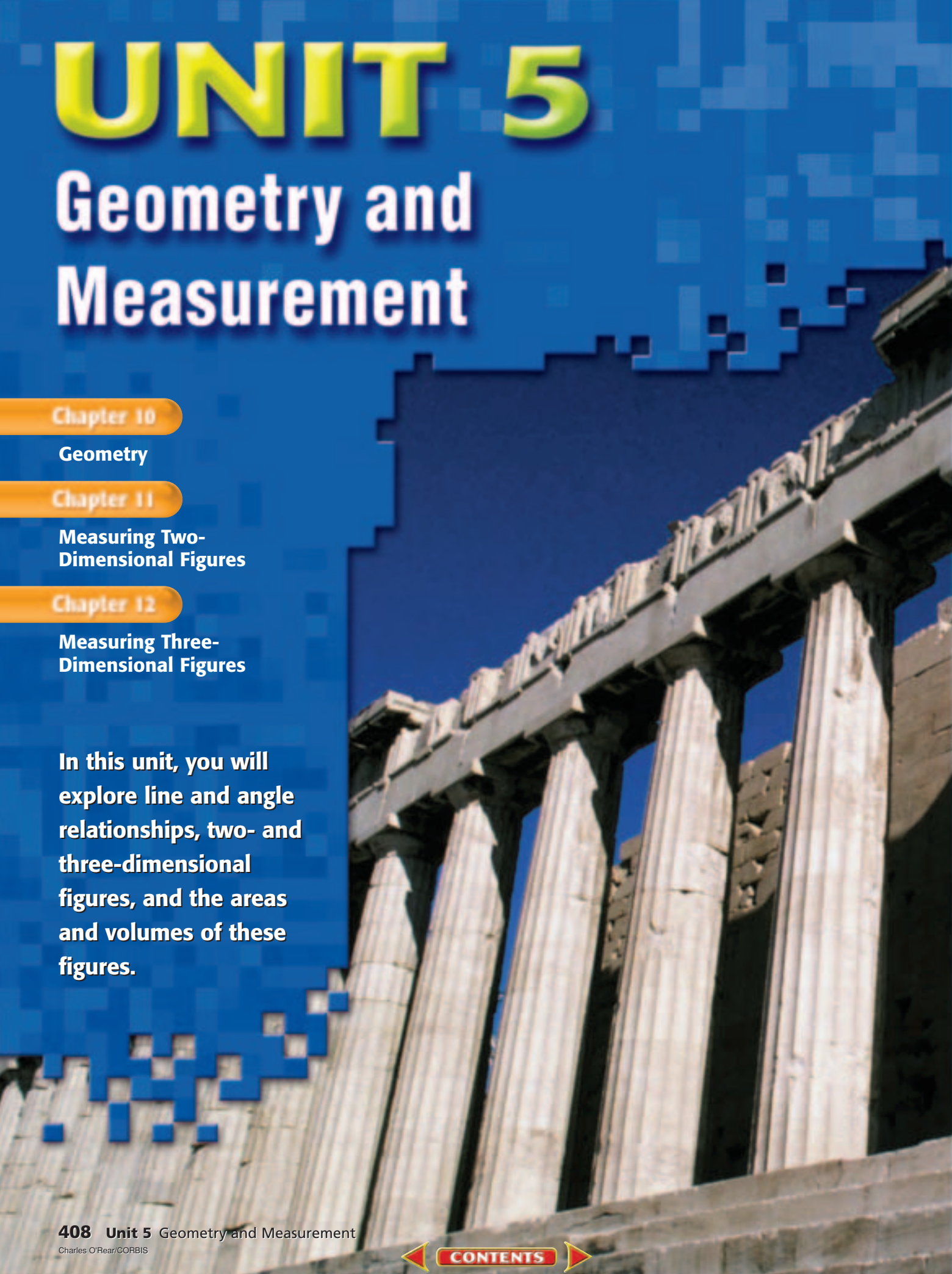
UNIT 5
Geometry and Measurement



Chapter 10

Geometry

Chapter 11

Measuring Two-Dimensional Figures

Chapter 12

Measuring Three-Dimensional Figures

In this unit, you will explore line and angle relationships, two- and three-dimensional figures, and the areas and volumes of these figures.

Charles O'Rear/CORBIS

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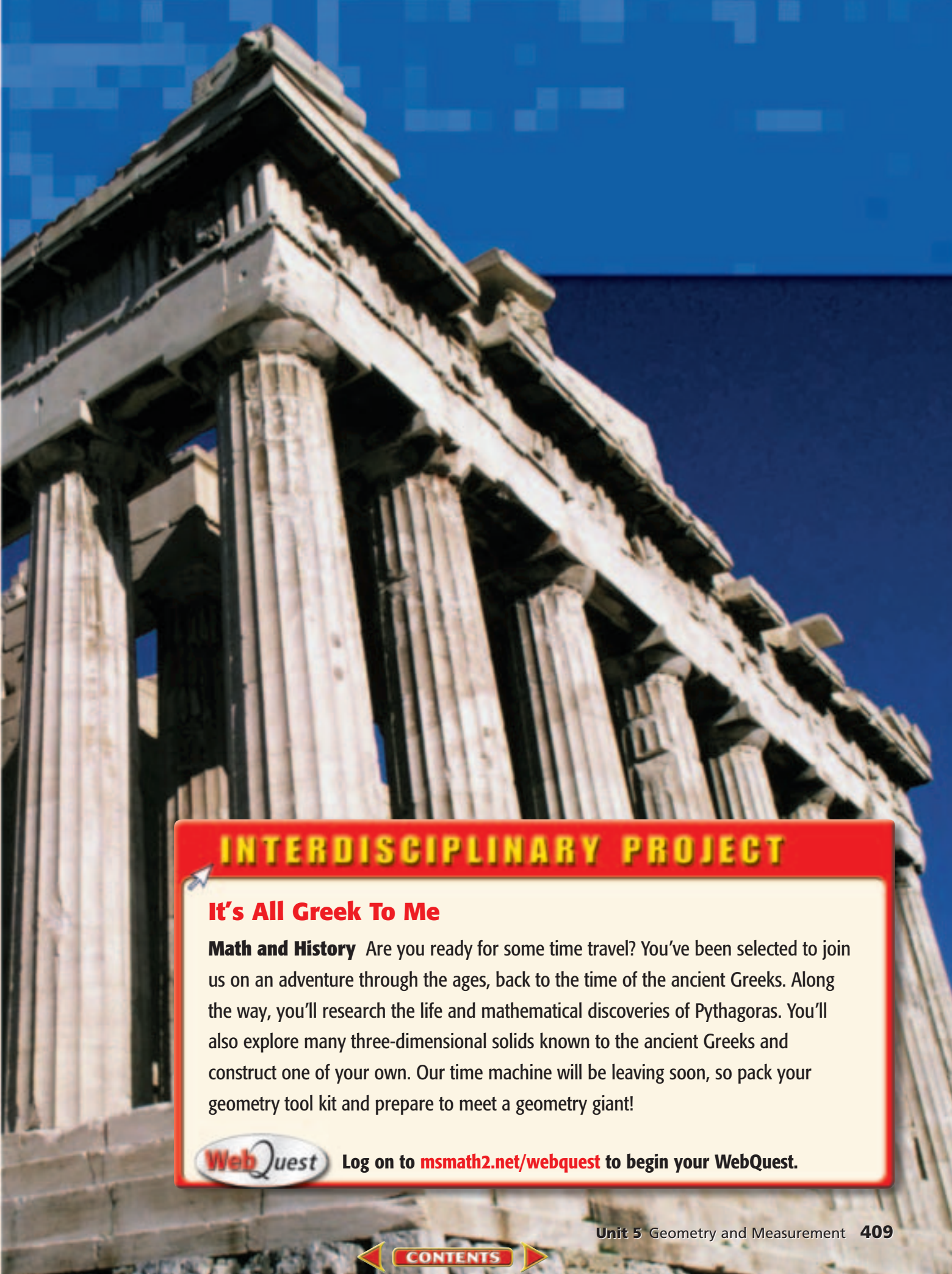


INTERDISCIPLINARY PROJECT

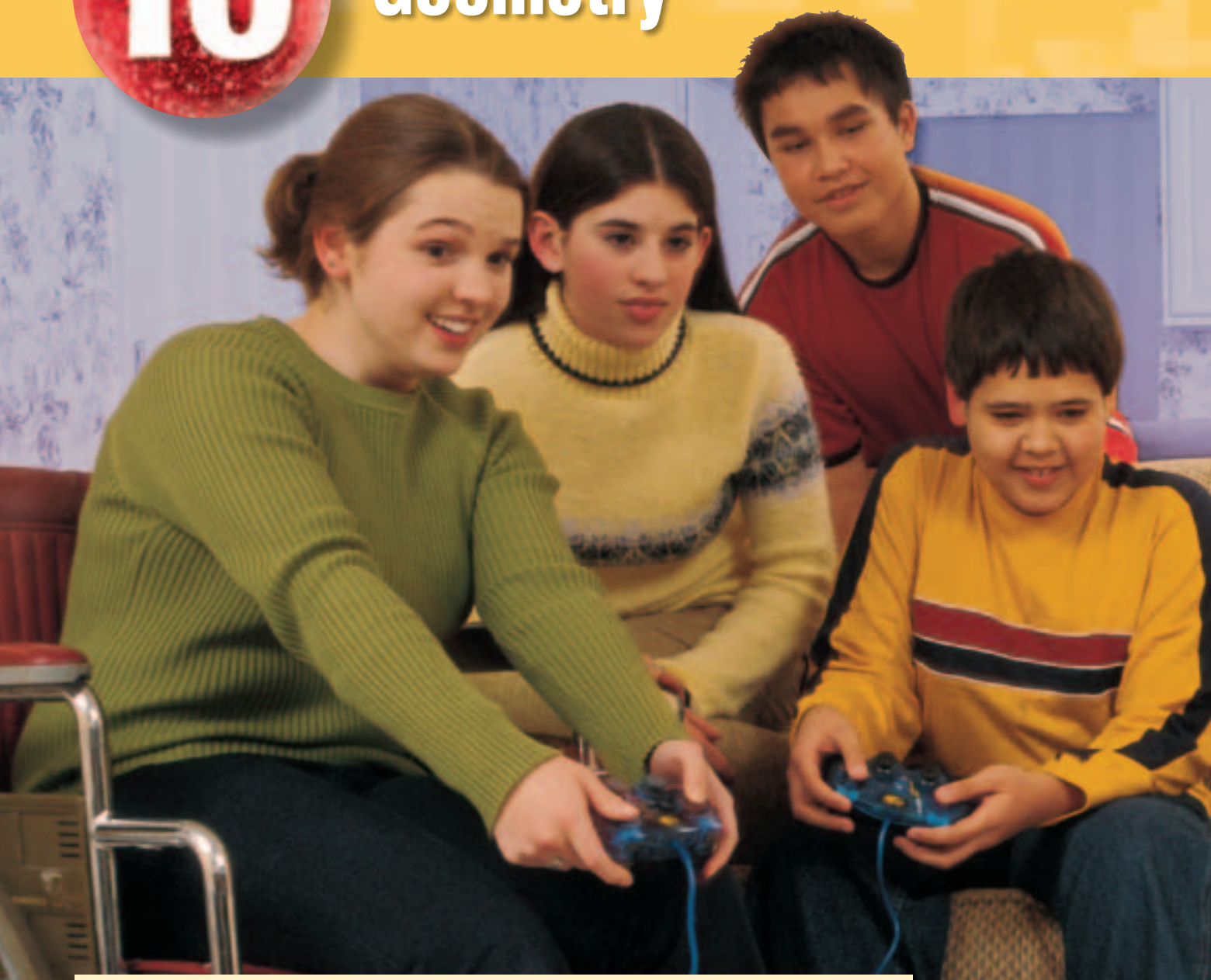
It's All Greek To Me

Math and History Are you ready for some time travel? You've been selected to join us on an adventure through the ages, back to the time of the ancient Greeks. Along the way, you'll research the life and mathematical discoveries of Pythagoras. You'll also explore many three-dimensional solids known to the ancient Greeks and construct one of your own. Our time machine will be leaving soon, so pack your geometry tool kit and prepare to meet a geometry giant!

WebQuest **Log on to msmath2.net/webquest to begin your WebQuest.**

CHAPTER 10

Geometry



"What do video games have to do with math?"

The first video game programmers used quadrilaterals like rectangles, squares, and trapezoids in designing video games. Now they use these basic figures as a starting point to make the games more elaborate with real-life characters, breath-taking scenery, and silly animations.

You will solve problems about quadrilaterals in Lesson 10-5.

Aaron Haupt

CONTENTS

GETTING STARTED

Diagnose Readiness

Take this quiz to see if you are ready to begin Chapter 10. Refer to the lesson or page number in parentheses for review.

Vocabulary Review

Complete each sentence.

1. A comparison of two numbers by division is called a ___?___. (Lesson 7-1)
2. The ___?___ is written as part = percent · base. (Lesson 8-2)

Prerequisite Skills

Multiply or divide. Round to the nearest hundredth if necessary. (Pages 560 and 562)

3. $360 \cdot 0.85$
4. $48 \div 191$
5. $24 \div 156$
6. $0.37 \cdot 360$
7. $33 \div 307$
8. $0.69 \cdot 360$

Solve each equation. (Lessons 4-2 and 4-3)

9. $b + 36 = 89$
10. $74 = 22 + s$
11. $15 + r = 146$
12. $m + 78 = 93$
13. $153 = d + 61$
14. $6x = 360$
15. $180 = 2f$
16. $120 = 3c$
17. $5n = 270$
18. $15z = 90$

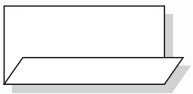
Solve each proportion. (Lesson 7-3)

19. $\frac{4}{a} = \frac{3}{9}$
20. $\frac{7}{16} = \frac{h}{32}$
21. $\frac{5}{8} = \frac{15}{y}$
22. $\frac{t}{42} = \frac{6}{7}$
23. $\frac{s}{12} = \frac{2}{3}$
24. $\frac{24}{p} = \frac{2}{3}$

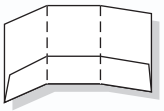
FOLDABLES Study Organizer

Geometry Make this Foldable to help you organize your notes. Begin with a sheet of 11″ × 17″ paper and six index cards.

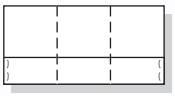
STEP 1 **Fold**
Fold lengthwise about 3″ from the bottom.



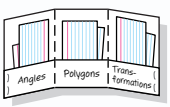
STEP 2 **Fold Again**
Fold the paper in thirds.



STEP 3 **Open and Staple**
Staple the edges on either side to form three pockets.



STEP 4 **Label**
Label the pockets as shown. Place two index cards in each pocket.



Noteables™ **Chapter Notes** Each time you find this logo throughout the chapter, use your *Noteables™: Interactive Study Notebook with Foldables™* or your own notebook to take notes. Begin your chapter notes with this Foldable activity.

Math Online **Readiness** To prepare yourself for this chapter with another quiz, visit **msmath2.net/chapter_readiness**

10-1a HANDS-ON LAB

A Preview of Lesson 10-1

Measuring Angles

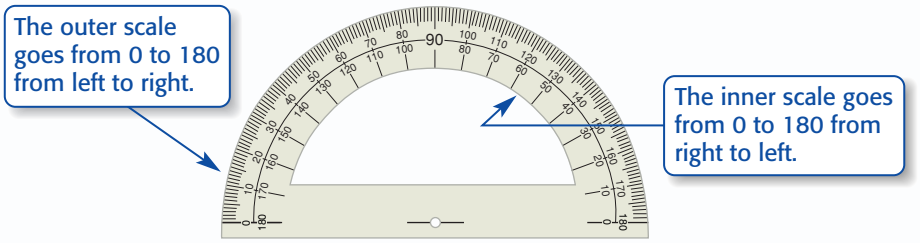
What You'll LEARN

Measure angles.

Materials

- protractor

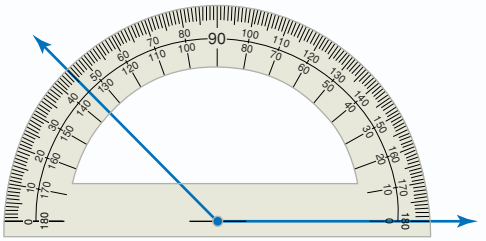
To measure lines, you use a ruler. To measure angles, you use a *protractor*. Angles are measured in units called **degrees**. In this lab, you will learn how to measure angles using a protractor.



ACTIVITY *Work with a partner.*

Find the measure of the angle below.

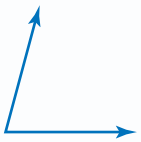
STEP 1 Place the protractor on the angle so that the center is on the vertex of the angle and one side goes through 0° on the protractor.



STEP 2 In this case, 0° is on the inner scale. So, follow the inner scale to the point where the other side of the angle meets the protractor. The inner number is the angle's degree measure.

So, the measure of this angle is 135°.

Your Turn **Find the measure of each angle.**

a. 

b. 

c. 

Writing Math

1. **Explain** why there are two scales on the protractor.
2. Can you place either side of an angle through 0° and get the same angle measure? **Explain** your reasoning.
3. What angle has the same measure on both the inner and outer scales?
4. **Explain** how the two scales on the protractor are related.

10-1 Angles

What You'll LEARN

Classify and draw angles.

NEW Vocabulary

angle
degrees
vertex
acute angle
right angle
obtuse angle
straight angle

Link to READING

Everyday Meaning of Acute: characterized by sharpness, as in acute pain

WHEN am I ever going to use this?

CLOCKS The hour and minute hands of a clock form angles of different sizes.

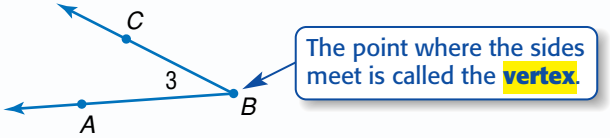
3:10
less than 90°

3:00
90°

3:40
greater than 90°

1. Name other times in which the hands of a clock form an angle less than 90°, equal to 90°, and greater than 90°.
2. How many degrees is the angle that is formed by clock hands at 6:00?

An **angle** is made up of two rays with a common endpoint and is measured in units called **degrees**. If a circle were divided into 360 equal-sized parts, each part would have an angle measure of 1 degree.



You can use the symbol for angle, ∠, to name an angle.

Use the vertex as the middle letter and a point from each side.	∠*ABC* or ∠*CBA*
Use the vertex only.	∠*B*
Use a number.	∠3

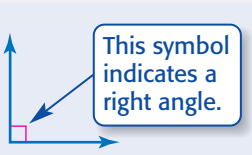
Angles are classified according to their measure.

Noteables™ Key Concept: Types of Angles

Acute Angle

less than 90°

Right Angle



exactly 90°

Obtuse Angle

between 90° and 180°

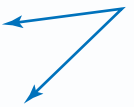
Straight Angle

exactly 180°

EXAMPLES Classify Angles

Classify each angle as *acute*, *obtuse*, *right*, or *straight*.

1



The angle is less than 90°, so it is an acute angle.

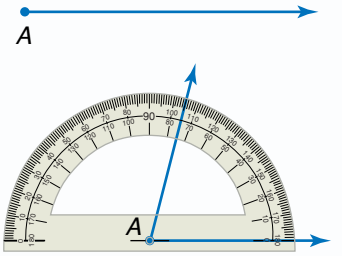
2

The angle is greater than 90°, so it is an obtuse angle.

EXAMPLE Draw an Angle

1 **Draw $\angle A$ with a measure of 75°.**

- Draw a ray with endpoint A.
- Place the center point of a protractor on A. Align the ray with 0°.
- Use the scale that begins with 0°. Locate the mark labeled 75. Then draw the other side of the angle.



Skill and Concept Check

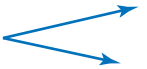
1. Writing Math Describe a right angle.

2. **OPEN ENDED** Draw and label acute angle XYZ. Then find its measure.

GUIDED PRACTICE

Classify each angle as *acute*, *obtuse*, *right*, or *straight*.

3. 

4. 

Draw an angle having each measurement. Then classify the angle as *acute*, *obtuse*, *right*, or *straight*.

5. 90°

6. 170°

7. 11°

8. **BICYCLE SAFETY** A cyclist should be familiar with arm and hand signals indicating his or her movements. Describe the angles formed by the arm of the cyclist below.

Practice and Applications

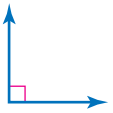
HOMEWORK HELP

For Exercises	See Examples
9–11, 18, 21	1, 2
12–17	3

Extra Practice
See pages 587, 605.

Classify each angle as *acute*, *obtuse*, *right*, or *straight*.

9. 

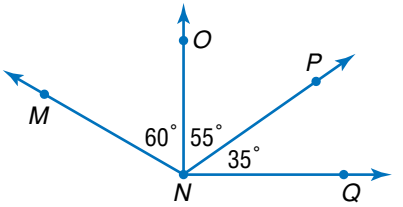
10. 

11. 

Draw an angle having each measurement. Then classify each angle as *acute*, *obtuse*, *right*, or *straight*.

12. 56° **13.** 147° **14.** 180° **15.** 99° **16.** 8° **17.** 90°

For Exercises 18–20, use the figure at the right.



18. Name the angles that are obtuse.

19. The symbol $m\angle MNQ$ means the *measure of angle MNQ*. Find $m\angle MNQ$.

20. Angles are said to be *adjacent* if they have a common vertex and a common side between them. So, $\angle MNO$ is adjacent to $\angle ONP$. Name another angle adjacent to $\angle ONP$.

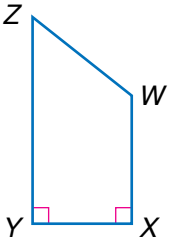
21. SKI JUMPING When skiers jump off a hill, they want to make the angle between their bodies and the front of their skis as small as possible. Describe where the ski jumper's legs and skis form acute and obtuse angles in the photograph.

22. EARTH SCIENCE Earth rotates 360° degrees in one day. Through how many degrees does it rotate in one hour?

23. CRITICAL THINKING How many times do the hands of a clock make a right angle in a 24-hour time period?

Spiral Review with Standardized Test Practice

24. SHORT RESPONSE Name the obtuse angle in the figure at the right.



25. MULTIPLE CHOICE Which is the measure of an acute angle?

(A) 87° (B) 95° (C) 120° (D) 180°

PROBABILITY A number cube is rolled, and a coin is tossed. Find each probability. (Lesson 9-7)

26. P(5 and heads) **27.** P(odd and tails) **28.** P(7 and heads or tails)

29. Anica spins a spinner fifty times, and it lands on 3 fifteen times. What is the experimental probability of *not* landing on 3? (Lesson 9-6)

GETTING READY FOR THE NEXT LESSON

PREREQUISITE SKILL Multiply or divide. Round to the nearest hundredth if necessary. (Pages 560 and 562)

30. 0.62 · 360 **31.** 360 · 0.25 **32.** 17 ÷ 146 **33.** 63 ÷ 199

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10-1b HANDS-ON LAB

A Follow-Up of Lesson 10-1

Constructing and Bisecting Angles

What You'll LEARN

Construct and bisect angles.

Two angles that have the same measure are **congruent angles**. To **bisect** an angle means to divide it into two congruent angles. In this lab, you will learn how to construct congruent angles and bisect angles.

Materials

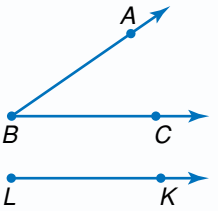
- straightedge
- compass

STUDY TIP

Symbols $\overrightarrow{LK}$ is read *ray LK*. A ray is a path that extends infinitely from one point in a certain direction.

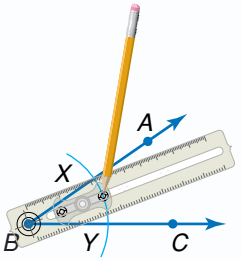
ACTIVITY *Work with a partner.*

1 **Construct an angle congruent to $\angle ABC$.**

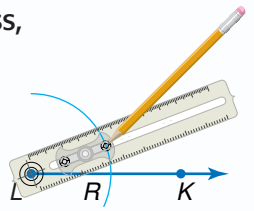


STEP 1 Use a straightedge to draw $\overrightarrow{LK}$.

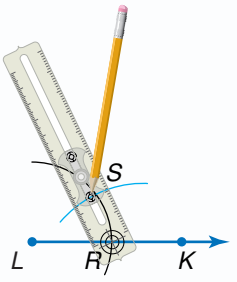
STEP 2 With the compass at point *B*, draw an arc that intersects both sides of $\angle ABC$. Label the two points of intersection as *X* and *Y*.



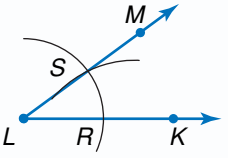
STEP 3 With the same setting on your compass, place your compass at point *L*. Draw another arc. Label the intersection *R*.



STEP 4 Open your compass to the same width as the distance between points *X* and *Y*. Then place the compass at point *R*. Draw an arc that intersects the arc you drew in Step 3. Label this point of intersection *S*.



STEP 5 Draw $\overrightarrow{LM}$ through point *S*. Angle *MLK* is congruent to $\angle ABC$.

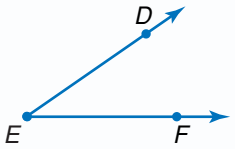


Your Turn

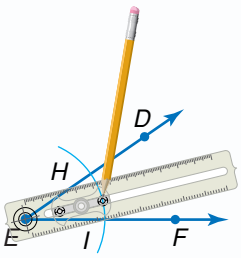
a. Draw an obtuse angle. Then construct an angle congruent to it.

ACTIVITY *Work with a partner.*

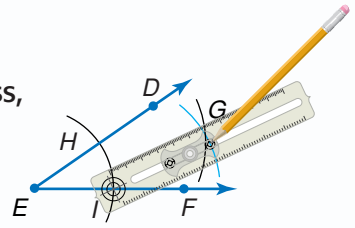
2 **Bisect $\angle DEF$.**



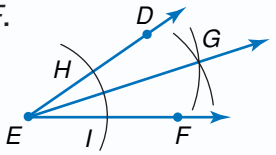
STEP 1 Place the compass at point E and draw an arc that intersects both sides of $\angle DEF$. Mark the two points of intersection as H and I.



STEP 2 Place your compass at point H. Draw an arc inside $\angle DEF$. Using the same setting on your compass, place your compass at point I. Draw another arc inside $\angle DEF$ intersecting the first arc. Label the intersection point G.



STEP 3 Draw $\overrightarrow{EG}$. $\overrightarrow{EG}$ is the bisector of $\angle DEF$.



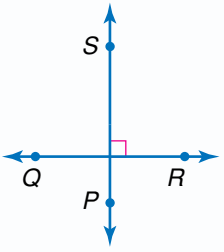
Your Turn

b. Draw a right angle. Then bisect it.

Writing Math

Work with a partner.

1. **Explain** how you could verify that $\angle ABC$ and $\angle MLK$ in Activity 1 are congruent.
2. **Explain** how you could verify that $\angle DEF$ in Activity 2 is bisected.
3. A straight angle has a measure of 180°. What kind of angle is formed if you bisect a straight angle?
4. **Perpendicular lines** are lines that meet to form right angles. In the figure at the right, $\overline{PS}$ is perpendicular to $\overline{QR}$. Use a compass and a straightedge to construct perpendicular lines. (*Hint*: Use the procedure for bisecting angles.)



10-2 Statistics: Making Circle Graphs

What You'll LEARN

Construct and interpret circle graphs.

NEW Vocabulary

circle graph

REVIEW Vocabulary

ratio: a comparison of two numbers by division (Lesson 7-1)

percent equation: part = percent · base (Lesson 8-2)

WHEN am I ever going to use this?

COLORS **In a recent survey, people ages 13–20 were asked to choose their favorite shade of blue. The results are shown in the table.**

1. Explain how you know that each person surveyed chose only one shade of blue.
2. If 500 people took part in the survey, how many preferred aquamarine?

Favorite Shades of Blue for People Ages 13–20

Shade	Percent
navy	35%
sky/light blue	30%
aquamarine	17%
other	18%

Source: *American Demographics*

A graph used to compare parts of a whole is called a **circle graph**. In a circle graph, the percents add up to 100.

EXAMPLE 1 Construct a Circle Graph

COLORS **Make a circle graph of the data in the table above.**

- Find the degrees for each part. Round to the nearest whole degree.

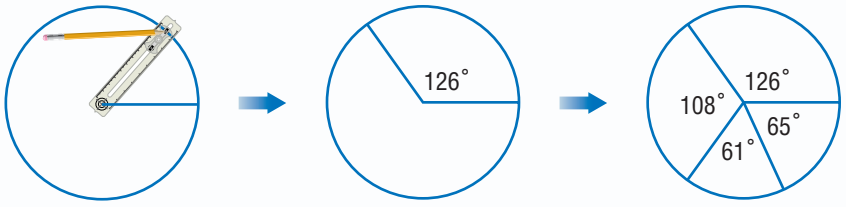
  35% of 360° = 0.35 · 360° or 126°

  30% of 360° = 0.30 · 360° or 108°

  17% of 360° = 0.17 · 360° or about 61°

  18% of 360° = 0.18 · 360° or about 65°

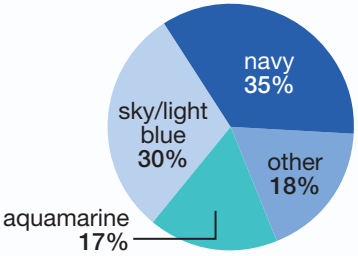
- Use a compass to draw a circle with a radius as shown. Then use a protractor to draw the first angle, in this case 126°. Repeat this step for each section or *sector.*



- Label each section of the graph with the category and percent. Give the graph a title.

Check To draw an accurate circle graph, make sure the sum of the angle measures equals 360°.

Favorite Shades of Blue for People Ages 13–20



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When constructing a circle graph, it is sometimes necessary to first convert the data to percents or decimals, and then to degrees.

EXAMPLE 2 Construct a Circle Graph

OLYMPICS **The table shows the number of each type of medal won by the United States during the Summer Olympics from 1896 to 2000. Make a circle graph of the data.**

U.S. Summer Olympic Medals

Type	Number
gold	872
silver	658
bronze	587

Source: infoplease.com

REAL-LIFE MATH

OLYMPICS The United States has won 2,117 Summer Olympic medals through 2000, the most by any country.

Source: infoplease.com

- Find the total number of medals: 872 + 658 + 587 or 2,117.
- Find the ratio that compares each number with the total. Write the ratio as a decimal rounded to the nearest hundredth.

  gold: $\frac{872}{2{,}117} \approx 0.41$ silver: $\frac{658}{2{,}117} \approx 0.31$ bronze: $\frac{587}{2{,}117} \approx 0.28$

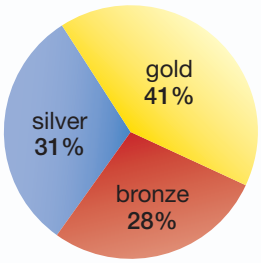
- Find the number of degrees for each section of the graph.

  gold: $0.41 \cdot 360° \approx 148°$
  silver: $0.31 \cdot 360° \approx 112°$
  bronze: $0.28 \cdot 360° \approx 101°$

  Because of rounding, the sum of the degrees is 361°.

- Draw the circle graph.

U.S. Summer Olympic Medals

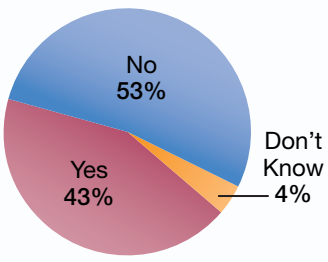


Check After drawing the first two sections, you can measure the last section of a circle graph to verify that the angles have the correct measures.

EXAMPLE 3 Interpret a Circle Graph

MONEY **The circle graph shows the percent of Americans who favor, oppose, or don't know how they feel about a common currency for North America. Use the graph to describe the opinion of most Americans.**

Do Americans Favor Common North American Currency?



Source: Coinstar

The greatest percent of the circle graph is the section representing the "No" response.

So, most Americans do not favor a common North American currency.

Skill and Concept Check

1. **OPEN ENDED** Draw a circle graph that has three parts. Label the parts and describe what they represent.

2. **DATA SENSE** The table shows the percent of people who use the sweeteners listed. Can the data be represented in a circle graph? Explain.

Type of Sweetener	Percent
sugar	74%
honey, molasses, syrup	46%
low calorie sweeteners	36%

Source: Yankelovich Partners

GUIDED PRACTICE

Make a circle graph of the data in each table.

3.

Favorite Shades of Blue for People Ages 21–34	
Shade	**Percent**
navy	48%
sky/light blue	23%
aquamarine	12%
other	18%

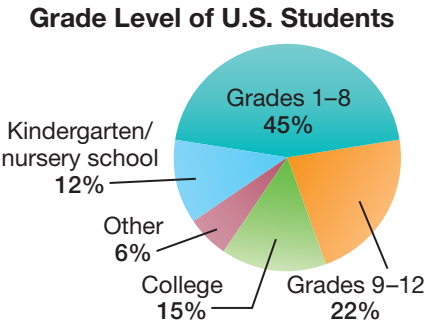
Source: *American Demographics*

4.

Speed Limit (mph)	Number of States
55	1
65	20
70	18
75	11

Source: *The World Almanac*

5. **EDUCATION** The circle graph shows the percent of students by grade level in U.S. schools. In which grades are most students?



Source: U.S. Census Bureau

6. Refer to the circle graph in Example 1 and the graph you drew in Exercise 3. What can you conclude about the favorite shades of blue for people in different age groups?

Practice and Applications

Make a circle graph of the data in each table.

7.

New York City Commuters	
Transportation	**Percent**
driving alone	24%
carpool	9%
public transit	53%
other	14%

Source: *Time Almanac*

8.

Los Angeles Commuters	
Transportation	**Percent**
driving alone	65%
carpool	15%
public transit	11%
other	9%

Source: *Time Almanac*

9. Compare and contrast the data from the circle graphs you drew in Exercises 7 and 8.

HOMEWORK HELP

For Exercises	See Examples
7–8, 12–13	1
10–11	2
9, 14	3

Extra Practice
See pages 587, 605.

Tim Fuller

CONTENTS

Make a circle graph of the data in each table.

10.

Endangered Species in U.S.	Number of Species
mammals	63
birds	78
reptiles	14
amphibians	10

Source: U.S. Fish and Wildlife Service

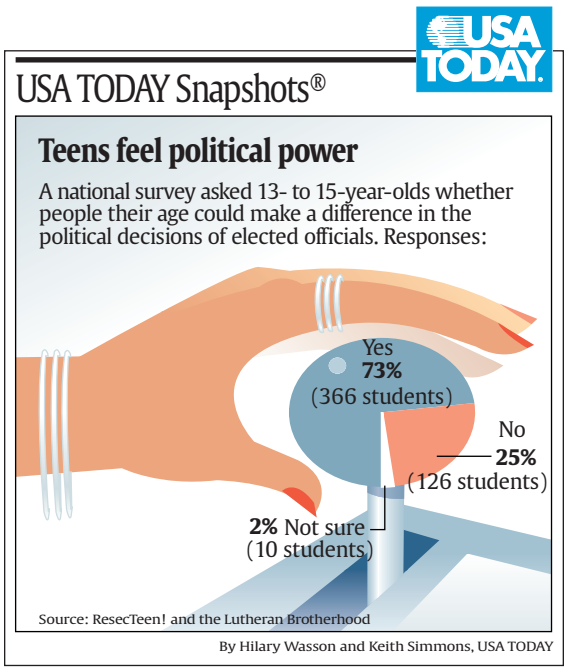
11.

U.S. Regions	Population (millions)
Northeast	54
Midwest	64
South	100
West	63

Source: *Time Almanac*

POLITICS **For Exercises 12–14, refer to the graphic at the right.**

12. How many 13- to 15-year olds participated in the survey?
13. Calculate the angle measure for each section.
14. Measure the angles for each section on the graph. Explain any differences.



15. **RESEARCH** Use the Internet or another source to find data that add up to 100%. Make a circle graph of the data.

16. **CRITICAL THINKING** Line graphs are usually best for data that show change over time. When might it be more appropriate to display data in a circle graph? Give an example.

Spiral Review with Standardized Test Practice

17. **MULTIPLE CHOICE** On a circle graph of the data in the table, which section would have an angle measure of about 38°?

(A) Lake Erie (B) Lake Huron
(C) Lake Michigan (D) Lake Ontario

Lake	Area (sq mi)
Erie	9,930
Huron	23,010
Michigan	22,400
Ontario	7,520
Superior	31,820

Source: www.infoplease.com

18. **SHORT RESPONSE** Find the angle measure of the Lake Michigan section in the circle graph referred to in Exercise 17. Round to the nearest whole degree.

Classify each angle as *acute*, *obtuse*, *right*, or *straight*. (Lesson 10-1)

19. 65° 20. 102° 21. 90°

22. **PROBABILITY** Corey has an after-school activity 15% of the time. Li-Cheng has one 20% of the time. Find the probability that they will both have an after-school activity on the same day. (Lesson 9-7)

GETTING READY FOR THE NEXT LESSON

PREREQUISITE SKILL **Solve each equation.** (Lesson 4-2)

23. $a + 18 = 90$ 24. $44 + x = 90$ 25. $180 = 39 + n$ 26. $123 + t = 180$

10-3 Angle Relationships

What You'll LEARN

Identify and apply angle relationships.

NEW Vocabulary

vertical angles
congruent angles
supplementary angles
complementary angles

MATH Symbols

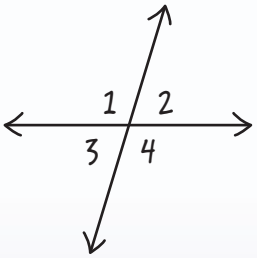
≅ is congruent to

HANDS-ON Mini Lab

Materials
- protocol

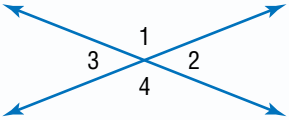
Work with a partner.

Draw two intersecting lines and label the angles as shown. Then measure each angle with your protractor and record the measurements.



1. Which angles have the same measure?
2. Draw two other pairs of intersecting lines. Measure their angles. **Make a conjecture** involving four angles created by intersecting lines.
3. What is the relationship between the measures of ∠1 and ∠2? ∠3 and ∠4?
4. Do other pairs of angles share the same relationship? Explain.

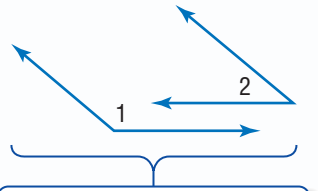
When two lines intersect, they form two pairs of opposite angles called **vertical angles**. In the Mini Lab, you found that vertical angles have the same measure. Angles with the same measure are **congruent angles**.



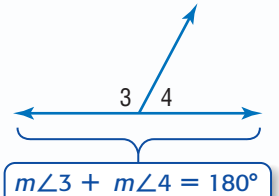
$\angle 1 \cong \angle 4$
$\angle 2 \cong \angle 3$

The symbol ≅ is used to show that the angles are congruent.

Pairs of angles can also have other relationships. In the Mini Lab, you found pairs of angles whose sum is 180°. Two angles are **supplementary** if the sum of their measures is 180°.

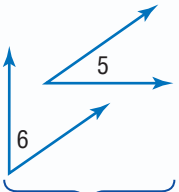


$m\angle 1 = 140°, m\angle 2 = 40°,$
$m\angle 1 + m\angle 2 = 180°$

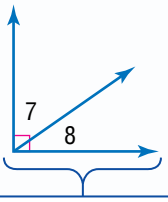


$m\angle 3 + m\angle 4 = 180°$

Two angles are **complementary** if the sum of their measures is 90°.



$m\angle 5 = 35°, m\angle 6 = 55°,$
$m\angle 5 + m\angle 6 = 90°$



$m\angle 7 + m\angle 8 = 90°$

READING in the Content Area

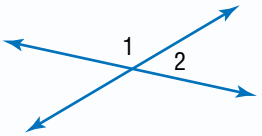
For strategies in reading this lesson, visit msmath2.net/reading.

CONTENTS

EXAMPLES Classify Angles

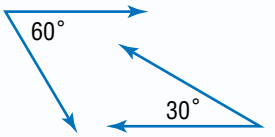
Classify each pair of angles as *complementary*, *supplementary*, or *neither*.

1



$\angle 1$ and $\angle 2$ form a straight line. So, the angles are supplementary.

2

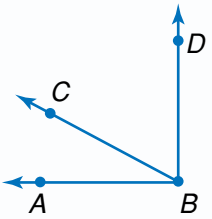


$60° + 30° = 90°$
The angles are complementary.

You can use angle relationships to find missing measures.

EXAMPLE Find a Missing Angle Measure

3 **Angles *ABC* and *CBD* are complementary. If $m\angle ABC = 28°$, find $m\angle CBD$.**



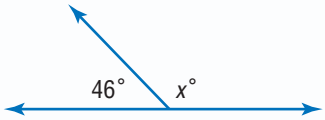
Since $\angle ABC$ and $\angle CBD$ are complementary, $m\angle ABC + m\angle CBD = 90°$.

$m\angle ABC + m\angle CBD =$	90	Write the equation.
$28 + m\angle CBD =$	90	Replace $m\angle ABC$ with 28.
-28	-28	Subtract 28 from each side.
$m\angle CBD =$	62	$90 - 28 = 62$

The measure of $\angle CBD$ is 62°.

Your Turn **Find the value of x in each figure.**

a.



b.

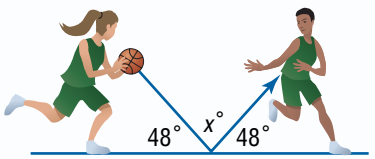
REAL-LIFE MATH

BASKETBALL Canadian Dr. James Naismith invented the game of basketball in 1891 using a ball the size of a soccer ball and two peach baskets.

Source: www.allsands.com

EXAMPLE Use Angles to Solve A Problem

4 **BASKETBALL Erin wants to make a bounce pass to Mackenzie. Find the value of x so that Erin's pass hits Mackenzie in the hands.**



Since the sum of the three angles is 180°, $48° + x° + 48° = 180°$.

$48 + x + 48 =$	180	Write the equation.
$x + 96 =$	180	Simplify.
-96	-96	Subtract 96 from each side.
$x =$	84	$180 - 96 = 84$

So, the angle must be 84° for the ball to hit Mackenzie in the hands.

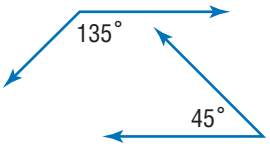
Skill and Concept Check

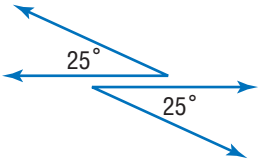
1. **OPEN ENDED** Draw two angles that are complementary.

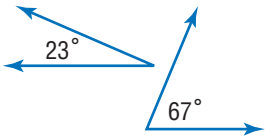
2. Writing Math Can a pair of angles be vertical and supplementary? Give an example or nonexample, with angle measurements, to support your answer.

GUIDED PRACTICE

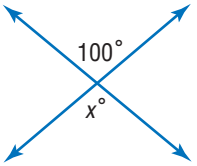
Classify each pair of angles as *complementary*, *supplementary*, or *neither*.

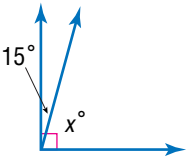
3. 

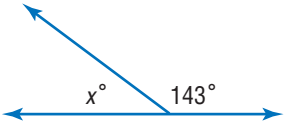
4. 

5. 

Find the value of x in each figure.

6. 

7. 

8. 

9. Suppose $\angle 1$ and $\angle 2$ are supplementary. If $m\angle 1 = 84°$, find $m\angle 2$.

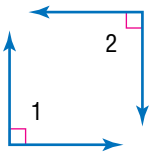
Practice and Applications

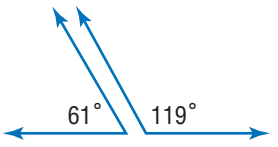
HOMEWORK HELP

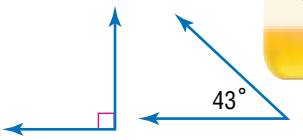
For Exercises	See Examples
10–15, 22–23	1, 2
16–21	3, 4

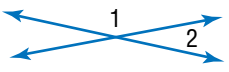
Extra Practice
See pages 587, 605.

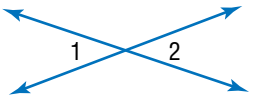
Classify each pair of angles as *complementary*, *supplementary*, or *neither*.

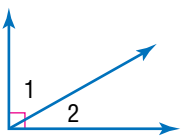
10. 

11. 

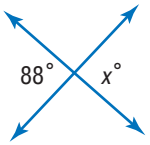
12. 

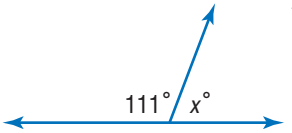
13. 

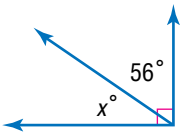
14. 

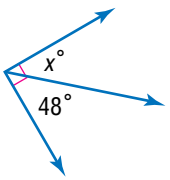
15. 

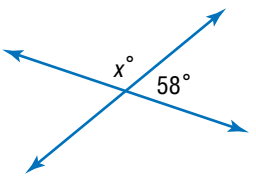
Find the value of x in each figure.

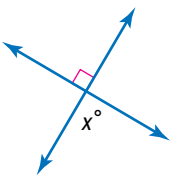
16. 

17. 

18. 

19. 

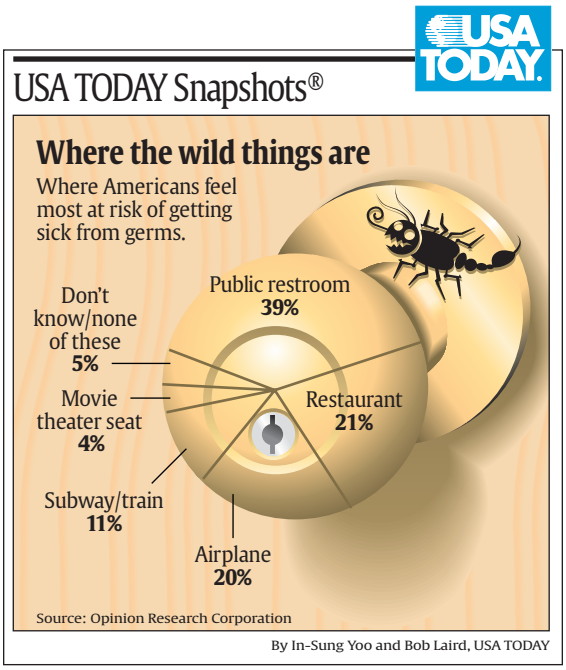
20. 

21. 

HEALTH **For Exercises 22 and 23, use the graphic at the right.**

22. Which two sections have angles that are complementary?

23. Which two sections have angles that are supplementary?



Determine whether each statement is *sometimes*, *always*, or *never* true. Explain or give an example to support your answer.

24. Adjacent angles are complementary.

25. Two straight angles are supplementary.

26. Vertical angles have the same angle measure.

27. Adjacent angles are congruent.

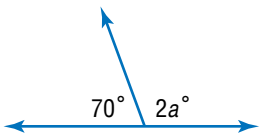
28. **WRITE A PROBLEM** Write about a real-life object that has angles. Draw a diagram of it, measure all angles, and identify any complementary, supplementary, and vertical angles.

29. **CRITICAL THINKING** Angles E and F are complementary. If $m\angle E = x - 10$ and $m\angle F = x + 2$, find the measure of each angle.

Spiral Review with Standardized Test Practice

30. **SHORT RESPONSE** Find the measure of two angles that are vertical and complementary.

31. **MULTIPLE CHOICE** Find the value of a in the figure.



(A) 90 (B) 75 (C) 55 (D) 45

32. **STATISTICS** A company surveyed people about the type of crust they preferred on their pizza. Make a circle graph of the results shown at the right. (Lesson 10-2)

Type of Crust	Percent
regular thin	61%
thick	14%
deep dish	14%
extra thin	11%

Source: CREST

33. **TIME** Classify the angle the hands of a clock make at 3:30. (Lesson 10-1)

34. **REAL ESTATE** A house for sale has a rectangular lot with a length of 250 feet and a width of 120 feet. What is the area of the lot? (Lesson 6-8)

Write each percent as a decimal. (Lessons 5-5 and 7-6)

35. 53% 36. 78.5% 37. 431% 38. 0.23%

GETTING READY FOR THE NEXT LESSON

PREREQUISITE SKILL **Solve each equation.** (Lesson 4-2)

39. $x + 112 = 180$ 40. $50 + t = 180$ 41. $180 = 79 + y$ 42. $180 = h + 125$

10-3b HANDS-ON LAB

A Follow-Up of Lesson 10-3

Constructing Parallel Lines

What You'll LEARN

Construct parallel lines, and discover angle relationships.

Parallel lines are lines that do not intersect. The symbol ∥ means parallel. In this lab, you will learn how to construct parallel lines and discover angle relationships that are created from parallel lines.

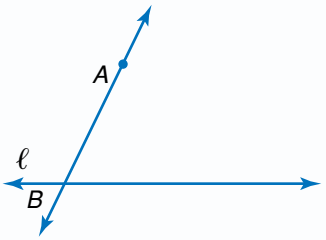
Materials

- straightedge
- compass
- protractor
- colored pencils
- notebook paper

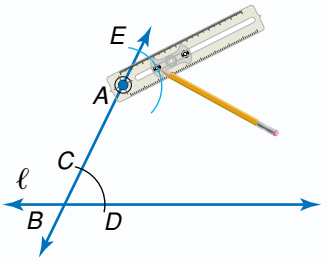
ACTIVITY *Work with a partner.*

1 **Construct a line parallel to line ℓ.**

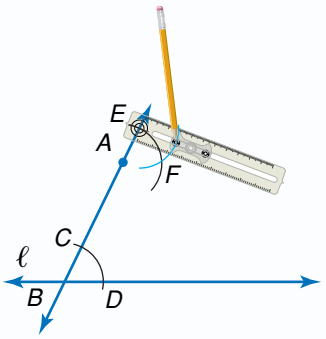
STEP 1 Draw line ℓ. Choose a point A not on the line. Then draw a line through point A that intersects ℓ. Label the point of intersection B.



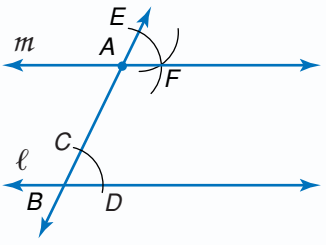
STEP 2 Place the compass at vertex B and draw an arc. Label the points of intersection C and D. With the same compass setting, place the compass at point A and draw an arc. Label the point of intersection E.



STEP 3 Open your compass to the same width as the distance between C and D. Then place the compass at point E. Draw an arc that intersects the arc you drew in Step 2. Label this point of intersection F.



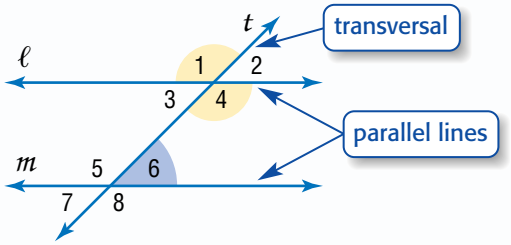
STEP 4 Draw a line through points A and F. Label the line m. Line m is parallel to line ℓ.



Your Turn

a. Draw a line. Then construct a line parallel to it.

A line that intersects parallel lines is called a **transversal**. Line t is a transversal for parallel lines ℓ and m. When a transversal cuts two parallel lines, there are several angle relationships formed.



ACTIVITY *Work with a partner.*

2 **Find angle relationships in the figure above.**

STEP 1 Draw parallel lines and a transversal on notebook paper. Label the angles as shown above.

STEP 2 Measure each angle with your protractor. Record each measure.

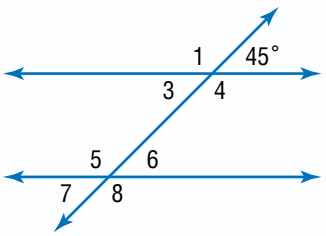
STEP 3 Using colored pencils, shade any angles with the same measure one color. If there are angles with a different measure, shade them a second color. For example, $\angle 1$ and $\angle 4$ shown above are both shaded yellow because they have the same measure. Angle 6 is shaded blue because it has a different measure.

In the figure above, certain pairs of angles have special names. The angles that make up each pair have the same measure.

alternate interior angles	$\angle 3$ and $\angle 6$, $\angle 4$ and $\angle 5$
alternate exterior angles	$\angle 1$ and $\angle 8$, $\angle 2$ and $\angle 7$
corresponding angles	$\angle 1$ and $\angle 5$, $\angle 2$ and $\angle 6$, $\angle 3$ and $\angle 7$, $\angle 4$ and $\angle 8$
vertical angles	$\angle 1$ and $\angle 4$, $\angle 2$ and $\angle 3$, $\angle 5$ and $\angle 8$, $\angle 6$ and $\angle 7$

Writing Math

1. **Explain** why you think $\angle 1$, $\angle 2$, $\angle 7$, and $\angle 8$ are called exterior angles.
2. **Explain** why you think $\angle 3$, $\angle 4$, $\angle 5$, and $\angle 6$ are called interior angles.
3. What are $\angle 2$ and $\angle 4$ called?
4. If you know only one angle measure in the figure, **explain** how you can find the measures of the other angles without measuring.
5. Predict the measure of the other angles in the figure at the right using the 45° angle. Then copy the figure onto notebook paper and check by using a protractor.



10-4 Triangles

What You'll LEARN

Identify and classify triangles.

NEW Vocabulary

triangle
acute triangle
right triangle
obtuse triangle
congruent segments
scalene triangle
isosceles triangle
equilateral triangle

MATH Symbols

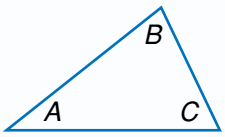
$m\angle 1$ measure of angle 1

HANDS-ON Mini Lab

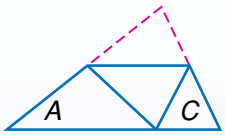
Materials
- paper
- straightedge
- scissors

Work with a partner.

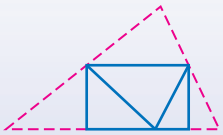
STEP 1 Use a straightedge to draw a triangle with three acute angles. Label the angles *A*, *B*, and *C*. Cut out the triangle.



STEP 2 Fold $\angle B$ so that its vertex touches the line between angles *A* and *C*. The fold should be parallel to the base of the triangle.



STEP 3 Fold $\angle A$ and $\angle C$ so the vertices meet.



1. What kind of angle is formed where the three vertices meet?
2. Repeat the activity with another triangle. **Make a conjecture** about the sum of the measures of three angles of any triangle.

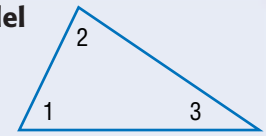
A **triangle** is a figure with three sides and three angles. In the Mini Lab, you discovered a relationship among the three angles in a triangle.

Noteables **Key Concept: Angles of a Triangle**

Words The sum of the measures of the angles of a triangle is 180°.

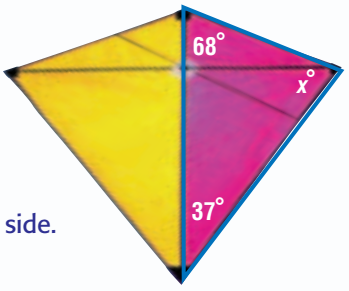
Symbols $m\angle 1 + m\angle 2 + m\angle 3 = 180°$

Model



EXAMPLE 1 Find Angle Measures of Triangles

KITES A kite is constructed with two triangles. Find the missing measure.



$x + 68 + 37 = 180$ The sum of the measures is 180.

$x + 105 = 180$ Simplify.

$-105 \quad -105$ Subtract 105 from each side.

$x = 75$

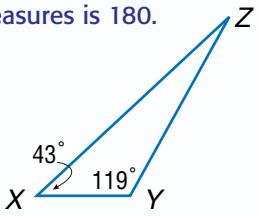
The missing measure is 75°.

EXAMPLE 2 Find a Missing Measure

ALGEBRA Find $m\angle Z$ in $\triangle XYZ$ if $m\angle X = 43°$ and $m\angle Y = 119°$.

Draw the triangle. Then write and solve an equation to find $m\angle Z$.

$m\angle X + m\angle Y + m\angle Z =$	180	The sum of the measures is 180.
$43 + 119 + m\angle Z =$	180	Substitute.
$162 + m\angle Z =$	180	Simplify.
-162	-162	Subtract 162 from each side.
$m\angle Z =$	18	



So, the measure of $\angle Z$ is 18°.

Check the Reasonableness of Results You can check whether you found the correct measure by adding 43 + 119 + 18. The sum should be 180.

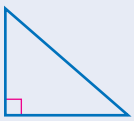
Since every triangle has at least two acute angles, one way you can classify a triangle is by using the third angle.

Noteables™ Key Concept: Classify Triangles Using Angles

Acute Triangle

all acute angles

Right Triangle



1 right angle

Obtuse Triangle

1 obtuse angle

Another way to classify triangles is by their sides. Sides with the same length are **congruent segments**.

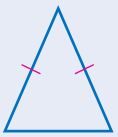
Congruent Segments The marks on the sides of the triangles indicate that those sides are congruent.

Noteables™ Key Concept: Classify Triangles Using Sides

Scalene Triangle

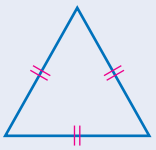
no congruent sides

Isosceles Triangle



at least 2 congruent sides

Equilateral Triangle

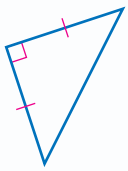


3 congruent sides

EXAMPLES 3 and 4 Classify Triangles

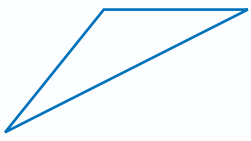
Classify each triangle by its angles and by its sides.

3



The triangle has a right angle and two congruent sides. So, it is a right, isosceles triangle.

4



The triangle has one obtuse angle and no congruent sides. So, it is an obtuse, scalene triangle.

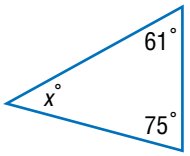
Skill and Concept Check

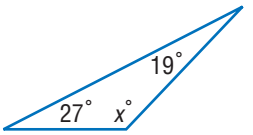
1. Writing Math Describe the angles in an obtuse triangle.

2. **OPEN ENDED** Draw an acute scalene triangle.

GUIDED PRACTICE

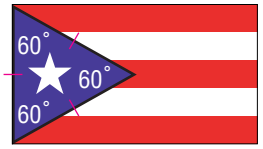
Find the missing measure in each triangle. Then classify the triangle as *acute*, *right*, or *obtuse*.

3. 

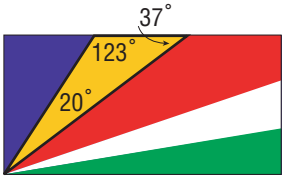
4. 

Classify the marked triangle in each flag by its angles and by its sides.

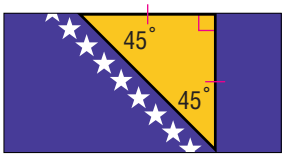
5. Puerto Rico



6. Seychelles Islands



7. Bosnia-Herzegovina



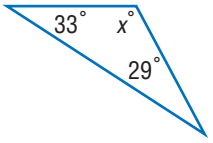
Practice and Applications

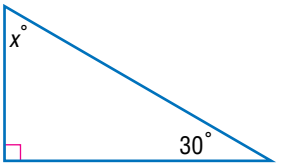
Find the missing measure in each triangle. Then classify the triangle as *acute*, *right*, or *obtuse*.

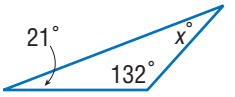
HOMEWORK HELP

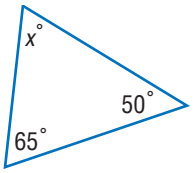
For Exercises	See Examples
8–14, 17, 24	1, 2
8–13, 15–16, 18–23	3, 4

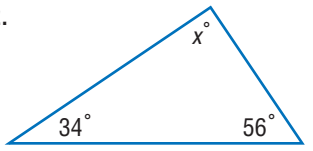
Extra Practice
See pages 588, 605.

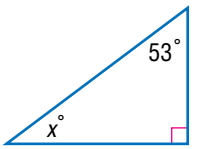
8. 

9. 

10. 

11. 

12. 

13. 

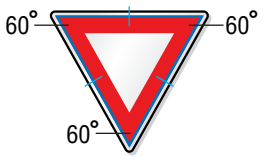
14. Find the third angle of a right triangle if the measure of one of the angles is 10°.

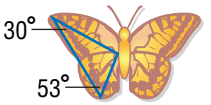
15. Three angles of a triangle measure 30°, 60°, and 90°. Classify the triangle by its angles.

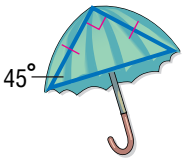
16. Three sides of a triangle measure 5 meters, 8 meters, and 8 meters. Classify the triangle by its sides.

17. **ALGEBRA** Find $m\angle T$ in $\triangle RST$ if $m\angle R = 88°$ and $m\angle S = 75°$.

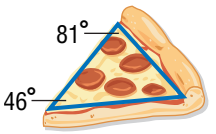
Classify each triangle by its angles and by its sides.

18. 

19. 

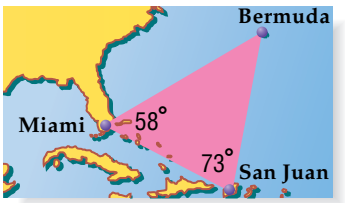
20. 

21. 

22. 

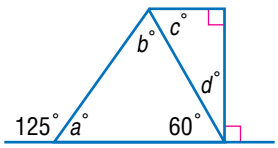
23. 

24. **GEOGRAPHY** A triangular area in the southern Atlantic Ocean where airplanes and boats have disappeared is known as the *Bermuda Triangle*. Find the missing angle measurement at Bermuda in the figure at the right.



25. **WRITE A PROBLEM** Write about a real-life situation or object involving a triangle and its measures. Classify the triangle by its sides and its angles.

26. **CRITICAL THINKING** Find the missing angle measures in the figure.

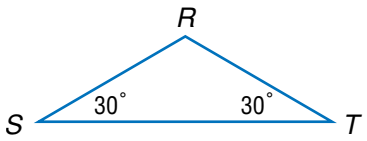


Spiral Review with Standardized Test Practice

27. **MULTIPLE CHOICE** How would you find $m\angle R$?

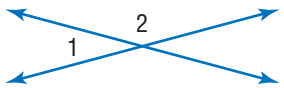
(A) Add 30° to 180°. (B) Subtract 60° from 180°.

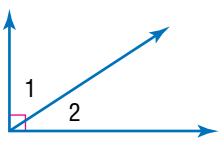
(C) Subtract 30° from 90°. (D) Subtract 180° from 60°.

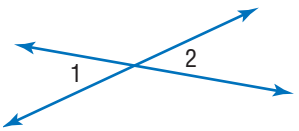


28. **SHORT RESPONSE** Find the measure of two congruent angles of a triangle if the third angle measure is 54°.

Classify each pair of angles as *complementary*, *supplementary*, or *neither*. (Lesson 10-3)

29. 

30. 

31. 

32. **BIRDS** A circle graph shows that 41% of people who bird watch live in the Northeast region of the United States. What is the measure of the angle of the Northeast section of the graph? (Lesson 10-2)

GETTING READY FOR THE NEXT LESSON

PREREQUISITE SKILL Solve each equation. (Lesson 4-2)

33. $x + 120 + 120 + 60 = 360$

34. $73 + 119 + x + 50 = 360$

10-4b HANDS-ON LAB

A Follow-Up of Lesson 10-4

Constructing Triangles

What You'll LEARN

Construct equilateral and isosceles triangles.

Equilateral triangles are triangles with three congruent sides. Isosceles triangles are triangles with at least two congruent sides. In this lab, you will learn how to construct both types of triangles.

Materials

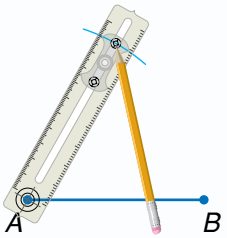
- straightedge
- compass
- protractor
- ruler

ACTIVITY *Work with a partner.*

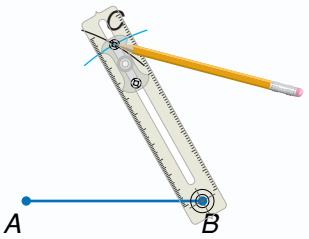
1 **Construct an equilateral triangle.**

STEP 1 Use your straightedge to draw line segment $\overline{AB}$.

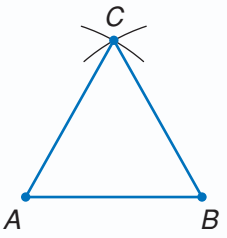
STEP 2 Open the compass to the same length as $\overline{AB}$. With the compass at point A, draw an arc above the line.



STEP 3 With the same compass setting, place the compass at point B. Draw an arc that intersects the arc you drew in Step 2. Label the intersection C.



STEP 4 Connect the points to complete equilateral $\triangle ABC$.



Your Turn

a. Construct equilateral triangle TUV with sides measuring 3 inches.

STUDY TIP

Check You can measure each side of the triangle to see if the sides are congruent.

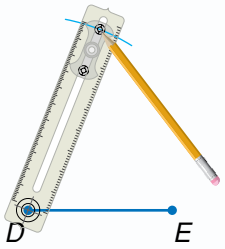
In order to construct equilateral triangles in the activity above, you copied line segments using a compass. You constructed line segments with the same length by copying $\overline{AB}$ and making $\overline{AC}$ and $\overline{BC}$ congruent. So, a compass is also a useful tool to check whether line segments have the same length.

ACTIVITY *Work with a partner.*

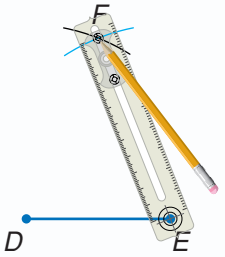
2 **Construct an isosceles triangle.**

STEP 1 Use your straightedge to draw line segment $\overline{DE}$.

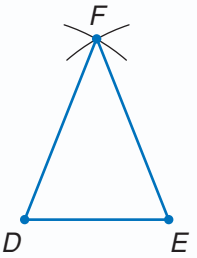
STEP 2 Open the compass to a length greater than $\overline{DE}$. With the compass at point *D*, draw an arc above the line.



STEP 3 With the same compass setting, place the compass at point *E*. Draw an arc that intersects the arc you drew in Step 2. Label the intersection *F*.



STEP 4 Connect the points to complete isosceles $\triangle DEF$.



STUDY TIP

Check You can measure $\overline{DF}$ and $\overline{EF}$ to check if they are congruent.

Your Turn

b. Construct isosceles triangle *XYZ* with sides measuring 3 centimeters, 5 centimeters, and 5 centimeters.

Writing Math

Work with a partner.

1. **Measure** the angles in the equilateral triangle you constructed with a protractor. Compare your measurements with other groups.
2. **Make a conjecture** about the measure of the angles of an equilateral triangle.
3. **Measure** the angles in the isosceles triangle you constructed with a protractor. Compare your measurements with other groups.
4. **Make a conjecture** about the measure of the angles of an isosceles triangle.

10-5 Quadrilaterals

What You'll LEARN

Identify and classify quadrilaterals.

NEW Vocabulary

quadrilateral
parallelogram
trapezoid
rhombus

REVIEW Vocabulary

parallel: lines that do not intersect (Lesson 10-3b)

READING Math

Parallel Lines The sides with matching arrows are parallel.

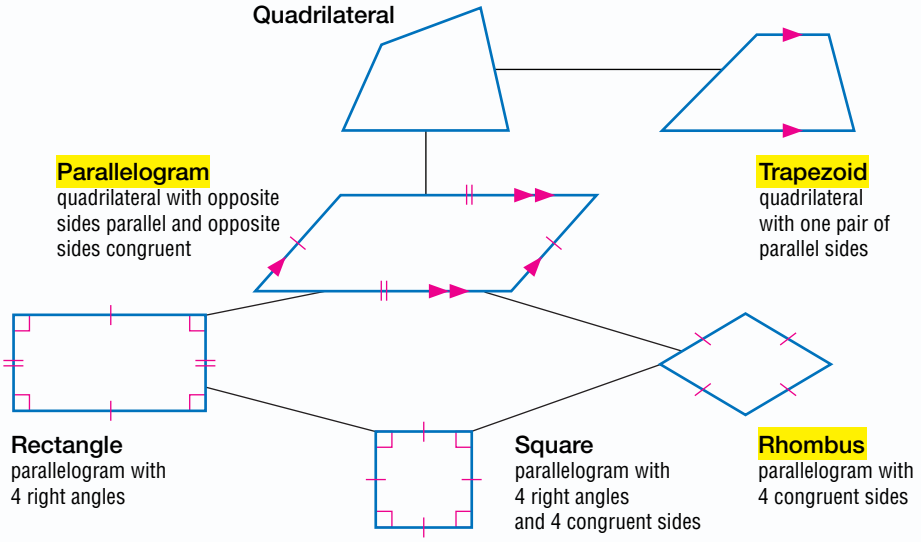
WHEN am I ever going to use this?

BASKETBALL The photograph shows the free throw lane used in international basketball.

1. Describe the angles inside the 4-sided figure.
2. Which sides of the figure appear to be parallel?
3. Which sides of the figure appear to be congruent?

The shape of the free-throw lane above is called a trapezoid. Squares, rectangles, and trapezoids are examples of quadrilaterals. A **quadrilateral** is a closed figure with four sides and four angles. Quadrilaterals are named based on their sides and angles.

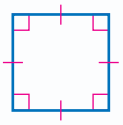
The diagram shows how quadrilaterals are related. Notice how it goes from the most general to the most specific.



EXAMPLES Classify Quadrilaterals

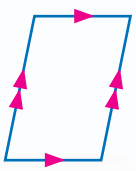
Classify the quadrilateral using the name that *best* describes it.

1



The quadrilateral has 4 right angles and 4 congruent sides. It is a square.

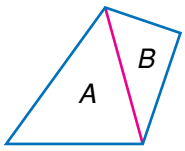
2



The quadrilateral has opposite sides parallel. It is a parallelogram.

CONTENTS

A quadrilateral can be separated into two triangles, A and B. Since the sum of the angle measures of each triangle is 180°, the sum of the angle measures of both triangles is $2 \cdot 180$, or 360°.



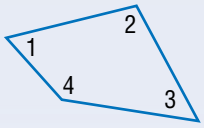
Noteables

Key Concept: Angles of a Quadrilateral

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

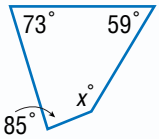
Symbols $m\angle 1 + m\angle 2 + m\angle 3 + m\angle 4 = 360°$

Model



EXAMPLE 1 Find a Missing Measure

Find the missing angle measure in the quadrilateral.



$85 + 73 + 59 + x = 360$ The sum of the measures is 360°.

$217 + x = 360$ Simplify.

$-217 \quad -217$ Subtract 217 from each side.

$x = 143$

So, the missing angle measure is 143°.

Skill and Concept Check

1. **Writing Math** Explain why all squares are rectangles but not all rectangles are squares.

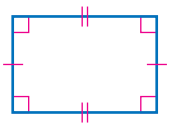
2. **OPEN ENDED** Describe a real-life example of a rhombus.

3. **FIND THE ERROR** Venus and Justin are describing a square. Who is correct? Explain.

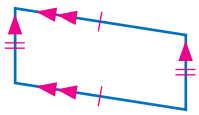
Venus	Justin
a parallelogram with 4 right angles	a rhombus with 4 right angles

GUIDED PRACTICE

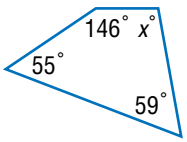
Classify the quadrilateral using the name that *best* describes it.

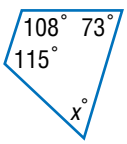
4. 

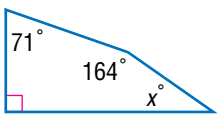
5. 

6. 

Find the missing angle measure in each quadrilateral.

7. 

8. 

9. 

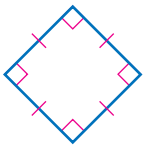
Practice and Applications

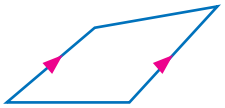
HOMEWORK HELP

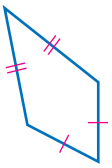
For Exercises	See Examples
10–15, 25, 27, 29–31	1, 2
19–24, 28	3

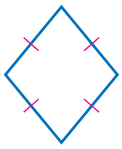
Extra Practice
See pages 588, 605.

Classify the quadrilateral using the name that *best* describes it.

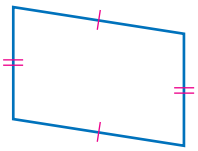
10. 

11. 

12. 

13. 

14. 

15. 

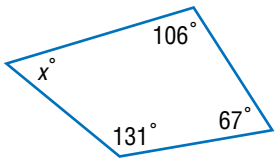
Determine whether each statement is *sometimes*, *always*, or *never* true. Explain.

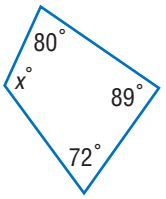
16. A quadrilateral is a trapezoid.

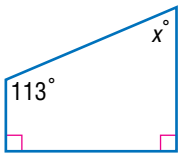
17. A parallelogram is a rectangle.

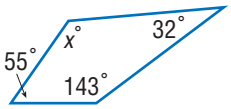
18. A trapezoid is a parallelogram.

Find the missing angle measure in each quadrilateral.

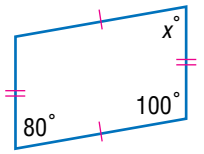
19. 

20. 

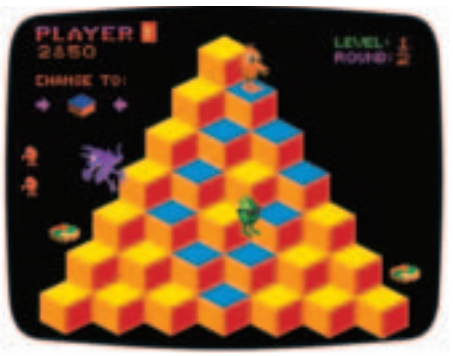
21. 

22. 

23. 

24. 

25. **VIDEO GAMES** The first video games used basic shapes like rectangles, squares, and circles in their interface. Name the quadrilaterals used in the video game shown at the right.



26. **RESEARCH** Use the Internet or another source to find other early video games that used different types of quadrilaterals as part of their interface. Classify the quadrilaterals in the games you found.

27. **ART** Design and draw a stained glass window that contains the following types of quadrilaterals: trapezoid, parallelogram, and rhombus.

28. **ALGEBRA** Find $m\angle B$ in quadrilateral $ABCD$ if $m\angle A = 87°$, $m\angle C = 135°$, and $m\angle D = 22°$.

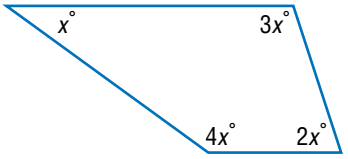
Determine whether each figure described below can be drawn. Explain.

29. a quadrilateral that is both a rhombus and a rectangle

30. a trapezoid with 3 right angles

31. a trapezoid with two congruent sides

32. **CRITICAL THINKING** Find the value of x in the quadrilateral. Then find the measure of each angle.



Spiral Review with Standardized Test Practice

33. **MULTIPLE CHOICE** Which property is *not* characteristic of a rhombus?

(A) opposite sides parallel (B) 4 right angles

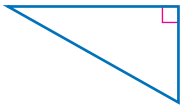
(C) 4 congruent sides (D) opposite sides congruent

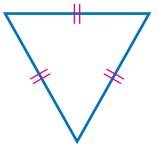
34. **MULTIPLE CHOICE** Which quadrilateral does *not* have opposite sides congruent?

(F) parallelogram (G) square (H) trapezoid (I) rectangle

Classify each triangle by its angles and by its sides. (Lesson 10-4)

35. 

36. 

37. 

38. Suppose $\angle RST$ and $\angle TSU$ are supplementary angles. Find $m\angle TSU$ if $m\angle RST$ is 76°. (Lesson 10-3)

Find the sales tax or discount to the nearest cent. (Lesson 8-5)

39. \$54 jacket; 7% sales tax

40. \$23 hat; 15% discount

Find each number. Round to the nearest tenth if necessary. (Lesson 7-7)

41. 20% of what number is 17?

42. What number is 45% of 160?

43. 5 is 12% of what number?

44. 15 is what percent of 24?

45. **TRAVEL** On his summer vacation, Timothy drove 250 miles in 5 hours on the first day. He continued driving at the same rate the second day and drove for 8 hours. How many miles did Timothy drive the second day of his vacation? (Lesson 7-2)

GETTING READY FOR THE NEXT LESSON

PREREQUISITE SKILL **Solve each proportion.** (Lesson 7-3)

46. $\frac{3}{5} = \frac{x}{75}$

47. $\frac{a}{7} = \frac{18}{42}$

48. $\frac{7}{9} = \frac{28}{m}$

49. $\frac{3.5}{t} = \frac{16}{32}$

50. $\frac{3}{6} = \frac{c}{5}$

CHAPTER 10

Mid-Chapter Practice Test

Vocabulary and Concepts

1. **Define** *supplementary angles*. (Lesson 10-3)
2. **Describe** the difference between a square and a rhombus. (Lesson 10-5)

Skills and Applications

Draw an angle having each measurement. Then classify each angle as *acute*, *obtuse*, *right*, or *straight*. (Lesson 10-1)

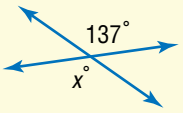
3. 134°
4. 90°
5. 180°
6. 17°

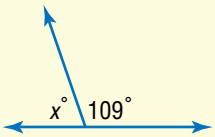
7. **SOCCER** Make a circle graph of total injuries of high school girls soccer players by position. (Lesson 10-2)

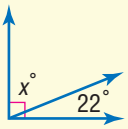
Injuries of High School Girls Soccer Players	
Position	**Percent**
halfbacks	37%
fullbacks	23%
forward line	28%
goalkeepers	12%

Source: National Athletic Trainers' Association

Find the value of x in each figure. (Lesson 10-3)

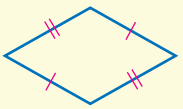
8. 

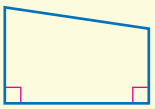
9. 

10. 

11. **ALGEBRA** Find $m\angle B$ in $\triangle ABC$ if $m\angle A = 62°$ and $m\angle C = 44°$. (Lesson 10-4)

Classify the quadrilateral using the name that *best* describes it. (Lesson 10-5)

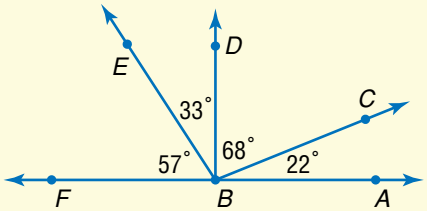
12. 

13. 

14. 

Standardized Test Practice

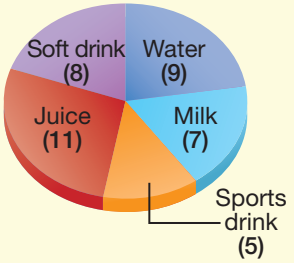
15. **MULTIPLE CHOICE** Which angle is complementary to $\angle CBD$? (Lesson 10-1)



(A) $\angle ABC$ (B) $\angle DBE$
(C) $\angle FBC$ (D) $\angle EBF$

16. **SHORT RESPONSE** Which section of the circle graph has an angle measure of 63°? (Lesson 10-2)

What Do You Drink With Dinner?



CONTENTS

The Game Zone

A Place To Practice Your Math Skills

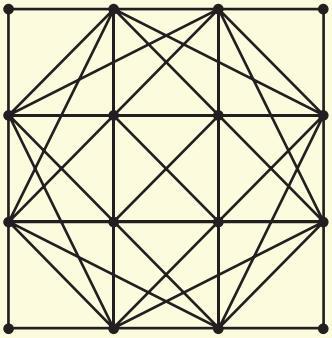
Squares Everywhere!

GET READY!

Players: two
Materials: 8 red counters, 8 yellow counters, dot paper, straight edge

GET SET!

- Copy the game board onto dot paper.



GO!

- The first player covers any dot with a counter. Then, players alternate turns.
- The object of the game is to cover the four vertices of a square with one set of counters. Note that the sides of a square don't have to be vertical or horizontal. The square can be "tilted" to one side.
- **Who Wins?** The first player to cover the four vertices of a square with his or her counters wins.
- Once you have played a game covering the four vertices of a square, change the game so you cover the four vertices of a rectangle or a parallelogram.

10-6 Similar Figures

What You'll LEARN

Determine whether figures are similar and find a missing length in a pair of similar figures.

NEW Vocabulary

similar figures
indirect measurement

REVIEW Vocabulary

proportion: an equation that shows that two ratios are equivalent (Lesson 7-3)

MATH Symbols

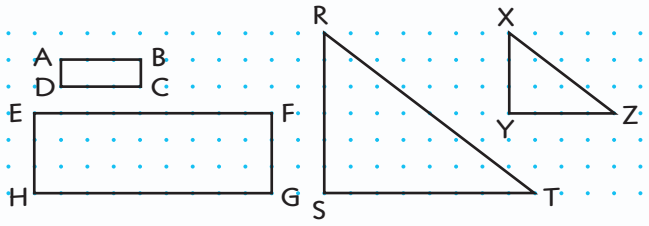
$\sim$ is similar to

HANDS-ON Mini Lab

Materials
- dot paper
- protractor

Work with a partner.

Copy each pair of rectangles and triangles onto dot paper. Then find the measure of each angle and the length of each side. Letters such as *AB* refer to the measure of the segment with those endpoints.



- Each pair of figures has the same shape but different sizes.
- Side $\overline{AB}$ "goes with" side $\overline{EF}$. So, they are *corresponding sides*.

1. Write each fraction in simplest form.
   a. $\frac{AB}{EF}; \frac{BC}{FG}; \frac{DC}{HG}; \frac{AD}{EH}$ b. $\frac{RS}{XY}; \frac{ST}{YZ}; \frac{RT}{XZ}$
2. What do you notice about the ratios of corresponding sides?
3. Measure the corresponding angles in the figures above. What do you notice about the measure of these angles?
4. The rectangles are similar, and the triangles are similar. **Make a conjecture** about similar figures.

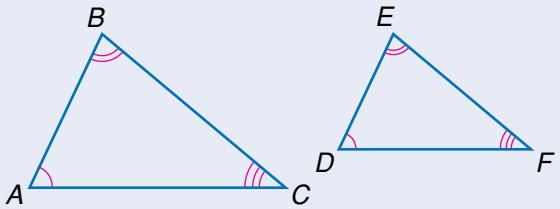
Figures that have the same shape but not necessarily the same size are **similar figures**. The Mini Lab illustrates the following definition.

Noteables

Key Concept: Similar Figures

Words If two figures are similar, then
- the corresponding sides are proportional, and
- the corresponding angles are congruent.

Models



Symbols $\triangle ABC \sim \triangle DEF$ The symbol $\sim$ means *is similar to*.

corresponding sides: $\frac{AB}{DE} = \frac{BC}{EF} = \frac{AC}{DF}$

corresponding angles: $\angle A \cong \angle D$; $\angle B \cong \angle E$; $\angle C \cong \angle F$

CONTENTS

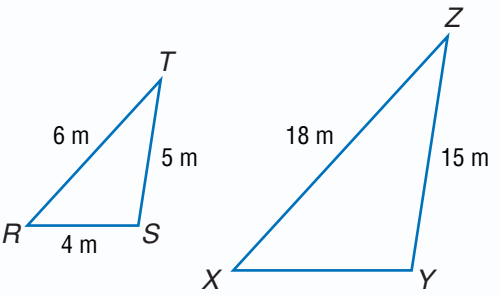
READING Math

Line Segments The symbol $\overline{XY}$ means the line segment $\overline{XY}$. XY means the measure of $\overline{XY}$.

EXAMPLE 1 Find Side Measures of Similar Triangles

If $\triangle RST \sim \triangle XYZ$, find the length of $\overline{XY}$.

Since the two triangles are similar, the ratios of their corresponding sides are equal. So, you can write and solve a proportion to find XY.



$\frac{RT}{XZ} = \frac{RS}{XY}$ Write a proportion.

$\frac{6}{18} = \frac{4}{n}$ Let n represent the length of $\overline{XY}$. Then substitute.

$6n = 18(4)$ Find the cross products.

$6n = 72$ Simplify.

$n = 12$ Divide each side by 6.

The length of $\overline{XY}$ is 12 meters.

You can use similar figures to find the length, width, or height of objects that are too difficult to measure directly. This type of measurement is called **indirect measurement**.

Standardized Test Practice

EXAMPLE 2 Use Indirect Measurement

GRID-IN TEST ITEM Natalie wants to resize a 4-inch wide by 5-inch long photograph for the school newspaper. It is to fit in a space that is 2 inches wide. What is the length of the resized photograph in inches?

Read the Test Item

To find the length of the resized photograph, draw a picture and write a proportion.

Solve the Test Item

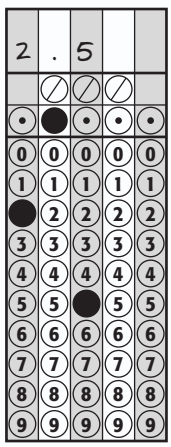
$\frac{4}{2} = \frac{5}{x}$ Write a proportion.

$4x = 10$ Find the cross products.

$x = 2.5$ Divide each side by 4.

So, the length of the photograph is 2.5 inches.

Fill in the Grid



Test-Taking Tip

Grid In
When filling in the response grid, you can print your answer with the first digit in the left answer box, or with the last digit in the right answer box.

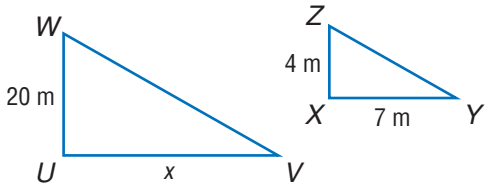
Skill and Concept Check

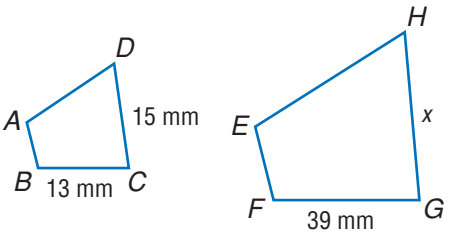
1. Writing Math Describe characteristics common to two similar triangles.

2. **OPEN ENDED** Draw two similar quadrilaterals and label the vertices. Then write equivalent ratios comparing all corresponding sides.

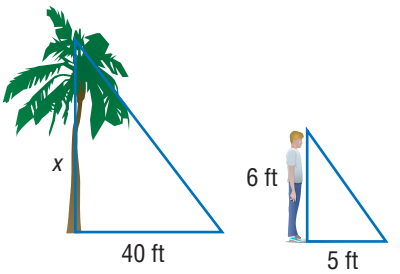
GUIDED PRACTICE

Find the value of x in each pair of similar figures.

3. 

4. 

5. **MEASUREMENT** The height of an object and its shadow is proportional to the height of another object and its shadow. Suppose you are 6 feet tall and you cast a shadow 5 feet long. Find the height of the tree if it casts a shadow 40 feet long.



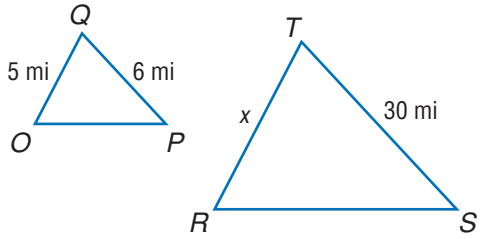
Practice and Applications

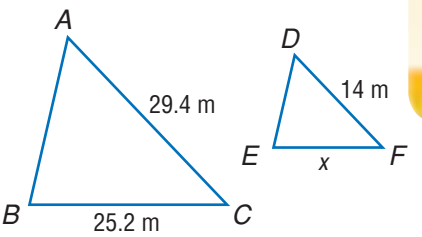
Find the value of x in each pair of similar figures.

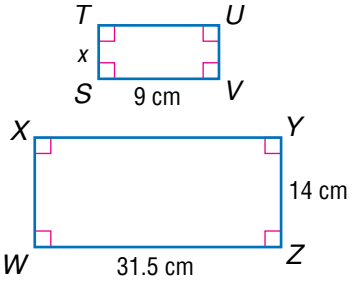
HOMEWORK HELP

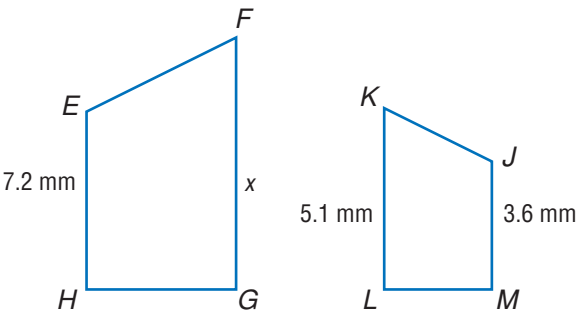
For Exercises	See Examples
6–9, 11–12	1
10, 13–15	2

Extra Practice
See pages 588, 605.

6. 

7. 

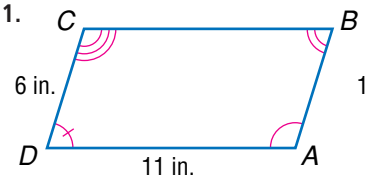
8. 

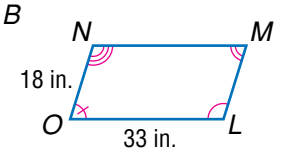
9. 

10. **FURNITURE** Kidco Furniture produces children's furniture that is similar in shape to full-sized furniture. The top of a full-sized desk measures 54 inches long by 36 inches wide. If the top of a child's desk is 24 inches wide, what is the length?

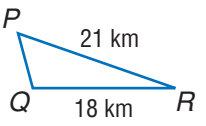
Determine whether each pair of figures is similar. Justify your answer.

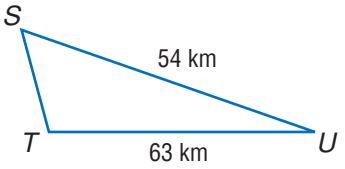
11.



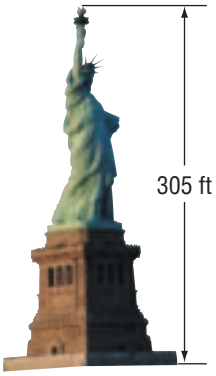


12.





STATUES **For Exercises 13 and 14, use the information below and at the right.** Alyssa bought a miniature replica of the Statue of Liberty. The replica is 9 inches tall, and the length of the statue's right arm holding the torch is $1\frac{1}{4}$ inches.



13. **MULTI STEP** About how long is the Statue of Liberty's right arm?

14. **MULTI STEP** Alyssa's friend Garcia brought home a smaller replica. The length of the statue's right arm is $\frac{3}{4}$ inch. How tall is Garcia's statue?

15. **GEOMETRY** The ratio of square H's length to square I's length is 3 : 5. If the length of square H is 18 meters, what is the perimeter of square I?

CRITICAL THINKING **Two rectangles are similar. The ratio of their corresponding sides is 1 : 4.**

16. Find the ratio of their perimeters.

17. Find the ratio of their areas.

Spiral Review with Standardized Test Practice

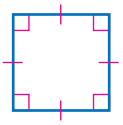
18. **MULTIPLE CHOICE** Which of the following is *not* a true statement?

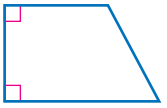
(A) All squares are similar. (B) All rhombi are similar.

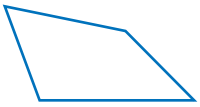
(C) Some trapezoids are similar. (D) All equilateral triangles are similar.

19. **SHORT RESPONSE** Old Faithful in Yellowstone National Park shoots water 60 feet into the air and casts a shadow of 42 feet. What is the height of a nearby tree if it casts a shadow 63 feet long?

Classify the quadrilateral using the name that *best* describes it. (Lesson 10-5)

20. 

21. 

22. 

23. **SAILING** A triangular-shaped sail has angle measures of 44° and 67°. Find the measure of the third angle. (Lesson 10-4)

GETTING READY FOR THE NEXT LESSON

PREREQUISITE SKILL Solve each equation. (Lesson 4-3)

24. $5a = 120$ 25. $360 = 4a$ 26. $940 = 8n$ 27. $6t = 720$

10-7a Problem-Solving Strategy

A Preview of Lesson 10-7

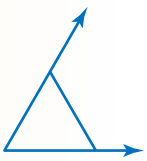
Use Logical Reasoning

What You'll LEARN

Solve problems using logical reasoning.

Dion, how can we check that the garden we dug is in the shape of an equilateral triangle?

There is a relationship between the angles of an equilateral triangle that can help us. Nathaniel, let's **use logical reasoning** to find out!

Explore	Equilateral triangles have sides that are congruent. We need to find a relationship between the angles.
Plan	Let's draw several equilateral triangles and measure the angles.
Solve	 sides = 1 cm; sides = 2 cm; sides = 3 cm; sides = 4 cm Each angle of the triangles is 60°. So, if the angles of our triangular garden are 60°, then the garden is in the shape of an equilateral triangle.
Examine	Any triangle with angle measures of 60° is equilateral. If we try to draw a triangle with angle measures of 60° and different side lengths, the drawing would not be in the shape of a triangle. 

Analyze the Strategy

1. When you use *inductive reasoning*, you make a rule after seeing several examples. When you use *deductive reasoning*, you use a rule to make a decision. What type of reasoning did Nathaniel and Dion use to solve the problem? **Explain** your reasoning.
2. **Explain** how Nathaniel and Dion could have solved the problem using deductive reasoning.
3. **Explain** how the *look for a pattern* problem-solving strategy is similar to inductive reasoning.

Laura Sifferlin

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Apply the Strategy

Solve. Use logical reasoning.

4. **GEOMETRY** Draw several isosceles triangles and measure their angles. What can you conclude about the measures of the angles of an isosceles triangle? See Exercise 1. Did you use inductive or deductive reasoning?

5. **TRAVEL** Use $d = rt$ where d is distance, r is rate, and t is time to find how far Mrs. Petricca drives if she drives 55 miles per hour for seven hours. See Exercise 1. Did you use inductive or deductive reasoning?

Mixed Problem Solving

Solve. Use any strategy.

6. **PHOTOCOPYING** Suppose you enlarge a drawing to 120% of its original size on the copy machine. If the drawing is 2 inches long and 3 inches wide, what are the dimensions of the copy?

7. **TOYS** Hannah was finding the relationship between the time it took a yo-yo to swing back and forth and its length. Predict the length of a yo-yo if it takes 5 seconds to swing back and forth.

Time (seconds)	Length (units)
1	1
2	4
3	9
4	16

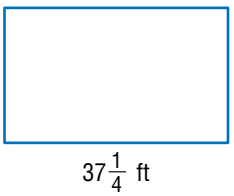
GEOMETRY For Exercises 8 and 9, draw several rectangles and measure their diagonals.

8. Find a relationship between the diagonals of a rectangle.

9. See Exercise 1. Did you use inductive or deductive reasoning in Exercise 8?

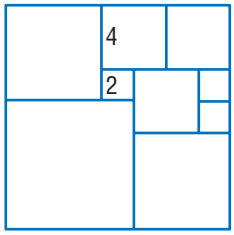
10. **BASKETBALL** Placido, Dexter, and Scott play guard, forward, and center on a team, but not necessarily in that order. Placido and the center drove Scott to practice on Saturday. Placido does not play guard. Who is the guard?

11. **GARDENING** Shelby wants to fence in her garden with the dimensions shown. How much fencing will she need?

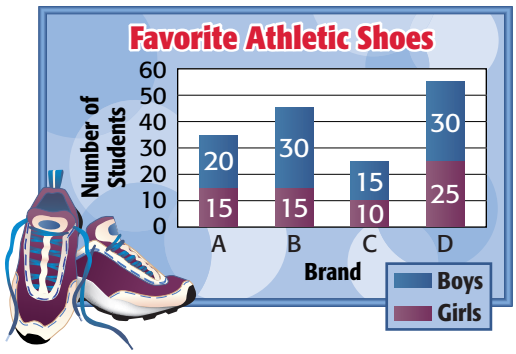


12. **CLOTHES** Careta put a $5 bill into one of seven pockets of her jacket. If she randomly reaches into one pocket, what is the probability that she will find the $5 bill?

13. **GEOMETRY** The large square has been divided into 9 squares. The lengths of the sides of two squares are given. Find the area of the entire square.



14. **STANDARDIZED TEST PRACTICE**
What can you conclude from the survey about favorite athletic shoes?



(A) Brand A is the most popular among both boys and girls.

(B) Brand B is two times more popular among boys than girls.

(C) Brand C cost more than Brand D.

(D) Brand A is less popular than Brand C.

10-7 Polygons and Tessellations

What You'll LEARN

Classify polygons and determine which polygons can form a tessellation.

NEW Vocabulary

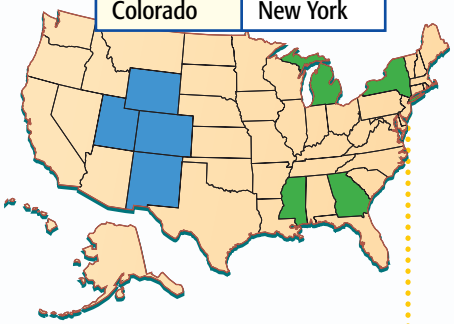
polygon
pentagon
hexagon
heptagon
octagon
nonagon
decagon
regular polygon
tessellation

WHEN am I ever going to use this?

GEOGRAPHY The size and shape of each state in the United States is different. Analyze the shapes of the states in both groups at the right.

1. Find the difference between the shapes of the states in Group 1 and the shapes of the states in Group 2.
2. Why do most states have boundaries that are not straight line segments?

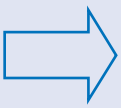
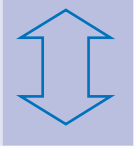
Group 1	Group 2
Utah	Georgia
Wyoming	Michigan
New Mexico	Mississippi
Colorado	New York



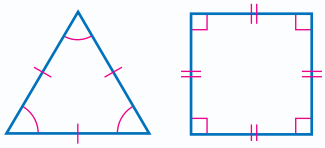
The states listed in Group 1 above are examples of polygons. A **polygon** is a simple, closed figure formed by three or more straight lines. A simple figure does not have lines that cross each other. You have drawn a closed figure when your pencil ends up where it started.

Polygons	Not Polygons
	
• Line segments are called sides. • Sides meet only at their endpoints. • Points of intersection are called vertices.	• Figures whose sides overlap. • Figures that are open. • Figures that have curved sides.

Just as a triangle has three sides and a quadrilateral has four sides, other polygons can be classified by the number of sides they have.

Words	pentagon	hexagon	heptagon	octagon	nonagon	decagon
Number of Sides	5	6	7	8	9	10
Models						

A polygon that has all sides congruent and all angles congruent is called a **regular polygon**. Equilateral triangles and squares are regular polygons.



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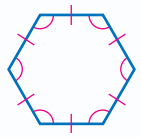
EXAMPLES Classify Polygons

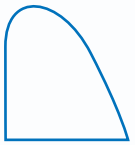
Determine whether each figure is a polygon. If it is, classify the polygon and state whether it is regular. If it is *not* a polygon, explain why.

1



The figure has 6 congruent sides and 6 congruent angles. It is a regular hexagon.

2



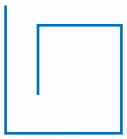
The figure is not a polygon since it has a curved side.

READING Math

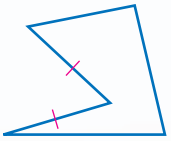
Regular Polygons Since regular polygons have *equal-sized angles*, they are also called *equiangular*.

Your Turn **Determine whether each figure is a polygon. If it is, classify the polygon and state whether it is regular. If it is *not* a polygon, explain why.**

a.



b.



The sum of the measures of the angles of a triangle is 180°. You can use this relationship to find the measures of the angles of regular polygons.

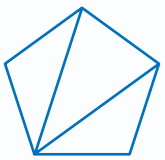
STUDY TIP

Diagonal A diagonal of a polygon is a line segment that connects two vertices that are not next to each other.

EXAMPLE Angle Measures of a Polygon

1 **ALGEBRA** **Find the measure of each angle of a regular pentagon.**

- Draw all of the diagonals from one vertex as shown and count the number of triangles formed.



- Find the sum of the angle measures in the polygon.

number of triangles formed × 180° = sum of angle measures in polygon

$$3 \times 180° = 540°$$

- Find the measure of each angle of the polygon. Let n represent the measure of one angle in the pentagon.

$5n = 540$ There are five congruent angles.

$n = 108$ Divide each side by 5.

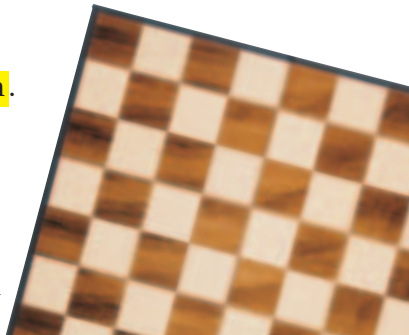
The measure of each angle in a regular pentagon is 108°.

Your Turn **Find the measure of an angle in each polygon.**

c. regular octagon

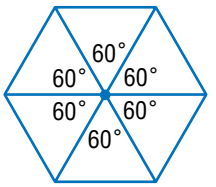
d. equilateral triangle

A repetitive pattern of polygons that fit together with no overlaps or holes is called a **tessellation**. The surface of a chessboard is an example of a tessellation of squares.

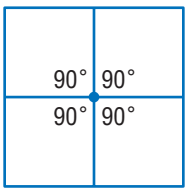


Aaron Haupt

The sum of the measures of the angles where the vertices meet in a tessellation is 360°. The diagrams below show tessellations of equilateral triangles and squares.



$6 \times 60^\circ = 360^\circ$



$4 \times 90^\circ = 360^\circ$

REAL-LIFE CAREERS

How Does a Landscape Architect Use Math?

Landscape architects multiply the length times the width of a garden to find the amount of mulch needed to cover the garden.

Research

For information about a career as a landscape architect, visit: msmath2.net/careers

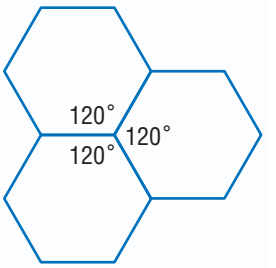
EXAMPLE Tessellations

LANDSCAPING **Mr. Brooks bought hexagonal-shaped stones to pave his patio. The stones are regular hexagons. Can Mr. Brooks tessellate his patio with the stones?**

The measure of each angle in a regular hexagon is 120°.

The sum of the measures of the angles where the vertices meet must be 360°. So, solve $120n = 360$.

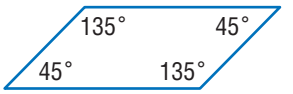
Since the solution, $n = 3$, is a whole number, a regular hexagon makes a tessellation.



Check You can check if your answer is correct by drawing a tessellation of regular hexagons.

Skill and Concept Check

1. **Explain** how you know the parallelogram at the right can be used by itself to make a tessellation.



2. **OPEN ENDED** Draw examples of a pentagon, hexagon, heptagon, octagon, nonagon, and decagon.

3. Writing Math Explain why a rhombus is not a regular polygon.

GUIDED PRACTICE

Determine whether each figure is a polygon. If it is, classify the polygon and state whether it is regular. If it is *not* a polygon, explain why.

4.

5.

6. Find the measure of each angle of a regular hexagon.

7. Can a regular polygon with an angle measure of 140° be used by itself to make a tessellation? Explain.

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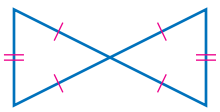
Practice and Applications

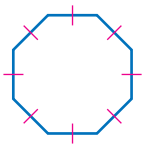
HOMEWORK HELP

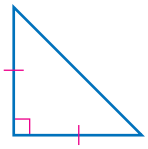
For Exercises	See Examples
8–13, 18, 20, 24–25, 27	1, 2
14–17, 19, 26	3
21–23, 28	4

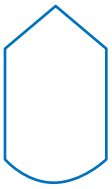
Extra Practice
See pages 589, 605.

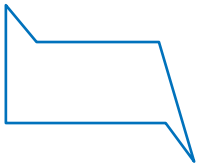
Determine whether each figure is a polygon. If it is, classify the polygon and state whether it is regular. If it is *not* a polygon, explain why.

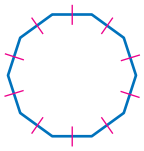
8. 

9. 

10. 

11. 

12. 

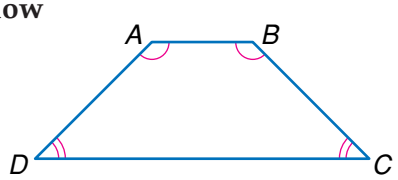
13. 

Find the measure of an angle in each polygon if the polygon is regular. Round to the nearest tenth of a degree if necessary.

14. decagon
15. nonagon
16. 13-gon
17. 20-gon

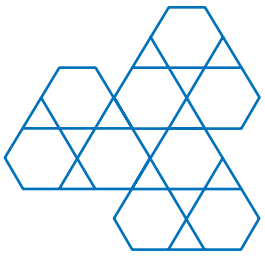
MANUFACTURING **For Exercises 18–20, use the information below and the figure at the right.**

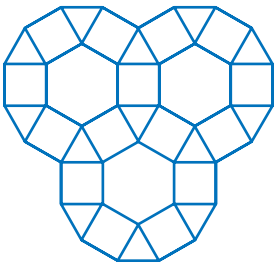
A company designs cafeteria trays so that four people can place their trays around a square table without bumping corners. The trays are similar to the one at the right. The top and bottom sides of the tray are parallel.

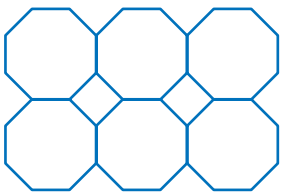


18. Classify the shape of the tray.
19. If $\angle A \cong \angle B$, $\angle C \cong \angle D$, and $m\angle A = 135°$, find $m\angle B$, $m\angle C$, and $m\angle D$.
20. Name the polygon formed by the outside of four trays when they are placed around the table with their sides touching.

Identify the polygons that are used to create each tessellation.

21. 

22. 

23. 

24. **ART** The mosaic at the right is decorated with handmade tiles from Pakistan. Name the polygons used in the tessellation.

25. What is the perimeter of a nonagon with sides 4.8 centimeters long?
26. Name the regular polygon if the sum of the measures of the polygon is 2,880° and the measure of one angle is 160°.

CONTENTS

27. Find the perimeter of a pentagon having sides $7\frac{1}{2}$ yards long.

28. **SIGNS** Stop signs are made from large sheets of steel. Suppose nine stop signs can be cut from one sheet of steel. Can all nine signs be arranged on the sheet so that none of the steel goes to waste? Explain your reasoning.

29. **RESEARCH** Use the Internet or another source to find the shape of other traffic signs. Name the type of sign, its shape, and whether it is regular.

30. **WRITE A PROBLEM** Write about a real-life object or situation that contains a tessellation. Name the polygons used and draw a picture of the tessellation.

31. **CRITICAL THINKING** You can make a tessellation with equilateral triangles. Can you make a tessellation with any isosceles or scalene triangles? If so, explain your reasoning and make a drawing.

Spiral Review with Standardized Test Practice

32. **MULTIPLE CHOICE** Which of the following flowchart symbols is *not* a polygon?

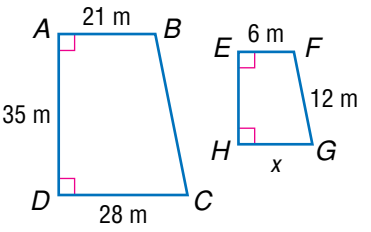
Ⓐ process box Ⓑ decision box Ⓒ stop box Ⓓ preparation box

33. **MULTIPLE CHOICE** Which of the following regular shapes *cannot* be used by itself to make a tessellation?

Ⓕ hexagon Ⓖ triangle Ⓗ square Ⓘ pentagon

34. **SHORT RESPONSE** What is the sum of the measures of the angles of a quadrilateral?

For Exercises 35 and 36, use the figures at the right.



35. Classify figure $ABCD$. (Lesson 10-5)

36. The quadrilaterals are similar. Find the value of x. (Lesson 10-6)

37. **MEASUREMENT** How many $\frac{1}{2}$-cup servings of ice cream are there in a gallon of chocolate ice cream? (Lesson 6-5)

Add or subtract. Write each sum or difference in simplest form. (Lesson 6-3)

38. $3\frac{2}{9} + 5\frac{4}{9}$ 39. $5\frac{1}{3} - 2\frac{1}{6}$ 40. $1\frac{3}{7} + 6\frac{1}{4}$ 41. $9\frac{4}{5} - 4\frac{7}{8}$

GETTING READY FOR THE NEXT LESSON

PREREQUISITE SKILL On graph paper, draw a coordinate plane. Then graph and label each point. Connect the points in order. (Lesson 3-3)

42. $A(-2, 3)$ 43. $B(4, 3)$ 44. $C(2, -1)$ 45. $D(-4, -1)$

CONTENTS

10-8 Translations

What You'll LEARN

Graph translations of polygons on a coordinate plane.

NEW Vocabulary

transformation
translation

Link to READING

Everyday Meaning of Translation: a change from one language to another, as in an English-to-Spanish translation

HANDS-ON Mini Lab

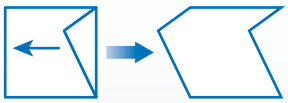
Materials
- paper
- scissors

Work with a partner.

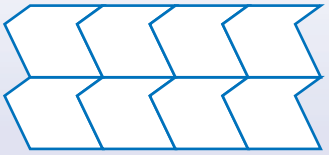
You can make changes in the polygons that tessellate to create new shapes that also tessellate.

STEP 1 Draw a square and cut a shape from it as shown.

STEP 2 Slide the shape to the opposite side without turning it.



STEP 3 The new shape will make a tessellation.



1. Make your own tessellation. Use different colors and shapes to make an interesting design.

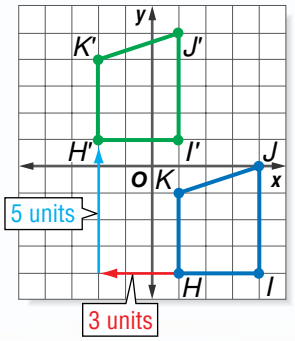
Anytime you move a geometric figure, it is called a **transformation**. In the Mini Lab, you slid the polygon to a new position without turning it. This sliding motion is called a **translation**.

When translating a figure, every point of the original figure is moved the same distance and in the same direction.

EXAMPLE 1 Graph a Translation

Translate trapezoid *HIJK* 3 units left and 5 units up.

- Move each vertex of the figure 3 units left and 5 units up. Label the new vertices H', I', J', and K'.
- Connect the vertices to draw the trapezoid. The coordinates of the vertices of the new figure are $H'(-2, 1)$, $I'(1, 1)$, $J'(1, 5)$, and $K'(-2, 4)$.



STUDY TIP

Transformations
Whenever a figure is translated, use prime symbols for the vertices in the transformed image.
$A \rightarrow A'$
$B \rightarrow B'$
$C \rightarrow C'$

When a figure has been translated, the original figure and the translated figure, or *image*, are congruent. In Example 1, trapezoid $HIJK$ is congruent to trapezoid $H'I'J'K'$. In congruent figures, the corresponding sides and angles have equal measures.

You can also add to or subtract from the coordinates of the vertices of a figure to find the translated vertices.

EXAMPLE 1 Find Coordinates of a Translation

Triangle LMN has vertices $L(-1, -2)$, $M(6, -3)$, and $N(2, -5)$. Find the vertices of $\triangle L'M'N'$ after a translation of 6 units left and 4 units up. Then graph the figure and its translated image.

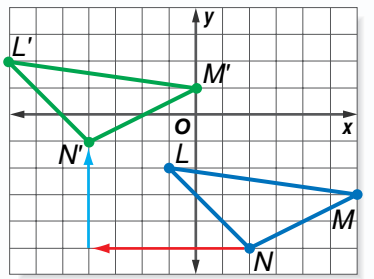
STUDY TIP

Translation
A *positive* integer describes a translation right or up on a coordinate plane. A *negative* integer describes a translation left or down.

Add -6 to each x-coordinate. Add 4 to each y-coordinate.

Vertices of $\triangle LMN$	$(x + (-6), y + 4)$	Vertices of $\triangle L'M'N'$
$L(-1, -2)$	$(-1 + (-6), -2 + 4)$	$L'(-7, 2)$
$M(6, -3)$	$(6 + (-6), -3 + 4)$	$M'(0, 1)$
$N(2, -5)$	$(2 + (-6), -5 + 4)$	$N'(-4, -1)$

The coordinates of the vertices of $\triangle L'M'N'$ are $L'(-7, 2)$, $M'(0, 1)$, and $N'(-4, -1)$.



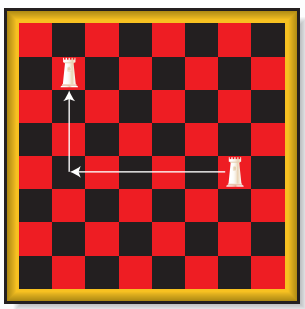
Your Turn **Triangle TUV has vertices $T(6, -3)$, $U(-2, 0)$, and $V(-1, 2)$. Find the vertices of $\triangle T'U'V'$ after each translation. Then graph the figure and its translated image.**

a. 3 units right and 4 units down **b.** 1 unit left and 6 units up

In Example 2, $\triangle LMN$ was translated 6 units left and 4 units up. This translation can be described using the ordered pair $(-6, 4)$.

EXAMPLE 2 Naming Translations with Ordered Pairs

GAMES **When playing chess, the rook can only move vertically or horizontally across a chessboard. The chessboard at the right shows the movement of a rook after two turns. Describe this translation as an ordered pair.**



The rook moved 5 places left and 3 places up. The translation can be written as $(-5, 3)$.

CONTENTS

Skill and Concept Check

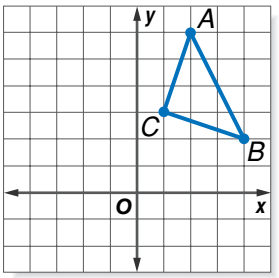
1. **OPEN ENDED** On a coordinate plane, draw a triangle and its translation 1 unit right and 4 units down.

2. **Which One Doesn't Belong?** Identify the translation that is not the same as the other three. Explain your reasoning.

(-5, -4)	(1, -3)	(6, -6)	(4, -2)

GUIDED PRACTICE

3. Translate $\triangle ABC$ 3 units left and 3 units down. Graph $\triangle A'B'C'$.



Quadrilateral $DEFG$ has vertices $D(1, 0)$, $E(-2, -2)$, $F(2, 4)$, and $G(6, -3)$. Find the vertices of $D'E'F'G'$ after each translation. Then graph the figure and its translated image.

4. 4 units right, 5 units down

5. 6 units right

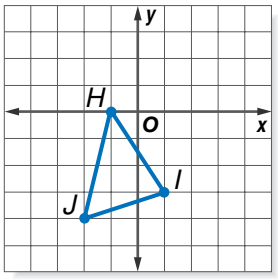
Practice and Applications

HOMEWORK HELP

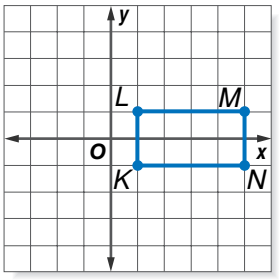
For Exercises	See Examples
6–7	1
8–11, 15	2
12, 16	3

Extra Practice
See pages 589, 605.

6. Translate $\triangle HIJ$ 2 units right and 6 units down. Graph $\triangle H'I'J'$.



7. Translate rectangle $KLMN$ 1 unit left and 3 units up. Graph rectangle $K'L'M'N'$.



Triangle PQR has vertices $P(0, 0)$, $Q(5, -2)$, and $R(-3, 6)$. Find the vertices of $P'Q'R'$ after each translation. Then graph the figure and its translated image.

8. 6 units right, 5 units up

9. 8 units left, 1 unit down

10. 3 units left

11. 9 units down

12. **MAPS** Payat lives at the corner of Wabash and Ohio. The school he attends is located at Huron and Dearborn. Describe Payat's walk from school to home as an ordered pair of the number of blocks.

13. **ART** Explain how translations and tessellations were used in *Horsemen*, created by M.C. Escher at the right.

Horsemen by M.C. Escher. © Cordon Art-Baarn-Holland. All rights reserved.

14. **RESEARCH** Use the Internet or another source to find other pieces of art that contain tessellations of translations. Describe how the artists incorporated both ideas into their work.

MULTI STEP **For Exercises 15 and 16, use the following information.**

$\triangle XYZ$ has vertices $X(7, 6)$, $Y(-3, 4)$, and $Z(1, -5)$. The translated figure $\triangle X'Y'Z'$ has vertices $X'(2, 4)$, $Y'(-8, 2)$, and $Z'(-4, -7)$.

15. Describe the translation.

16. Write the translation as an ordered pair.

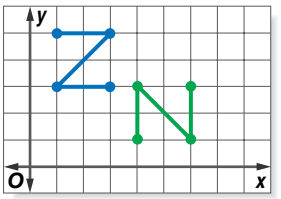
17. **TESSELLATIONS** Use the figure at the right and patty paper to make a tessellation using translations.

18. **CRITICAL THINKING** Is it possible to make a tessellation with translations of equilateral triangles? Explain your reasoning.

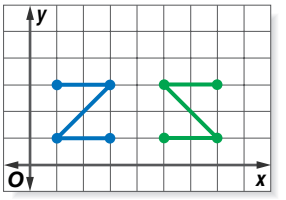
Spiral Review with Standardized Test Practice

19. **MULTIPLE CHOICE** Which graph shows a translation of the letter Z?

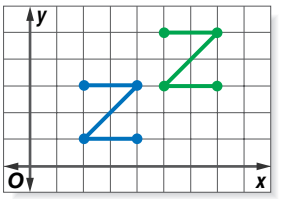
A



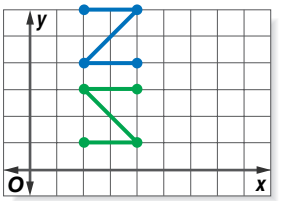
B



C



D



20. **SHORT RESPONSE** Triangle ABC with vertices $A(-5, 10)$, $B(5, 10)$, and $C(-10, 5)$ is translated by $(-10, 5)$. What are the coordinates of A'?

21. **GEOMETRY** What is the name of a polygon with eight sides? (Lesson 10-7)

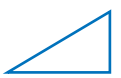
22. **TOWERS** Horatio is 167 centimeters tall and casts a shadow 93 centimeters long. What is the approximate height of a cellphone tower if it casts a shadow 763 centimeters long? (Lesson 10-6)

GETTING READY FOR THE NEXT LESSON

BASIC SKILL **Determine whether each figure can be folded in half so that one side matches the other. Write *yes* or *no*.**

23. 

24. 

25. 

26. 

10-8b Spreadsheet Investigation

A Follow-Up of Lesson 10-8

What You'll LEARN

Use a spreadsheet to enlarge and reduce polygons.

Dilations

A computer spreadsheet is a useful tool for calculating the vertices of polygons. You can enlarge or reduce the polygons by using a spreadsheet to automatically calculate the new coordinates of the vertices. Enlarging or reducing a figure is a transformation called a **dilation**.

ACTIVITY

Emma has plotted a pentagon on graph paper. The coordinates of the vertices of the pentagon are (2, 2), (4, 2), (5, 4), (3, 6), and (1, 4). She wants to multiply the coordinates by 3 to enlarge the pentagon. She enters the coordinates on a spreadsheet as shown below.

Set up the spreadsheet like the one shown below.

Pentagon Dilation

	A	B	C	D
1	original		dilation	
2	x-coordinate	y-coordinate	x-coordinate	y-coordinate
3	2	2	=A3*3	=B3*3
4	4	2	=A4*3	=B4*3
5	5	4		
6	3	6		
7	1	4		
8				

Sheet1 Sheet2 Sheet3

Continue entering the formulas in columns C and D to complete the dilation.

EXERCISE

1. How will the formulas in columns C and D change the original pentagon? How do you know?
2. Graph the original pentagon and its dilation on graph paper.
3. What is the percent of increase of the original pentagon to its dilation?
4. Find the coordinates of the pentagon enlarged 5 times.
5. Find the coordinates of the pentagon reduced by one-half.
6. What type of dilation had occurred if the new coordinates of the pentagon are (5, 5), (10, 5), (12.5, 10), (7.5, 15), and (2.5, 10)? What is the scale factor?
7. Select another geometric figure and plot its points on graph paper. Set up a spreadsheet to find two dilations, one enlargement and one reduction of the same figure.

10-9 Reflections

What You'll LEARN

Identify figures with line symmetry and graph reflections on a coordinate plane.

NEW Vocabulary

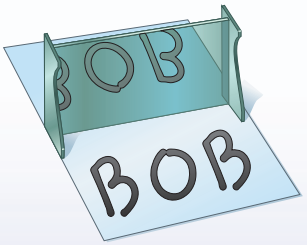
line symmetry
line of symmetry
reflection

HANDS-ON **Mini Lab**

Materials
- geomirror
- paper

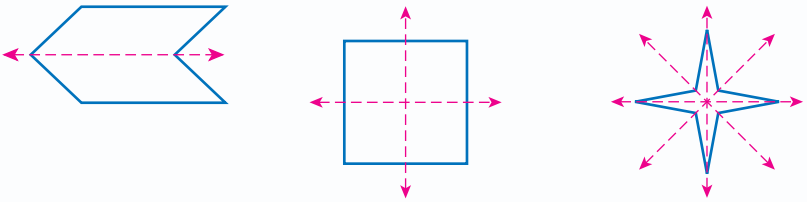
Work with a partner.

- Write your first name in capital letters on a sheet of paper.
- Use the geomirror to trace the reflection of the letters in your name.
- Write your last name. Draw the reflection of the letters without using the geomirror.



1. Describe how you drew the reflection of your last name.
2. List the capital letters that look the same as their reflections.
3. Explain why the line where the geomirror and paper meet is called the *line of symmetry*.

Figures that match exactly when folded in half have **line symmetry**. The figures below have line symmetry.

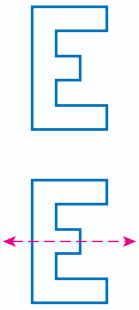


Each fold line is called a **line of symmetry**. Some figures can be folded in more than one way to show symmetry, so they have more than one line of symmetry.

EXAMPLES Identify Lines of Symmetry

Determine whether each figure has line symmetry. If so, copy the figure and draw all lines of symmetry.

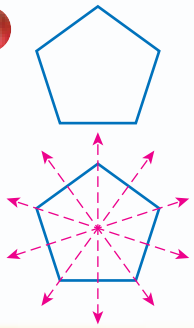
1



2

no symmetry

3



A type of transformation where a figure is flipped over a line of symmetry is a **reflection**. As with translations, the original figure and the reflected image are congruent.

STUDY TIP

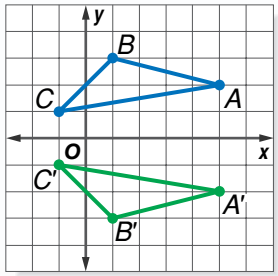
***x*-axis** When reflecting over the *x*-axis, change the *y*-coordinates to their opposites.

EXAMPLE 4 Reflect a Figure Over the *x*-axis

Triangle *ABC* has vertices *A*(5, 2), *B*(1, 3), and *C*(−1, 1). Find the coordinates of *ABC* after a reflection over the *x*-axis. Then graph the figure and its reflected image.

Vertices of $\triangle ABC$	Distance from *x*-axis	Vertices of $\triangle A'B'C'$
A(5, 2)	2	*A*′(5, −2)
B(1, 3)	3	*B*′(1, −3)
C(−1, 1)	1	*C*′(−1, −1)

Plot the vertices and connect to form $\triangle ABC$. The *x*-axis is the line of symmetry. So, the distance from each point on $\triangle ABC$ to the line of symmetry is the same as the distance from the line of symmetry to $\triangle A'B'C'$.



STUDY TIP

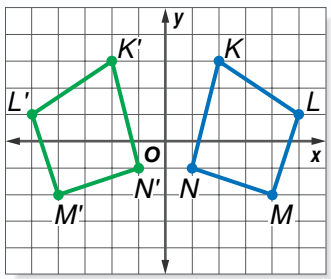
***y*-axis** When reflecting over the *y*-axis, change the *x*-coordinates to their opposites.

EXAMPLE 5 Reflect a Figure Over the *y*-axis

Quadrilateral *KLMN* has vertices *K*(2, 3), *L*(5, 1), *M*(4, −2), and *N*(1, −1). Find the coordinates of *KLMN* after a reflection over the *y*-axis. Then graph the figure and its reflected image.

Vertices of quad *KLMN*	Distance from *y*-axis	Vertices of quad *K′L′M′N′*
K(2, 3)	2	*K*′(−2, 3)
L(5, 1)	5	*L*′(−5, 1)
M(4, −2)	4	*M*′(−4, −2)
N(1, −1)	1	*N*′(−1, −1)

Plot the vertices and connect to form quadrilateral *KLMN*. The *y*-axis is the line of symmetry. So, the distance from each point on quadrilateral *KLMN* to the line of symmetry is the same as the distance from the line of symmetry to quadrilateral *K′L′M′N′*.



Your Turn

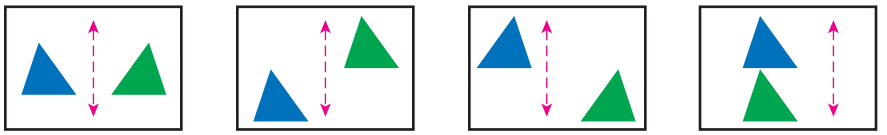
a. Find the coordinates of rectangle *GHIJ* with vertices *G*(3, −4), *H*(3, −1), *I*(−2, −1), and *J*(−2, −4) after a reflection over the *x*-axis. Then graph the figure and its reflected image.

b. Find the coordinates of triangle *PQR* with vertices *P*(1, 5), *Q*(3, 7), and *R*(5, −1) after a reflection over the *y*-axis. Then graph the figure and its reflected image.

Skill and Concept Check

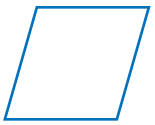
1. **OPEN ENDED** Draw a figure on a coordinate plane and its reflection over the y-axis.

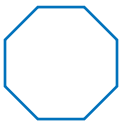
2. **Which One Doesn't Belong?** Identify the transformation that is not the same as the other three. Explain your reasoning.



GUIDED PRACTICE

Determine which figures have line symmetry. Write *yes* or *no*. If *yes*, draw all lines of symmetry.

3. 

4. 

Find the coordinates of each figure after a reflection over the given axis. Then graph the figure and its reflected image.

5. $\triangle ABC$ with vertices $A(5, 8)$, $B(1, 2)$, and $C(6, 4)$; x-axis
6. parallelogram $WXYZ$ with vertices $W(-4, -2)$, $X(-4, 3)$, $Y(-2, 4)$, and $Z(-2, -1)$; y-axis

Practice and Applications

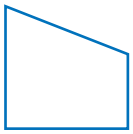
HOMEWORK HELP

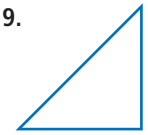
For Exercises	See Examples
7–10, 15–17	1–3
11–12	4
13–14	5

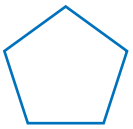
Extra Practice
See pages 589, 605.

Determine which figures have line symmetry. Write *yes* or *no*. If *yes*, draw all lines of symmetry.

7. 

8. 

9. 

10. 

Find the coordinates of each figure after a reflection over the x-axis. Then graph the figure and its reflected image.

11. quadrilateral $DEFG$ with vertices $D(-3, 6)$, $E(-2, -3)$, $F(2, 2)$, and $G(4, 9)$
12. $\triangle TUV$ with vertices $T(-6, 1)$, $U(-2, -3)$, and $V(5, -4)$

Find the coordinates of each figure after a reflection over the y-axis. Then graph the figure and its reflected image.

13. $\triangle QRS$ with vertices $Q(2, -5)$, $R(4, -5)$, and $S(2, 3)$
14. parallelogram $HIJK$ with vertices $H(-1, 3)$, $I(-1, -1)$, $J(2, -2)$, and $K(2, 2)$

15. **BUILDINGS** Describe the location of the line(s) of symmetry in the photograph of the Taj Mahal.

CONTENTS

16. **AMBULANCE** Explain why the word "AMBULANCE" is written backward and from right to left on the front of the emergency vehicle.

17. **SIGNAL FLAGS** International Marine Signal Flags are used by sailors to send messages at sea. A flag represents each letter of the alphabet. The flags below spell out the word *MATH*. Which flags have line symmetry? Draw all lines of symmetry.

M

A

T

H

Data Update What other maritime signal flags have line symmetry? Visit msmath2.net/data_update for more information.

18. **TESSELLATIONS** Make a tessellation using a combination of translations and reflections of polygons. Explain how you created your tessellation.

19. **CRITICAL THINKING** Triangle JKL has vertices $J(-7, 4)$, $K(7, 1)$, and $L(2, -2)$. Without graphing, reflect the triangle over the x-axis and then over the y-axis. What are the new coordinates of the triangle after the double reflection?

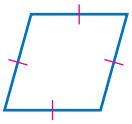
Spiral Review with Standardized Test Practice

20. **MULTIPLE CHOICE** $\triangle ABC$ with vertices $A(-2, -5)$, $B(4, 1)$, and $C(3, -2)$ is reflected over the y-axis. Find the coordinates of the new figure.

(A) $A'(2, -5)$, $B'(-4, 1)$, $C'(-3, -2)$ (B) $A'(-2, 5)$, $B'(4, -1)$, $C'(3, 2)$

(C) $A'(2, 5)$, $B'(-4, -1)$, $C'(-3, 2)$ (D) $A'(2, 5)$, $B'(4, 1)$, $C'(3, 2)$

21. **SHORT RESPONSE** How many lines of symmetry, if any, are in the rhombus at the right?



22. **GEOMETRY** Graph $\triangle FGH$ with vertices $F(-3, 7)$, $G(-1, 5)$, and $H(-2, 2)$ and its translation 4 units right and 1 unit down. Write the ordered pairs for the vertices of the new figure. (Lesson 10-8)

23. **ART** Aisha wishes to construct a tessellation for a wall hanging made only from regular decagons. Is this possible? Explain. (Lesson 10-7)

Estimate. (Lesson 6-1)

24. $\frac{4}{9} + 8\frac{1}{8}$

25. $\frac{1}{9} \times \frac{2}{5}$

26. $12\frac{1}{4} \div 5\frac{6}{7}$

27. Write an inequality for *six times a number is less than or equal to 18*. Then solve the inequality. (Lesson 4-5)

Mug Shots/CORBIS

10-9b HANDS-ON LAB

A Follow-Up of Lesson 10-9

Rotations

What You'll LEARN

Graph rotations on a coordinate plane.

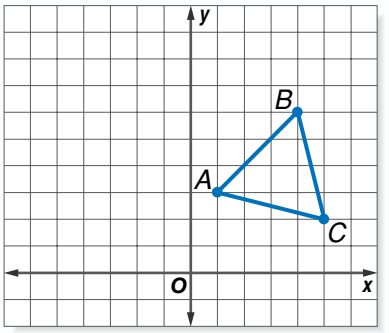
Materials

- graph paper
- protractor
- ruler

Another type of transformation is a rotation. A **rotation** moves a figure around a central point. Another name for a rotation is a *turn*. In this lab, you will learn how to rotate a figure on a coordinate plane.

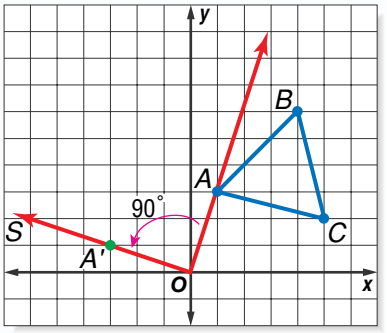
ACTIVITY *Work with a partner.*

1 **Rotate $\triangle ABC$ 90° counterclockwise about the origin. Then graph $\triangle A'B'C'$.**



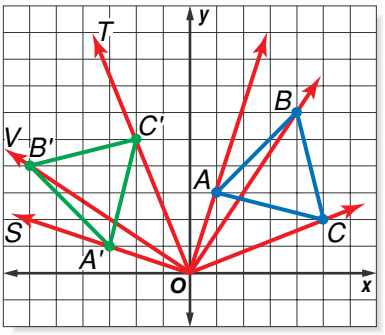
STEP 1 Draw a ray $\overrightarrow{OA}$ from the origin through point A.

STEP 2 Draw a 90° angle from $\overrightarrow{OA}$ rotated counterclockwise. Label the ray $\overrightarrow{OS}$.



STEP 3 Measure $\overline{OA}$. Then measure the same distance from O on $\overrightarrow{OS}$. This is the location of rotated vertex A'.

STEP 4 Rotate the other vertices in the same way by drawing rotated rays $\overrightarrow{OV}$ and $\overrightarrow{OT}$ to obtain vertices B' and C'.



STEP 5 Connect the rotated points to make $\triangle A'B'C'$.

Rotated figures are congruent because the side lengths remain the same. So, $\triangle ABC \cong \triangle A'B'C'$.

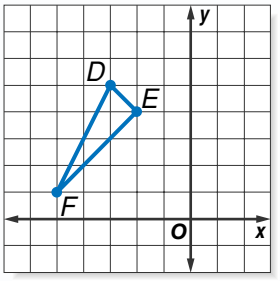
READING Math

Rotations If you rotate an image once, the vertices contain a prime symbol ($'$). If you rotate a rotated image, the vertices contain a double prime symbol ($''$).

Your Turn

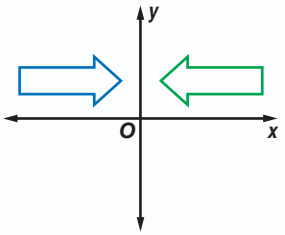
a. Rotate $\triangle DEF$ 90° counterclockwise about the origin. Then graph $\triangle D'E'F'$.

b. Rotate $\triangle D'E'F'$ from Part a above 90° counterclockwise about the origin. Then graph $\triangle D''E''F''$.



ACTIVITY *Work with a partner.*

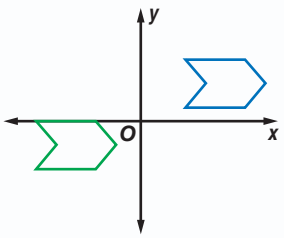
2 **Identify the transformation as a *translation*, *reflection*, or *rotation*. The original figure is blue and the transformation is green.**



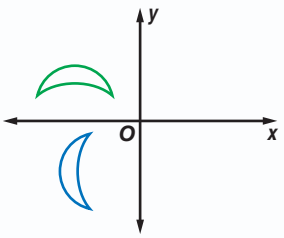
The distance from the point of the blue arrow to the line of symmetry is the same as the distance from the point of the green arrow to the line of symmetry. The *y*-axis is a line of symmetry. Therefore, the transformation is a reflection.

Your Turn **Identify the transformation as a *translation*, *reflection*, or *rotation*. The original figure is blue and the transformation is green.**

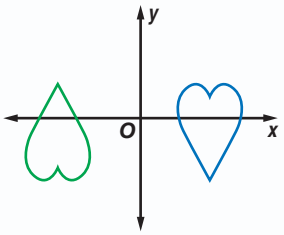
c.



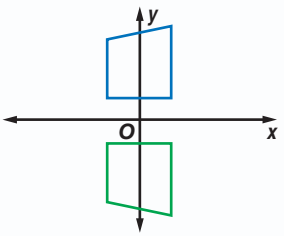
d.



e.



f.



Writing Math

Work with a partner.

1. Rotate $\triangle DEF$ from Your Turn a 180° counterclockwise. Compare your rotated figure with your answer from Your Turn b.
2. **Make a conjecture** about rotating figures 180°.
3. Without rotating $\triangle DEF$ 360°, **make a conjecture** about rotating figures 360°. Describe the figure after a 360° rotation.
4. A 60° *counterclockwise* rotation is the same as a −300° *clockwise* rotation. Find an equivalent rotation of a 90° counterclockwise rotation.
5. Complete the following sentence. Since you can rotate figures in clockwise or counterclockwise directions, a 270° counterclockwise rotation produces the same result as a ___?___ clockwise rotation.

CHAPTER 10

Study Guide and Review

Vocabulary and Concept Check

acute angle (p. 413)
acute triangle (p. 429)
angle (p. 413)
circle graph (p. 418)
complementary angles (p. 422)
congruent angles (p. 422)
congruent segments (p. 429)
decagon (p. 446)
degrees (p. 413)
equilateral triangle (p. 429)
heptagon (p. 446)
hexagon (p. 446)
indirect measurement (p. 441)
isosceles triangle (p. 429)
line of symmetry (p. 456)
line symmetry (p. 456)
nonagon (p. 446)
obtuse angle (p. 413)
obtuse triangle (p. 429)
octagon (p. 446)
parallelogram (p. 434)
pentagon (p. 446)
polygon (p. 446)
quadrilateral (p. 434)
reflection (p. 457)
regular polygon (p. 446)
rhombus (p. 434)
right angle (p. 413)
right triangle (p. 429)
scalene triangle (p. 429)
similar figures (p. 440)
straight angle (p. 413)
supplementary angles (p. 422)
tessellation (p. 447)
transformation (p. 451)
translation (p. 451)
trapezoid (p. 434)
triangle (p. 428)
vertex (p. 413)
vertical angles (p. 422)

Choose the letter of the term that best matches each phrase.

1. the point where the sides of an angle meet
2. an angle whose measure is less than 90°
3. two angles whose measures add to 180°
4. a polygon with six sides
5. a triangle with no congruent sides

a. scalene triangle
b. complementary angles
c. vertex
d. hexagon
e. acute angle
f. supplementary angles

Lesson-by-Lesson Exercises and Examples

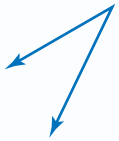
10-1 Angles (pp. 413–415)

Classify each angle as *acute*, *obtuse*, *right*, or *straight*.

6. 

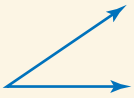
7. 

8. 

9. 

10. Draw $\angle PQR$ with a measure of 128°.

Example 1 **Classify the angle as *acute*, *obtuse*, *right*, or *straight*.**



The angle is an acute angle because its measure is less than 90°.

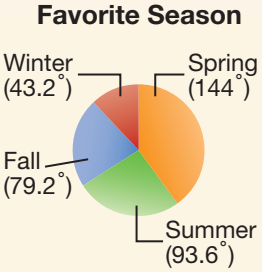
10-2 Statistics: Making Circle Graphs (pp. 418–421)

11. Make a circle graph of the data.

Favorite Soft Drink	Percent
Cola	36%
Diet Cola	28%
Root Beer	15%
Lemon Lime	7%
Other	14%

Example 2 **Make a circle graph of the data of favorite season: 40% spring, 26% summer, 22% fall, and 12% winter.**

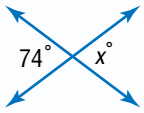
First find the degrees for each part. Then construct the circle graph.



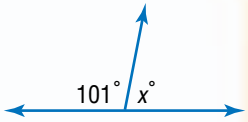
10-3 Angle Relationships (pp. 422–425)

Find the value of x in each figure.

12.

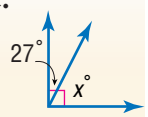


13.



14. If $\angle Y$ and $\angle Z$ are complementary angles and $m\angle Z = 35°$, find $m\angle Y$.

Example 3 **Find the value of x.**



Since the angles are complementary, $x + 27 = 90$.

$x + 27 = 90$ Write the equation.

$-27 \quad -27$ Subtract 27 from each side.

$x = 63$

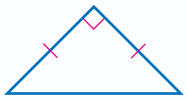
So, the value of x is 63.

10-4 Triangles (pp. 428–431)

Classify each triangle by its angles and by its sides.

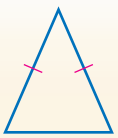
15.

16.



17. Find $m\angle S$ in $\triangle RST$ if $m\angle R = 28°$ and $m\angle T = 13°$.

Example 4 **Classify the triangle by its angles and by its sides.**

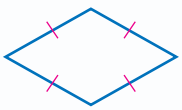


The triangle is acute since all three angles are acute. It is also isosceles because it has two congruent sides.

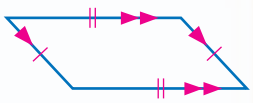
10-5 Quadrilaterals (pp. 434–437)

Classify the quadrilateral using the name that *best* describes it.

18.

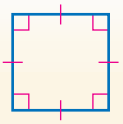


19.



20. What type of quadrilateral may *not* have opposite sides congruent?

Example 5 **Classify the quadrilateral using the name that *best* describes it.**



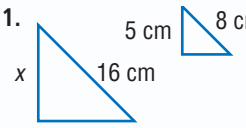
The quadrilateral is a parallelogram with 4 right angles and 4 congruent sides. It is a square.

Mixed Problem Solving
For mixed problem-solving practice, see page 605.

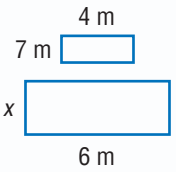
10-6 Similar Figures (pp. 440–443)

Find the value of x in each pair of similar figures.

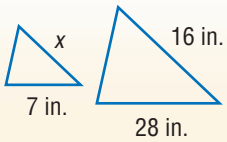
21.



22.



Example 6 **Find the value of x in the pair of similar figures.**



$\frac{7}{28} = \frac{x}{16}$ Write a proportion.

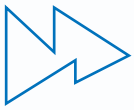
$28x = 112$ Multiply.

$x = 4$ Divide.

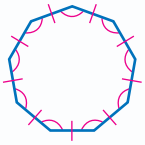
10-7 Polygons and Tessellations (pp. 446–450)

Classify each polygon below and state whether it is regular.

23.

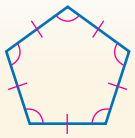


24.



25. **ALGEBRA** Find the measure of each angle of a regular 15-gon.

Example 7 **Classify the polygon and state whether it is regular.**



Since the polygon has 5 congruent sides and 5 congruent angles, it is a regular pentagon.

10-8 Translations (pp. 451–454)

Triangle PQR has coordinates $P(4, -2)$, $Q(-2, -3)$, and $R(-1, 6)$. Find the coordinates of $P'Q'R'$ after each translation. Then graph each translation.

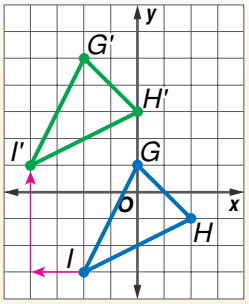
26. 6 units left, 3 units up

27. 4 units right, 1 unit down

28. 3 units left

29. 7 units down

Example 8
Find the coordinates of $\triangle G'H'I'$ after a translation of 2 units left and 4 units up.



The vertices of $\triangle G'H'I'$ are $G'(-2, 5)$, $H'(0, 3)$, and $I'(-4, 1)$.

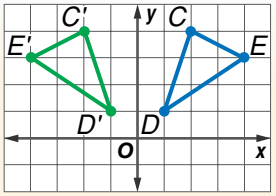
10-9 Reflections (pp. 456–459)

Find the coordinates of each figure after a reflection over the given axis. Then graph the figure and its reflected image.

30. $\triangle RST$ with coordinates $R(-1, 3)$, $S(2, 6)$, and $T(6, 1)$; x-axis

31. parallelogram $ABCD$ with coordinates $A(1, 3)$, $B(2, -1)$, $C(5, -1)$, and $D(4, 3)$; y-axis

Example 9
Find the coordinates of $\triangle C'D'E'$ after a reflection over the y-axis. Then graph its reflected image.



The vertices of $\triangle C'D'E'$ are $C'(-2, 4)$, $D'(-1, 1)$, and $E'(-4, 3)$.

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CHAPTER 10

Practice Test

Vocabulary and Concepts

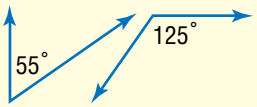
1. **List** the number of sides and number of angles in an octagon.
2. **Explain** how to translate a geometric figure.

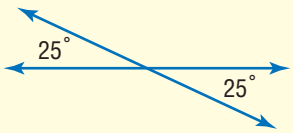
Skills and Applications

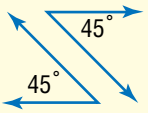
Classify each angle as *acute*, *obtuse*, *right*, or *straight*.

3. 53°
4. 97°
5. 180°

Classify each pair of angles as *complementary*, *supplementary*, or *neither*.

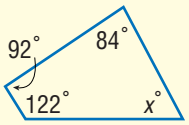
6. 

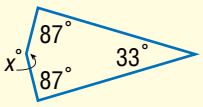
7. 

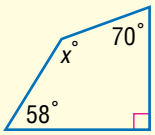
8. 

9. **FOOD** Angelo's Pizza Parlor makes square pizzas. After baking, the pizzas are cut along one diagonal into two triangles. Describe the triangles.

Find the missing measure in each quadrilateral.

10. 

11. 

12. 

13. **GEOGRAPHY** Luz is drawing a map similar to one found in the atlas. The map in the atlas is 7 inches wide and 10 inches long. If she draws the width 17.5 inches, how long should she draw the map?

14. Can a regular heptagon, whose angle measures total 900°, be used by itself to make a tessellation? Explain your reasoning.

15. Draw a figure with exactly one line of symmetry.

Standardized Test Practice

16. **MULTIPLE CHOICE** The table shows the results of a student survey of favorite type of book. Choose the statement that is *false*.

Favorite Type of Books	
Mystery	24
Science Fiction	8
Sports	26
Romance	30

(A) The science fiction section on a circle graph of the data at the right has an angle measure of about 33°.

(B) Romance books were the most favorite types of books.

(C) About 30% of students chose sports books as their favorite.

(D) The mystery and sports sections on a circle graph of the data at the right have supplementary angles.

CHAPTER 10

Standardized Test Practice

PART 1 Multiple Choice

Record your answers on the answer sheet provided by your teacher or on a sheet of paper.

1. Which inequality is false? (Prerequisite Skill, p. 556)

   (A) $0.0059 > 0.0005$

   (B) $6.1530 < 6.1532$

   (C) $89.13 > 89.10$

   (D) $5.06 < 5.006$

2. On Spring Street, there is an apartment building that houses four families, each with four members. One of the families moves away. Express this change in residents as an integer. (Lesson 3-1)

   (F) 12 (G) 4

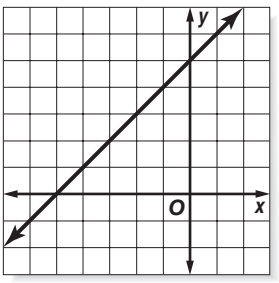
   (H) -4 (I) -1

3. Find the algebraic expression for the following statement. *Blanca has five more than three times as many CDs as Garrett.* (Lesson 4-1)

   (A) $B = \frac{3g}{5}$ (B) $B = 3g - 5$

   (C) $B = 3(g + 5)$ (D) $B = 5 + 3g$

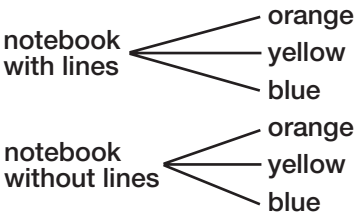
4. Which is the equation for the graphed line? (Lesson 4-7)



   (F) $y = x + 5$ (G) $y = x - 5$

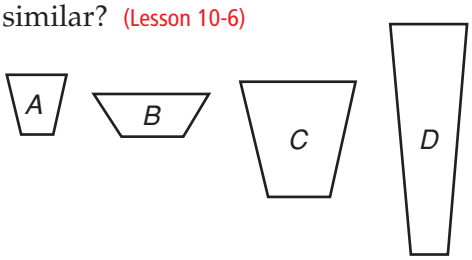
   (H) $y = 5x$ (I) $y = 5x + 5$

5. The tree diagram shows the types of notebooks Esther can buy for school. If Esther selects one at random, what are the chances that she will select an orange notebook without lines? (Lesson 9-2)



   (A) $\frac{1}{12}$ (B) $\frac{1}{8}$ (C) $\frac{1}{6}$ (D) $\frac{1}{5}$

6. Which two of the figures below appear to be similar? (Lesson 10-6)



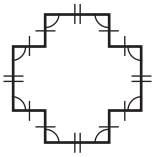
   (F) figure A and figure C

   (G) figure B and figure C

   (H) figure A and figure D

   (I) figure A and figure B

7. Kendrick chose a frame for a painting that looks like the polygon. Is this a regular polygon? (Lesson 10-7)



   (A) Yes, because the angles are congruent.

   (B) No, because the sides are not congruent.

   (C) Yes, because the polygon is made up of line segments.

   (D) Yes, because the angles and sides are congruent.

8. Which letter has two lines of symmetry? (Lesson 10-9)

   (F) B (G) E (H) L (I) X

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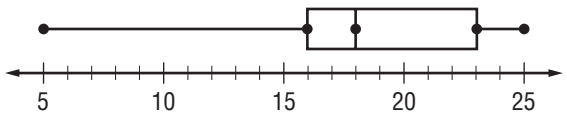
PART 2 Short Response/Grid In

Record your answers on the answer sheet provided by your teacher or on a sheet of paper.

9. According to the box-and-whisker plot, what is the interquartile range? (Lesson 2-6)



10. The table shows the values of p and q, where the values of p and q form a proportion. What are the values of Y and Z? (Lesson 7-3)

p	4	16	Z
q	7	Y	63

11. The veterinary hospital treated 162 animals last week. It treated 204 animals this week. What was the percent of increase? (Lesson 8-4)

12. Rebecca can choose seven different classes from five different class periods offered during the school day. How many possible ways can Rebecca arrange her class schedule? (Lesson 9-3)

13. How many degrees do the hands of a clock make at 9:00? (Lesson 10-1)

14. How long should the missing sides of the triangle be to make it isosceles with a perimeter of 15 centimeters? (Lesson 10-4)

15. Find the sum of the angle measures of a hexagon. (Lesson 10-7)

16. How many lines of symmetry does the figure at the right have? (Lesson 10-9)

TEST-TAKING TIP

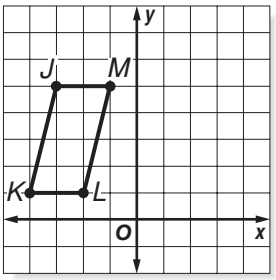
Question 17 Most standardized tests allow you to write in the test booklet. Use it to work out problems. For example, plot a figure and its translation on the coordinate graph given with the question in the booklet. Doing so will help keep you from making careless errors.

17. Triangle ABC with vertices $A(3, -7)$, $B(2, -3)$, and $C(8, -3)$ was translated to $A'B'C'$ with vertices $A'(-3, -3)$, $B'(-4, 1)$, and $C'(2, 1)$. Represent the translation as an ordered pair. (Lesson 10-8)

PART 3 Extended Response

Record your answers on a sheet of paper. Show your work.

18. Edmundo plotted polygon $JKLM$ on the coordinate plane below.



a. Classify $\angle J$. (Lesson 10-1)

b. Classify $\angle M$. (Lesson 10-1)

c. Classify polygon $JKLM$ using the name that *best* describes it. Be as specific as possible. (Lesson 10-5)

d. Can polygon $JKLM$ be used by itself to make a tessellation? Explain your reasoning. (Lesson 10-7)

e. If polygon $JKLM$ is translated 2 units right and 5 units down, what are the coordinates of the new figure? (Lesson 10-8)

f. If polygon $JKLM$ is reflected over the x-axis, what are the coordinates of the new figure? (Lesson 10-9)