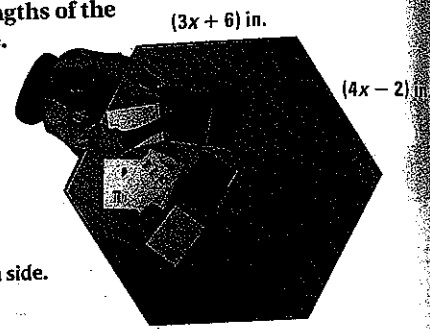### EXAMPLE 3 Find side lengths

READ VOCABULARY
Hexagonal means "shaped like a hexagon."

ALGEBRA A table is shaped like a regular hexagon. The expressions shown represent side lengths of the hexagonal table. Find the length of a side.

$(3x + 6)$ in.

$(4x - 2)$ in.

Solution

First, write and solve an equation to find the value of x. Use the fact that the sides of a regular hexagon are congruent.

$3x + 6 = 4x - 2$ Write equation.

$6 = x - 2$ Subtract $3x$ from each side.

$8 = x$ Add 2 to each side.

Then find a side length. Evaluate one of the expressions when $x = 8$.

$3x + 6 = 3(8) + 6 = 30$

▶ The length of a side of the table is 30 inches.

✓ **GUIDED PRACTICE** | for Example 3

3. The expressions $8y°$ and $(9y - 15)°$ represent the measures of two of the angles in the table in Example 3. Find the measure of an angle. **120°**

1.6 EXERCISES

HOMEWORK KEY
○ = WORKED-OUT SOLUTIONS on p. WS1 for Exs. 13, 19, and 33
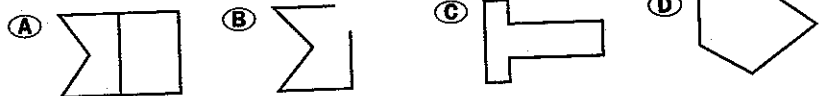★ = STANDARDIZED TEST PRACTICE Exs. 2, 7, 37, 39, and 40

SKILL PRACTICE

1. **VOCABULARY** *Explain* what is meant by the term *n*-gon.
An *n*-gon is a polygon with *n* sides.

2. ★ **WRITING** Imagine that you can tie a string tightly around a polygon. If the polygon is convex, will the length of the string be equal to the distance around the polygon? What if the polygon is concave? *Explain.* **See margin.**

EXAMPLE 1
on p. 42
for Exs. 3–7

IDENTIFYING POLYGONS Tell whether the figure is a polygon. If it is not, *explain* why. If it is a polygon, tell whether it is *convex* or *concave*. **3–6. See margin.**
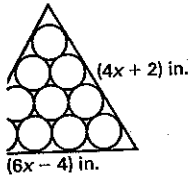
3.   4.   5.   6.

7. ★ **MULTIPLE CHOICE** Which of the figures is a concave polygon? **C**

Ⓐ   Ⓑ   Ⓒ   Ⓓ

44   Chapter 1   Essentials of Geometry

Left margin (teacher's edition notes):

ra Example 3

:k for billiard balls is shaped an equilateral triangle. Find the th of a side. **14 in.**

$(4x + 2)$ in.

$(6x - 4)$ in.

y Question to Ask for ample 3

'hat is the distance around the ble? **180 in.**

osing the Lesson

ve students summarize the major nts of the lesson and answer the sential Question: How do you issify polygons?

A polygon is a plane figure ormed by three or more line segments. Each side intersects exactly two other sides, one at each endpoint, so that no two sides with a common endpoint are collinear.

A polygon is convex if no line that contains a side of the polygon contains a point in the interior. Otherwise, the polygon is concave.

A polygon is regular if all sides are congruent and all angles in the interior are congruent.

The most basic way of classifying a polygon is by the number of sides. You can also tell whether the polygon is convex or concave, or indicate whether all the sides or angles are congruent. If all the sides of a convex polygon are congruent and all the angles are congruent, the polygon is a regular polygon.

2. Yes, the string will match the sides of a convex polygon, so it will be the perimeter of the polygon; no, the length of the string will be less than the perimeter of the polygon.

3. polygon; concave
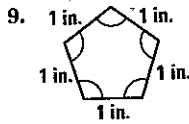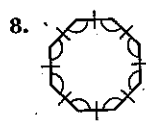
4. Not a polygon; part of the figure is not a segment.

5. polygon; convex

6. Not a polygon; some segments intersect more than two segments.

44

EXAMPLE 2
on p. 43
for Exs. 8–14

CLASSIFYING Classify the polygon by the number of sides. Tell whether the polygon is equilateral, equiangular, or regular. *Explain* your reasoning. 8–13. See margin.

8.

9. 1 in. / 1 in.
1 in. / 1 in.
1 in.

10.

11. 5 m
4 m
5 m

12.

13.
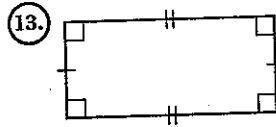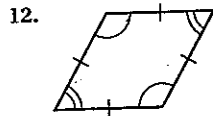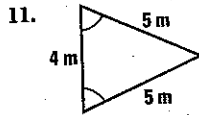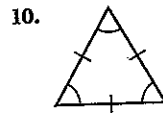
14. **ERROR ANALYSIS** Two students were asked to draw a regular hexagon, as shown below. *Describe* the error made by each student.
Student A: the hexagon is concave, Student B: the hexagon does not have congruent sides.

Student A   Student B
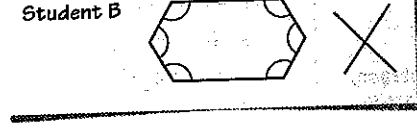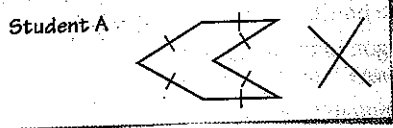
EXAMPLE 3
on p. 44
for Exs. 15–17

15. **ALGEBRA** The lengths (in inches) of two sides of a regular pentagon are represented by the expressions $5x - 27$ and $2x - 6$. Find the length of a side of the pentagon. **8 in.**

16. **ALGEBRA** The expressions $(9x + 5)°$ and $(11x - 25)°$ represent the measures of two angles of a regular nonagon. Find the measure of an angle of the nonagon. **140°**

17. **ALGEBRA** The expressions $3x - 9$ and $23 - 5x$ represent the lengths (in feet) of two sides of an equilateral triangle. Find the length of a side. **3 ft**
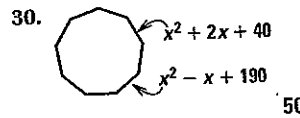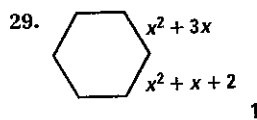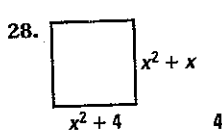
B **USING PROPERTIES** Tell whether the statement is *always*, *sometimes*, or *never* true.

18. A triangle is convex. **always**

19. A decagon is regular. **sometimes**

20. A regular polygon is equiangular. **always** 21. A circle is a polygon. **never**

22. A polygon is a plane figure. **always**   23. A concave polygon is regular. **never**

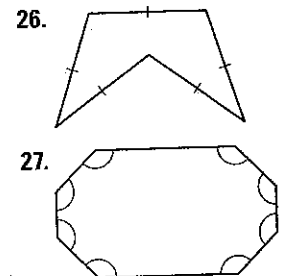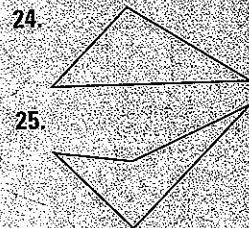**DRAWING** Draw a figure that fits the description. 24–27. See margin.

24. A triangle that is not regular

25. A concave quadrilateral

26. A pentagon that is equilateral but not equiangular

27. An octagon that is equiangular but not equilateral

ALGEBRA Each figure is a regular polygon. Expressions are given for two side lengths. Find the value of x.

28. $x^2 + x$
$x^2 + 4$ **4**

29. $x^2 + 3x$
$x^2 + x + 2$ **1**

30. $x^2 + 2x + 40$
$x^2 - x + 190$ **50**

1.6 Classify Polygons   **45**

8. Octagon; regular; it has 8 congruent sides and angles.
9. Pentagon; regular; it has 5 congruent sides and angles.
10. Triangle; regular; it has 3 congruent sides and angles.
11. Triangle; none of these; the sides and/or the angles are not all congruent.
12. Quadrilateral; equilateral; it has 4 congruent sides.
13. Quadrilateral; equiangular; it has 4 congruent angles.

24–27. Sample answers are given.
24.
25.

26.
27.

31. CHALLENGE Regular pentagonal tiles and triangular tiles are arranged in the pattern shown. The pentagonal tiles are all the same size and shape and the triangular tiles are all the same size and shape. Find the angle measures of the triangular tiles. *Explain* your reasoning. **See margin.**
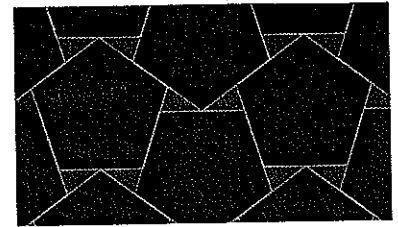
PROBLEM SOLVING

A **32. ARCHITECTURE** Longwood House, shown in the photograph on page 42, is located in Natchez, Mississippi. The diagram at the right shows the floor plan of a part of the house.

a. Tell whether the red polygon in the diagram is *convex* or *concave*. **convex**

b. Classify the red polygon and tell whether it appears to be regular.

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32b. Octagon, it appears to be regular.

SIGNS Each sign suggests a polygon. Classify the polygon by the number of sides. Tell whether it appears to be *equilateral*, *equiangular*, or *regular*.

EXAMPLE 2
on p. 43
for Exs. 33–36

33. **YIELD**
34. **RESERVED PARKING**
35. **STOP**
36. **RAILROAD CROSSING**
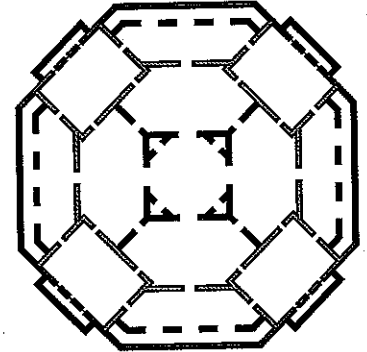
@HomeTutor for problem solving help at classzone.com

33. triangle; regular

34. quadrilateral; equiangular

35. octagon; regular

36. dodecagon; none of these

37. ★ **MULTIPLE CHOICE** Two vertices of a regular quadrilateral are $A(0, 4)$ and $B(0, -4)$. Which of the following could be the other two vertices? **C**

Ⓐ $C(4, 4)$ and $D(4, -4)$
Ⓑ $C(-4, 4)$ and $D(-4, -4)$
Ⓒ $C(8, -4)$ and $D(8, 4)$
Ⓓ $C(0, 8)$ and $D(0, -8)$

38. MULTI-STEP PROBLEM The diagram shows the design of a lattice made in China in 1850.
38a–b. See margin.
a. Sketch five different polygons you see in the diagram. Classify each polygon by the number of sides.

b. Tell whether each polygon you sketched is concave or convex, and whether the polygon appears to be equilateral, equiangular, or regular.
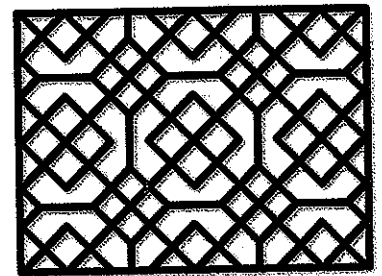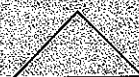

○ = **WORKED-OUT SOLUTIONS** on p. WS1
★ = **STANDARDIZED TEST PRACTICE**
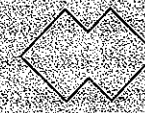
38a–b. Sample:

triangle convex none
quadrilateral convex regular
pentagon convex none
heptagon concave none
octagon concave none

EXAMPLE 3
on p. 44
for Ex. 39

39. ★ **SHORT RESPONSE** The shape of the button shown is a regular polygon. The button has a border made of silver wire. How many millimeters of silver wire are needed for this border? *Explain.*
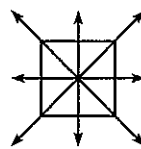
$(3x + 12)$ mm

$(20 − 5x)$ mm

39. 105 mm;
each side of
the button is
15 millimeters
long, so the
perimeter of
the button is
15(7) = 105
millimeters.

B
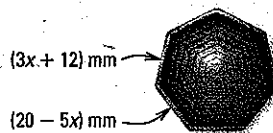
40. ★ **EXTENDED RESPONSE** A segment that joins two nonconsecutive vertices of a polygon is called a *diagonal.* For example, a quadrilateral has two diagonals, as shown below.

Type of polygon	Diagram	Number of sides	Number of diagonals
Quadrilateral		4	2
Pentagon	?	? 5	? 5
Hexagon	?	? 6	? 9
Heptagon	?	? 7	? 14

40a. See margin
for art. *Sample
answer:* The
difference
between
successive
number of
diagonals is
increasing by
one.

a. Copy and complete the table. *Describe* any patterns you see.

b. How many diagonals does an octagon have? a nonagon? *Explain.*

20 diagonals; 27 diagonals. *Sample answer:* The pattern described

c. The expression $\frac{n(n − 3)}{2}$ can be used to find the number of diagonals continues.
in an *n*-gon. Find the number of diagonals in a 60-gon. **1710 diagonals**

41. LINE SYMMETRY A figure has *line symmetry* if it can be folded over exactly onto itself. The fold line is called the *line of symmetry.* A regular quadrilateral has four lines of symmetry, as shown. Find the number of lines of symmetry in each polygon.
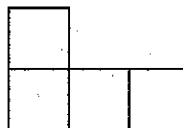
a. A regular triangle **3**   **b.** A regular pentagon **5**

c. A regular hexagon **6**   **d.** A regular octagon **8**

regular quadrilateral
4 lines of symmetry

C

42. CHALLENGE The diagram shows four identical squares lying edge-to-edge. Sketch all the different ways you can arrange four squares edge-to-edge. Sketch all the different ways you can arrange five identical squares edge-to-edge. **See margin.**

MIXED REVIEW

Solve the equation.

43. $\frac{1}{2}(35)b = 140$ *(p. 875)* **8**   **44.** $x^2 = 144$ *(p. 882)* **±12**   **45.** $3.14r^2 = 314$ *(p. 882)* **±10**

Copy and complete the statement. *(p. 886)*

46. 500 m = __?__ cm **50,000**   **47.** 12 mi = __?__ ft **63,360**   **48.** 672 in. = __?__ yd **18$\frac{2}{3}$**

49. 1200 km = __?__ m   **50.** $4\frac{1}{2}$ ft = __?__ yd **1$\frac{1}{2}$**   **51.** 3800 m = __?__ km **3.8**
1,200,000

Find the distance between the two points. *(p. 15)*

52. $D(−13, 13), E(0, −12)$ **53.** $F(−9, −8), G(−9, 7)$ **15**   **54.** $H(10, 5), J(−2, −2)$
about 28.2   **about 13.9**

EXTRA PRACTICE for Lesson 1.6, p. 897   **ONLINE QUIZ** at classzone.com   47

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5 ASSESS AND RETEACH

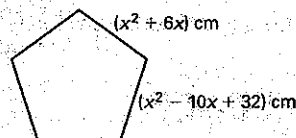## Daily Homework Quiz

📄 Transparency Available

1. Draw a convex hexagon.

2. This figure shows the tiles on a kitchen floor. What type of polygon are the tiles? Are they regular polygons? **quadrilaterals; not regular**

3. This figure is a regular polygon. Find the length of each side. **16 cm**

$(x^2 + 6x)$ cm

$(x^2 − 10x + 32)$ cm
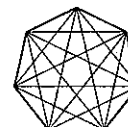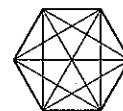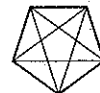
🌐 **Online Quiz**

Available at **classzone.com**

Diagnosis/Remediation

• Practice A, B, C in Chapter Resource Book
• Study Guide in Chapter Resource Book
• Practice Workbook
• @HomeTutor

Challenge

Additional challenge is available in the Chapter Resource Book.

40a.

42. See Additional Answers beginning on p. AA1.