

Example 4 Find Exterior Angle Measures of a Polygon

a. ALGEBRA Find the value of x in the diagram.

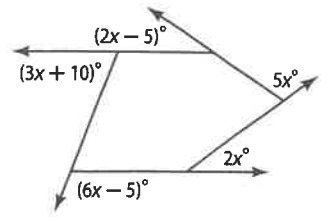
Use the Polygon Exterior Angles Sum Theorem to write an equation. Then solve for x .

$$(2x - 5) + 5x + 2x + (6x - 5) + (3x + 10) = 360$$

$$(2x + 5x + 2x + 6x + 3x) + [-5 + (-5) + 10] = 360$$

$$18x = 360$$

$$x = \frac{360}{18} \text{ or } 20$$



StudyTip

CCSS Perseverance To find the measure of each exterior angle of a regular polygon, you can find the measure of each interior angle and subtract this measure from 180, since an exterior angle and its corresponding interior angle are supplementary.

b. Find the measure of each exterior angle of a regular nonagon.

A regular nonagon has 9 congruent sides and 9 congruent interior angles. The exterior angles are also congruent, since angles supplementary to congruent angles are congruent. Let n = the measure of each exterior angle and write and solve an equation.

$$9n = 360 \quad \text{Polygon Exterior Angles Sum Theorem}$$

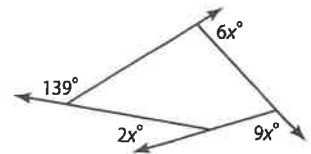
$$n = 40 \quad \text{Divide each side by 9.}$$

The measure of each exterior angle of a regular nonagon is 40.

GuidedPractice

4A. Find the value of x in the diagram.

4B. Find the measure of each exterior angle of a regular dodecagon.



Check Your Understanding

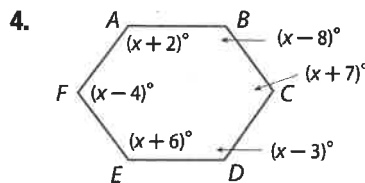
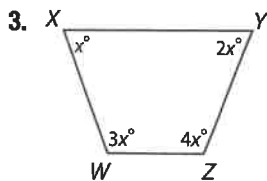
= Step-by-Step Solutions begin on page R14.

Example 1 Find the sum of the measures of the interior angles of each convex polygon.

1. decagon

2. pentagon

Find the measure of each interior angle.



Example 2



5 AMUSEMENT The Wonder Wheel at Coney Island in Brooklyn, New York, is a regular polygon with 16 sides. What is the measure of each interior angle of the polygon?

Example 3

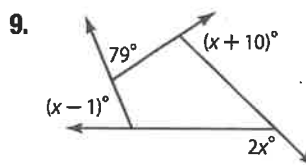
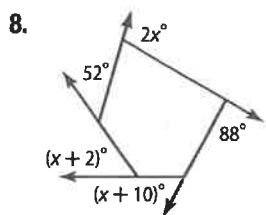
The measure of an interior angle of a regular polygon is given. Find the number of sides in the polygon.

6. 150

7. 170



Example 4 Find the value of x in each diagram.



Find the measure of each exterior angle of each regular polygon.

10. quadrilateral

11. octagon

Practice and Problem Solving

Extra Practice is on page R6.

Example 1 Find the sum of the measures of the interior angles of each convex polygon.

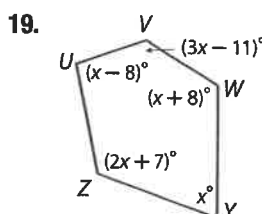
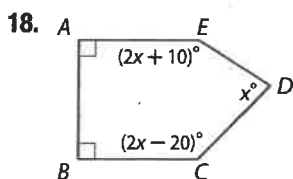
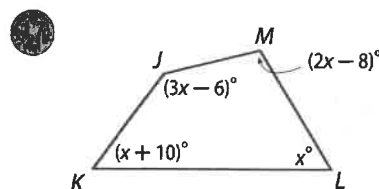
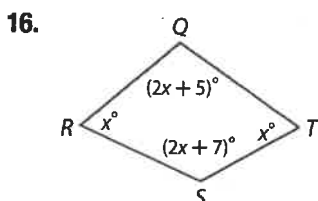
12. dodecagon

13. 20-gon

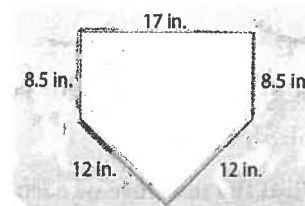
14. 29-gon

15. 32-gon

Find the measure of each interior angle.



20. **BASEBALL** In baseball, home plate is a pentagon. The dimensions of home plate are shown. What is the sum of the measures of the interior angles of home plate?



Example 2 Find the measure of each interior angle of each regular polygon.

21. dodecagon

22. pentagon

23. decagon

24. nonagon

25. **CCSS MODELING** Hexagonal chess is played on a regular hexagonal board comprised of 92 small hexagons in three colors. The chess pieces are arranged so that a player can move any piece at the start of a game.

- What is the sum of the measures of the interior angles of the chess board?
- Does each interior angle have the same measure? If so, give the measure. Explain your reasoning.



Example 3 The measure of an interior angle of a regular polygon is given. Find the number of sides in the polygon.

26. 60

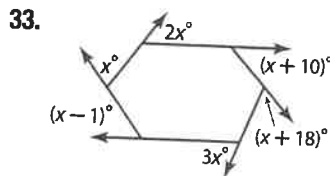
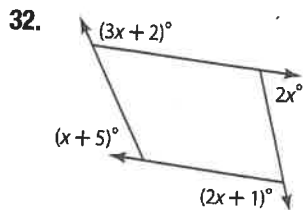
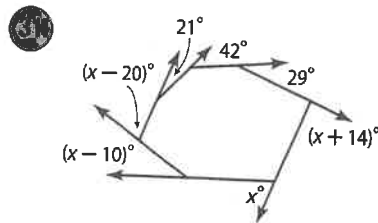
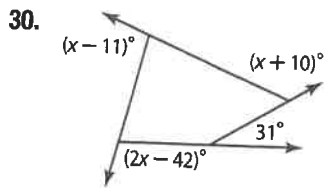
27. 90

28. 120

29. 156



Example 4 Find the value of x in each diagram.



Find the measure of each exterior angle of each regular polygon.

34. decagon

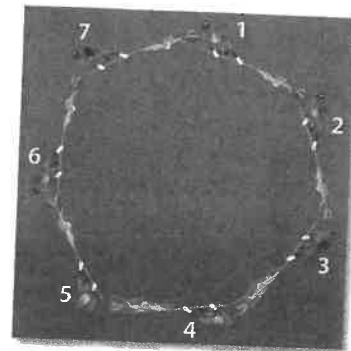
35. pentagon

36. hexagon

37. 15-gon

38. **COLOR GUARD** During the halftime performance for a football game, the color guard is planning a new formation in which seven members stand around a central point and stretch their flag to the person immediately to their left as shown.

- What is the measure of each exterior angle of the formation?
- If the perimeter of the formation is 38.5 feet, how long is each flag?



Find the measures of an exterior angle and an interior angle given the number of sides of each regular polygon. Round to the nearest tenth, if necessary.

39. 7

40. 13

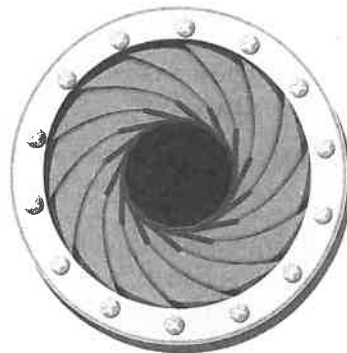
41. 14

42. **PROOF** Write a paragraph proof to prove the Polygon Interior Angles Sum Theorem for octagons.

43. **PROOF** Use algebra to prove the Polygon Exterior Angles Sum Theorem.

44. **CCSS MODELING** The aperture on the camera lens shown is a regular 14-sided polygon.

- What is the measure of each interior angle of the polygon?
- What is the measure of each exterior angle of the polygon?



ALGEBRA Find the measure of each interior angle.

- decagon, in which the measures of the interior angles are $x + 5$, $x + 10$, $x + 20$, $x + 30$, $x + 35$, $x + 40$, $x + 60$, $x + 70$, $x + 80$, and $x + 90$
- polygon $ABCDE$, in which the measures of the interior angles are $6x$, $4x + 13$, $x + 9$, $2x - 8$, $4x - 1$