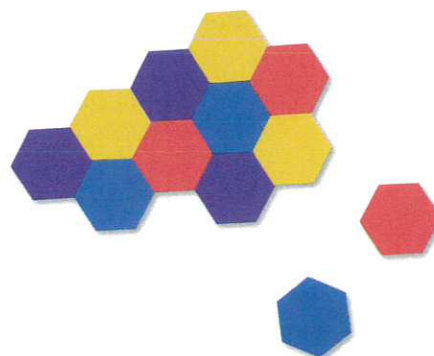
Tessellations

GOAL Decide if a shape tessellates. Create tessellations.

Word Watch

tessellation, p. 414

Tessellations You can use reflections, rotations, and translations to create a *tessellation*, like the one shown here. A **tessellation** is a repeating pattern of figures that covers a plane with no gaps or overlaps. If a figure can be used to create a tessellation, you say the figure *tessellates*.



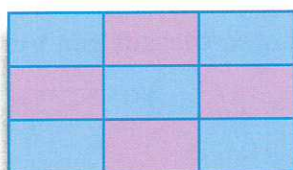
EXAMPLE 1 Identifying Tessellating Polygons

Tell whether the polygon tessellates.

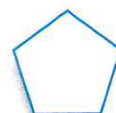
a.



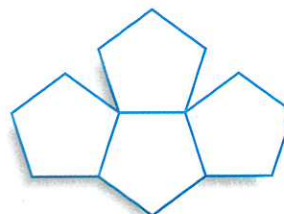
Yes, you can create a tessellation by translating a rectangle.



b.



No, regular pentagons will not cover the plane without gaps or overlaps.



You can create a tessellation by altering a polygon that tessellates.

EXAMPLE 2 Creating a Tessellation

Alter a parallelogram to create a tessellation.



Cut a triangle from the parallelogram.



Slide the triangle to the opposite side.



Translate the figure to create a tessellation.

EXAMPLE 3 Creating a Tessellation

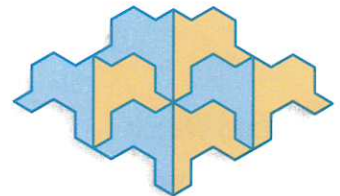
Create a tessellation by altering an equilateral triangle.



Cut a piece from the triangle.



Slide the piece to another side.

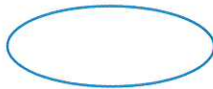


Reflect the figure then translate the pair.

Exercises

Tell whether the figure tessellates.

1.



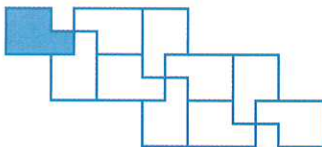
2.



3.



4. Explain how you can transform the blue shape to create the tessellation.

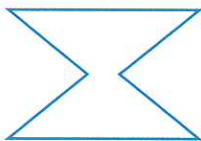


5. Copy and continue the pattern.

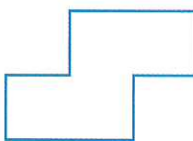


Copy the polygon and use it to create a tessellation. Describe how the polygon was transformed in your tessellation.

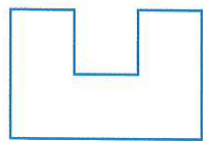
6.



7.



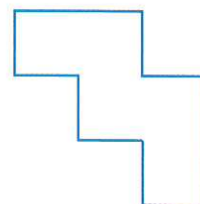
8.



9. **Make a Model** Create a tessellation by altering a rectangle.

10. Create a tessellation by altering a parallelogram that is not a rectangle.

11. Create two different tessellations using the shape at the right.



LESSON 8.8

Similarity and Dilations

BEFORE

You used congruent polygons to find missing measures.

Now

You'll use similar polygons to find missing measures.

WHY?

So you can find the height of a sand castle, as in Ex. 14.

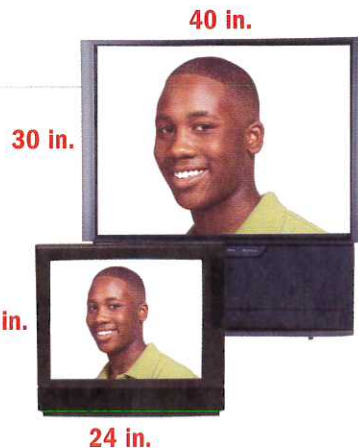
Word Watch

similar polygons, p. 416
dilation, p. 418
scale factor, p. 418

In the Real World

Television Screens The television screens shown here are different sizes, but they have the same shape. How are they related?

Similar polygons have the same shape, but they can be different sizes. The symbol \sim means "is similar to." When you name similar polygons, list their corresponding vertices in the same order.



Similar Polygons

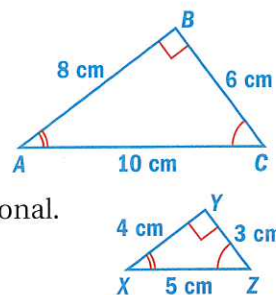
$$\triangle ABC \sim \triangle XYZ$$

Corresponding angles are congruent.

$$\angle A \cong \angle X \quad \angle B \cong \angle Y \quad \angle C \cong \angle Z$$

Corresponding side lengths are proportional.

$$\frac{AB}{XY} = \frac{BC}{YZ} \quad \frac{BC}{YZ} = \frac{AC}{XZ} \quad \frac{AC}{XZ} = \frac{AB}{XY}$$



EXAMPLE 1

Identifying Similar Polygons

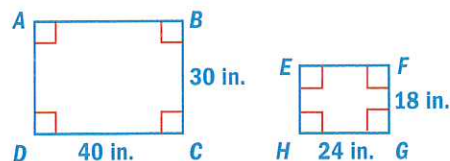
Tell whether the television screens are similar.

- (1) Corresponding angles are congruent. Each angle measures 90° .
 $\angle A \cong \angle E$ $\angle B \cong \angle F$ $\angle C \cong \angle G$ $\angle D \cong \angle H$

- (2) Corresponding side lengths are proportional.

$$\frac{30 \text{ inches}}{18 \text{ inches}} = \frac{40 \text{ inches}}{24 \text{ inches}}$$

$$720 = 720$$



ANSWER Quadrilateral $ABCD \sim$ quadrilateral $EFGH$

For help with writing and solving proportions, see p. 322.

EXAMPLE 2 Using Similar Triangles

In the diagram, $\triangle KLM \sim \triangle NPQ$. Find the value of y .

Corresponding side lengths are proportional.

$$\frac{KL}{NP} = \frac{LM}{PQ}$$

Write a proportion.

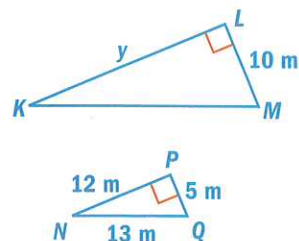
$$\frac{y}{12} = \frac{10}{5}$$

Substitute given values.

$$y = 24$$

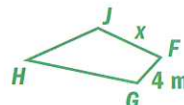
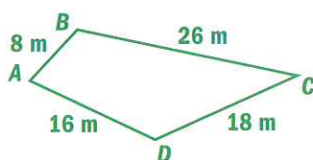
Solve the proportion.

ANSWER The value of y is 24 meters.



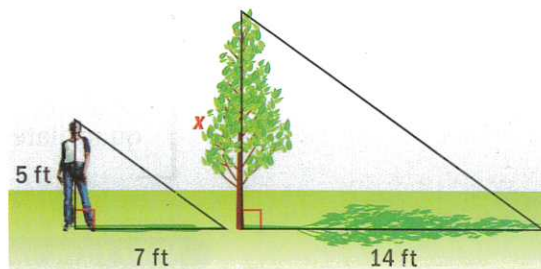
Your turn now Find the value of x .

1. Quadrilateral $ABCD \sim$ quadrilateral $FGHJ$



EXAMPLE 3 Using Indirect Measurement

Height Alma is 5 feet tall and casts a 7 foot shadow. At the same time, a tree casts a 14 foot shadow. The triangles formed are similar. Find the height of the tree.



Solution

You can use a proportion to find the height of the tree.

$$\frac{\text{Tree's height}}{\text{Alma's height}} = \frac{\text{Length of tree's shadow}}{\text{Length of Alma's shadow}}$$

Write a proportion.

$$\frac{x \text{ feet}}{5 \text{ feet}} = \frac{14 \text{ feet}}{7 \text{ feet}}$$

Substitute given values.

$$x = 10$$

Solve the proportion.

ANSWER The tree is 10 feet tall.

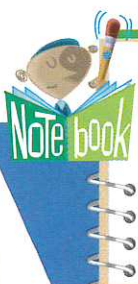
Dilations A **dilation** stretches or shrinks a figure. The image created by a dilation is similar to the original figure. The **scale factor** of a dilation is the ratio of corresponding side lengths. In this course, the center of dilation will always be the origin.

Watch Out!



The scale factor is the ratio of corresponding side lengths:

$$\frac{\text{after dilation}}{\text{before dilation}}$$



Dilation

Words To dilate a polygon, multiply the coordinates of each vertex by the scale factor k and connect the vertices.

Numbers $P(4, 1) \rightarrow P'(8, 2)$ **Algebra** $P(x, y) \rightarrow P'(kx, ky)$

EXAMPLE 4 Dilating a Polygon

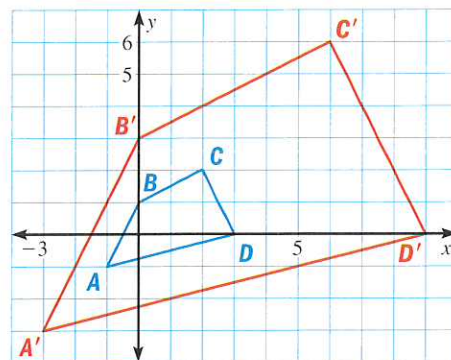
Quadrilateral $ABCD$ has vertices $A(-1, -1)$, $B(0, 1)$, $C(2, 2)$, and $D(3, 0)$. Dilate using a scale factor of 3.

Solution

Graph the quadrilateral. Find the vertices of the image.

Original	Image
(x, y)	$\rightarrow (3x, 3y)$
$A(-1, -1)$	$\rightarrow A'(-3, -3)$
$B(0, 1)$	$\rightarrow B'(0, 3)$
$C(2, 2)$	$\rightarrow C'(6, 6)$
$D(3, 0)$	$\rightarrow D'(9, 0)$

Graph the image of the quadrilateral.



Your turn now Graph the polygon with the given vertices. Then graph its image after dilation by the scale factor k .

- Triangle RST has vertices $R(1, 1)$, $S(3, 2)$, and $T(2, 3)$; $k = 2$.
- Quadrilateral $MNPQ$ has vertices $M(1, 0)$, $N(0, -1)$, $P(-1, 0)$, and $Q(0, 1)$; $k = 4$.
- Triangle JKL has vertices $J(0, 2)$, $K(6, 4)$, and $L(2, -2)$; $k = \frac{1}{2}$.
- Quadrilateral $CDGH$ has vertices $C(-6, -6)$, $D(-3, -3)$, $G(0, -3)$, and $H(3, -6)$; $k = \frac{1}{3}$.

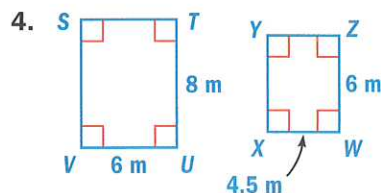
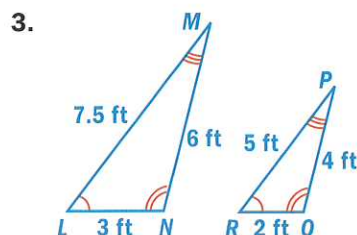


Getting Ready to Practice

Vocabulary Copy and complete the statement.

- The ? of a dilation is the ratio of corresponding side lengths.
- A figure and its image after dilation are always ?.

Name the similar polygons.



5. **Guided Problem Solving** Dilate $\triangle ABC$ using a scale factor of $\frac{1}{3}$.
- Graph $\triangle ABC$ with vertices $A(3, 6)$, $B(-3, -3)$, and $C(6, 0)$.
 - Find the vertices of its image using the scale factor.
 - Graph the image.

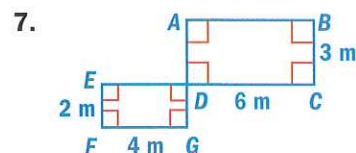
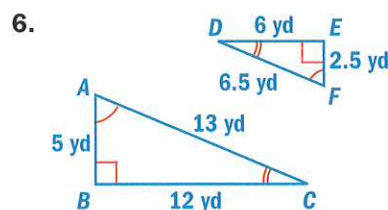
Watch Out!



Remember that corresponding parts are in the same position on different polygons.

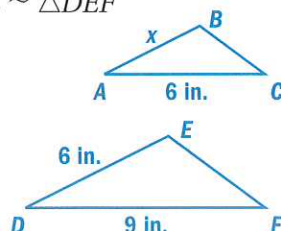
Practice and Problem Solving

In Exercises 6 and 7, name the similar polygons.

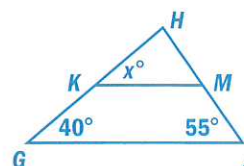


Use the similar triangles to find the value of x .

8. $\triangle ABC \sim \triangle DEF$



9. $\triangle GHJ \sim \triangle KHM$



HELP with Homework

Example Exercises

- 6-7
- 8-13
- 14, 21
- 15-19



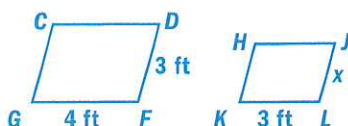
Online Resources
CLASSZONE.COM

- More Examples
- eTutorial Plus

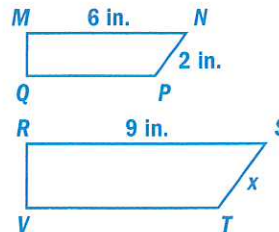


Use the similar polygons to find the value of x .

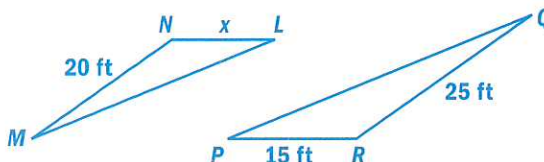
10. Parallelogram $CDFG$ is similar to parallelogram $HJLK$.



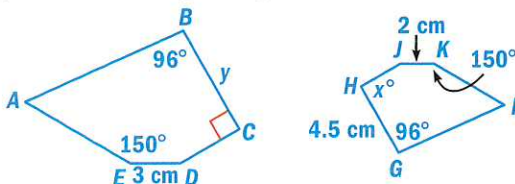
11. Trapezoid $MNPQ$ is similar to trapezoid $RSTV$.



12. $\triangle LMN$ is similar to $\triangle PQR$. Find the value of x .



13. Pentagon $ABCDE \sim$ pentagon $FGHIK$. Find the values of x and y .



14. **Indirect Measurement** A sand castle casts an 18 foot shadow. At the same time, your 5 foot friend casts a 20 foot shadow. How tall is the sand castle?

Graph the polygon with the given vertices. Then graph its image after dilation by the scale factor k .

15. $W(2, 2), X(0, 4), Y(4, 6), Z(6, 0); k = 3$

16. $B(0, -2), C(4, 2), D(2, 6), E(-2, 6), F(-4, 2); k = \frac{1}{2}$

17. $R(8, 8), S(-4, 4), T(-4, -4); k = \frac{3}{4}$

18. $L(2, -2), M(4, 2), N(-3, 2), P(-1, -2); k = 4$

19. $G(-2, -6), H(-8, -8), J(-6, -2), K(0, 0); k = 1.5$



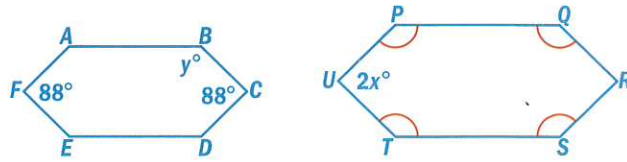
20. **Calculate** Pentagon $KLMNP$ has vertices $K(24.1, 5.2), L(4.9, 5.3), M(6.8, 0.2), N(3.3, 4.8),$ and $P(25.8, 22.1)$. Use the scale factor 1.8 to find the vertices of its image after dilation.

21. **Photo Reduction** You reduce a 12 inch by 24 inch photo to $\frac{1}{3}$ of its original dimensions. What are the new dimensions of the photo?

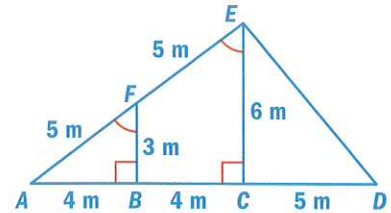


22. **Writing** Explain why all squares are similar.

23. **Algebra** Hexagon $ABCDEF$ is similar to hexagon $PQRSTU$. Find the values of x and y .



24. **Analyze** If a polygon is dilated by a scale factor of 1, will the image be *larger than*, *smaller than*, or *identical to* the original polygon? Explain.
25. **Challenge** Name two similar polygons in the diagram. Find their scale factor.



Mixed Review

Choose a Strategy Use a strategy from the list to solve the following problem. Explain your choice of strategy.

26. An ice cream stand offers vanilla, chocolate, mint chip, cookie crumble, and strawberry ice cream. Write all the possible 2 scoop cones you can order. How many possibilities are there?

Problem Solving Strategies

- Look for a Pattern
- Draw a Diagram
- Make a List
- Make a Model

27. You sell your bike for \$50 but owe your parents 45% of the selling price. How much money do you have left after you repay your parents? (*Lesson 7.3*)
28. Graph the polygon with vertices $A(0, 1)$, $B(3, 4)$, $C(9, 3)$, and $D(7, -3)$. Then graph its image after reflection in the x -axis. (*Lesson 8.6*)

Test-Taking Practice

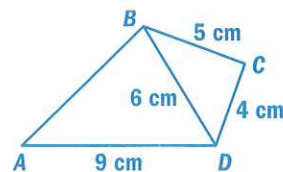


29. **Multiple Choice** Jenny is 5 feet tall and casts a 3 foot shadow. At the same time, a flagpole casts a 15 foot shadow. What mathematical idea can Jenny use to find the height of the flag pole?

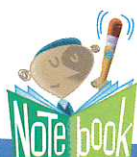
A. inequality B. congruence C. similarity D. symmetry

30. **Multiple Choice** Find the length of \overline{AB} . $\triangle ABD \sim \triangle BCD$.

F. 6 cm G. 7.2 cm
H. 7.5 cm I. 11.25 cm



Notebook Review



Review the vocabulary definitions in your notebook.

Copy the review examples in your notebook. Then complete the exercises.

Check Your Definitions

congruent sides, angles, p. 397	transformation, p. 404	rotation, p. 410
corresponding parts, p. 397	image, p. 404	similar polygons, p. 416
reflection, p. 404	line symmetry, p. 406	dilation, p. 418
	translation, p. 409	scale factor, p. 418

Use Your Vocabulary

Copy and complete the sentence with a review word.

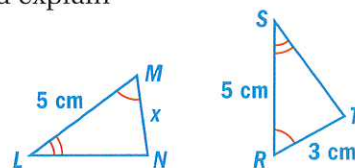
1. A(n) ? creates a mirror image of a figure.
2. A(n) ? is a transformation that slides a figure.

8.5 Can you name congruent polygons?



EXAMPLE Name the congruent triangles and explain how you know that they are congruent.

ANSWER $\triangle LMN \cong \triangle SRT$ by Angle-Side-Angle



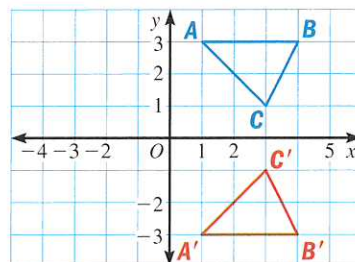
3. Find the value of x using the triangles above.

8.6–8.7 Can you reflect and rotate figures?



EXAMPLE Graph $\triangle ABC$ with vertices $A(1, 3)$, $B(4, 3)$, and $C(3, 1)$. Then graph its reflection in the x -axis.

Original	Image
$(x, y) \rightarrow$	$(x, -y)$
$A(1, 3) \rightarrow$	$A'(1, -3)$
$B(4, 3) \rightarrow$	$B'(4, -3)$
$C(3, 1) \rightarrow$	$C'(3, -1)$

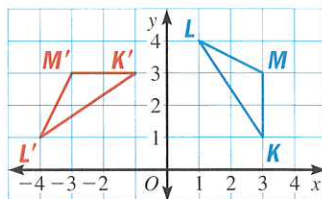


4. Graph the reflection of $\triangle ABC$ in the y -axis.

Review

EXAMPLE Rotate $\triangle KLM$ 90° counterclockwise.

Original		Image
(x, y)	\rightarrow	$(-y, x)$
$K(3, 1)$	\rightarrow	$K'(-1, 3)$
$L(1, 4)$	\rightarrow	$L'(-4, 1)$
$M(3, 3)$	\rightarrow	$M'(-3, 3)$



- ☒ 5. Rotate $\triangle KLM$ 180° .

8.8 Can you use similarity to find measures?

Review

EXAMPLE Polygons $ABCD$ and $FGHJ$ are similar. Find the value of x .

$$\frac{AB}{FG} = \frac{BC}{GH}$$

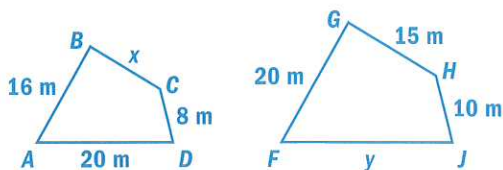
Write a proportion.

$$\frac{16}{20} = \frac{x}{15}$$

Substitute.

$$x = 12$$

Solve for x .



- ☒ 6. Use the similar polygons to find the value of y .

Stop and Think

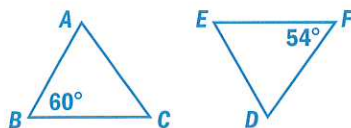
about Lessons 8.5–8.8



7. **Writing** Explain how dilation affects the perimeter of a figure.
8. **Critical Thinking** Give a real world example of a 180° rotation.

Review Quiz 2

1. In the diagram, $\triangle ABC \cong \triangle DEF$. Find $m\angle D$.



Name the type of transformation modeled by the action.

- | | |
|---|-------------------------|
| 2. sledding downhill | 3. leaving fingerprints |
| 4. spinning in place | 5. opening a drawer |
| 6. Graph $\triangle ABC$ with vertices $A(1, 1)$, $B(2, 3)$, and $C(3, 0)$. Dilate the triangle using a scale factor of 4. | |

Chapter Review

Vocabulary

straight angle,
right angle, p. 375
supplementary,
complementary angles,
p. 375
vertical angles, p. 376
perpendicular lines,
p. 376
parallel lines, p. 377
acute, right, obtuse
angle, p. 382
acute, right, obtuse
triangle, p. 382

equilateral, isosceles,
scalene triangle,
p. 382
quadrilateral, p. 386
trapezoid, parallelogram,
rhombus, p. 386
polygon, regular polygon,
p. 390
pentagon, hexagon,
heptagon, octagon,
p. 390
congruent sides, angles,
p. 397

corresponding parts,
p. 397
reflection, p. 404
transformation, p. 404
image, p. 404
line symmetry, p. 406
translation, p. 409
rotation, p. 410
similar polygons, p. 416
dilation, p. 418
scale factor, p. 418

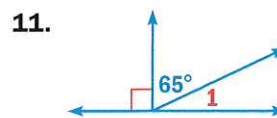
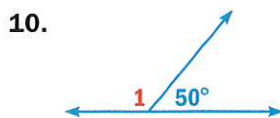
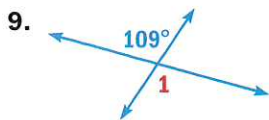
Vocabulary Review

Matching Match each word with the correct definition.

- | | |
|-------------------------|---|
| 1. transformation | A. Two angles whose measures have a sum of 90° |
| 2. reflection | B. A transformation that stretches or shrinks a figure |
| 3. parallel lines | C. Two angles whose measures have a sum of 180° |
| 4. complementary angles | D. A transformation that slides a figure |
| 5. supplementary angles | E. A transformation that creates a mirror image of a figure |
| 6. perpendicular lines | F. Two lines in the same plane that do not intersect |
| 7. translation | G. An operation that changes one figure into another figure |
| 8. dilation | H. Two lines that intersect to form a right angle |

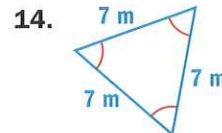
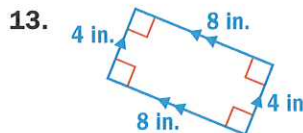
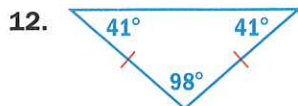
Review Questions

Find the measure of $\angle 1$. (Lesson 8.1)



Review Questions

Classify the polygon. (Lessons 8.2, 8.3)



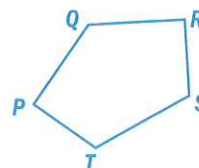
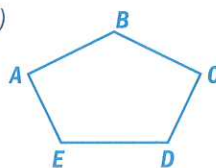
15. Find the sum of the angle measures in a heptagon. (Lesson 8.4)

16. Find the measure of one angle in a regular pentagon. (Lesson 8.4)

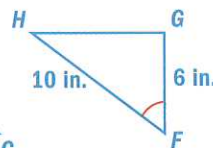
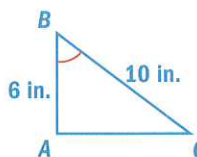
Pentagon $ABCDE \cong$ pentagon $PQRST$. (Lesson 8.5)

17. Name the congruent corresponding angles.

18. Name the congruent corresponding sides.



19. Name the congruent triangles and explain how you know they are congruent. (Lesson 8.5)

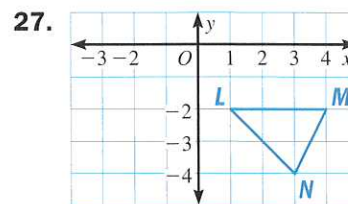
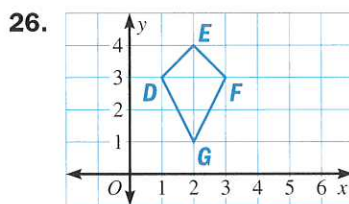
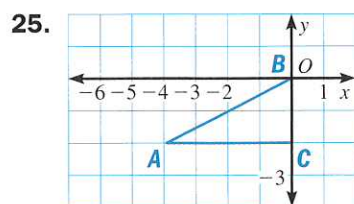


Tell whether the red figure is a reflection of the blue figure. (Lesson 8.6)



24. $\triangle XYZ$ has vertices $X(-1, 1)$, $Y(-3, 1)$, and $Z(-2, 5)$. Reflect $\triangle XYZ$ in the y -axis. Find the vertices of the image. (Lesson 8.6)

Rotate the polygon 90° clockwise and graph its image. (Lesson 8.7)



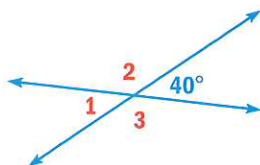
28. **Building Height** A 20 foot flagpole stands beside a building. The flagpole casts a shadow that is 25 feet long. At the same time, the building casts a shadow that is 60 feet long. How tall is the building? (Lesson 8.8)

29. A polygon has vertices $A(-2, 0)$, $B(-2, 4)$, $C(-6, 8)$, and $D(-12, 6)$. Dilate it using a scale factor of 2. Find the vertices of the image. (Lesson 8.8)

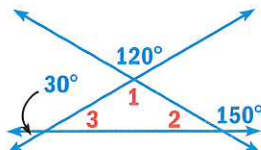
Chapter Test

Find the measures of the numbered angles.

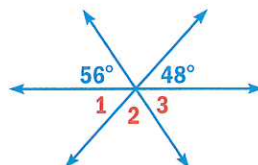
1.



2.



3.

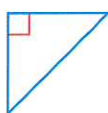


Classify the triangle by its angles.

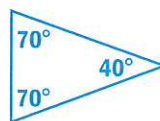
4.



5.



6.

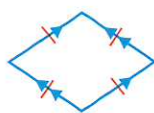


Classify the quadrilateral.

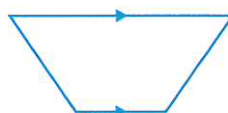
7.



8.



9.



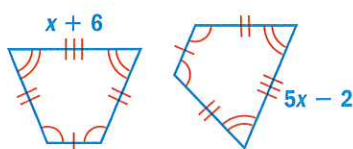
Find the measure of one angle in the polygon.

10. square

11. regular octagon

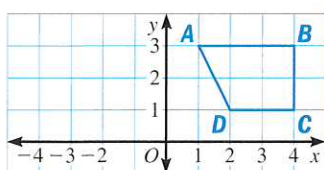
12. regular 9-gon

13. **Algebra** Write and solve an equation to find the value of x .



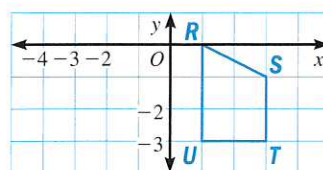
Graph the image of the given transformation.

14. Rotate 180° .



15. Translate using

$$(x, y) \rightarrow (x - 5, y + 3).$$



16. **Shadows** Joe is 72 inches tall and has a 108 inch shadow. At the same time, Martha has a 96 inch shadow. How tall is Martha?



Chapter Standardized Test

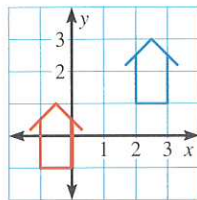
Test-Taking Strategy You can make notes, sketches, or graphs in your test booklet to help you solve problems, but you must keep your answer sheet neat.

Multiple Choice

1. $\angle A$ is supplementary to $\angle B$ and $m\angle A = 62^\circ$. What is $m\angle B$?

A. 28° B. 118° C. 152° D. 298°

2. Which transformation takes the blue figure to the red figure?



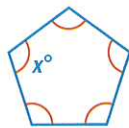
- F. reflection in x -axis
G. 90° rotation
H. $(x, y) \rightarrow (x + 3, y + 2)$
I. $(x, y) \rightarrow (x - 3, y - 2)$

3. Which statement is *not* always true?

- A. A rhombus is a figure with four sides.
B. A rhombus has four right angles.
C. A rhombus has parallel opposite sides.
D. A rhombus has four sides of equal length.

4. What is the value of x ?

- F. 108 G. 144
H. 180 I. 540



5. What is the sum of the angle measures in a 9-gon?

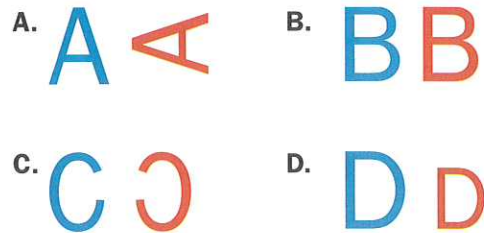
- A. 1260° B. 1620° C. 2520° D. 3240°

6. How many lines of symmetry does the figure have?

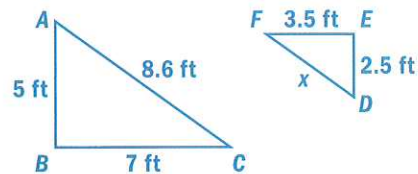
- F. 0 G. 1
H. 2 I. 4



7. Which diagram shows a reflection?



8. $\triangle ABC \sim \triangle DEF$. What is the value of x ?



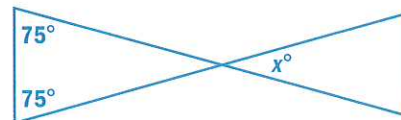
- F. 2.5 ft G. 3.5 ft H. 4.3 ft I. 5.1 ft

9. Which statement is *always* true?

- A. Supplementary angles are congruent.
B. Complementary angles are congruent.
C. Acute angles are congruent.
D. Vertical angles are congruent.

Short Response

10. Find the value of x and explain your steps.



Extended Response

11. Graph $\triangle RST$ with vertices $R(1, 3)$, $S(3, 0)$, and $T(1, 0)$. Graph $\triangle BCA$ with vertices $A(-3, 0)$, $B(-1, 3)$, and $C(-1, 0)$. Explain how you know the two triangles are congruent.

Real Numbers and Right Triangles

BEFORE

In previous chapters you've...

- Found the square of a number
- Investigated rational numbers

Now

In Chapter 9 you'll study...

- Finding square roots
- Classifying real numbers as rational or irrational
- Solving real-world problems using the Pythagorean theorem
- Using trigonometric ratios

WHY?

So you can solve real-world problems about...

- forest rangers, p. 435
- parasailing, p. 444
- softball, p. 456
- totem poles, p. 466



Internet Preview

CLASSZONE.COM

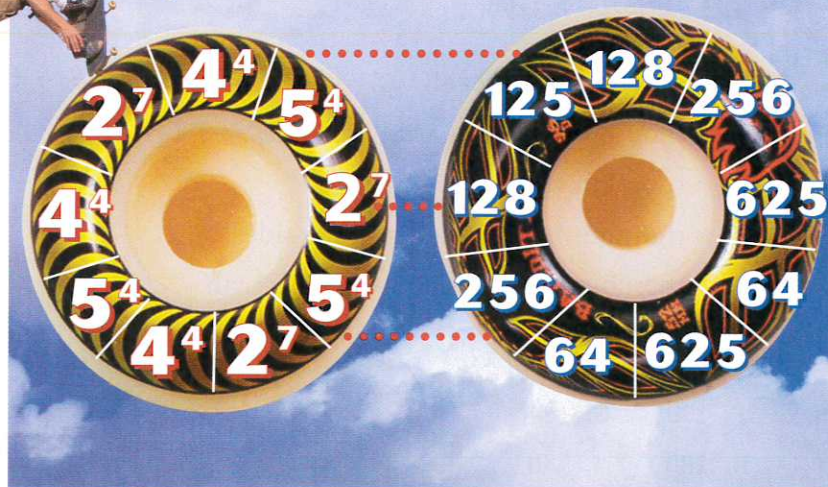
- eEdition Plus Online
- eWorkbook Plus Online
- eTutorial Plus Online
- State Test Practice
- More Examples

Chapter Warm-Up Games

Review skills you need for this chapter in these quick games.



Spin Your Wheels



Key Skill:
Evaluating powers

Spin the wheels until all three red lines connect equal values.

- You can turn the wheels one click at a time. Each click moves a wheel one space clockwise.
- How many clicks do you need to turn the left wheel?
- How many clicks do you need to turn the right wheel?