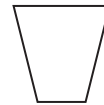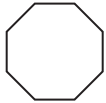# The Polygon Angle-Sum Theorems

Vocabulary

● Review

1. Underline the correct word to complete the sentence.

In a *convex* polygon, no point on the lines containing the sides of the polygon is in the
interior / exterior of the polygon.

2. Cross out the polygon that is NOT *convex*.

● Vocabulary Builder

> **regular polygon** (noun) REG **yuh lur** PAHL **ih gahn**
>
> **Definition:** A **regular polygon** is a polygon that is both equilateral and equiangular.
>
> **Example:** An equilateral triangle is a **regular polygon** with three congruent sides and three congruent angles.

● Use Your Vocabulary

Underline the correct word(s) to complete each sentence.

3. The sides of a *regular polygon* are congruent / scalene .

4. A right triangle is / is not a *regular polygon.*

5. An isosceles triangle is / is not always a *regular polygon.*

Write *equiangular, equilateral,* or *regular* to identify each hexagon. Use each word once.

6.

7.
120° 120°
120° 120°
120° 120°
120°

8.
120° 120°
120° 120°
120° 120°

take note
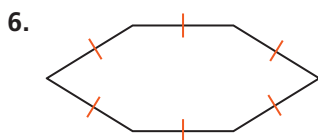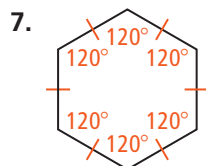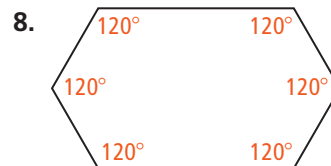
Theorem 6-1 Polygon Angle-Sum Theorem and Corollary

Theorem 6-1 The sum of the measures of the interior angles of an n-gon is $(n - 2)180$.

Corollary The measure of each interior angle of a regular n-gon is $\dfrac{(n - 2)180}{n}$.

9. When $n - 2 = 1$, the polygon is a(n) __?__.

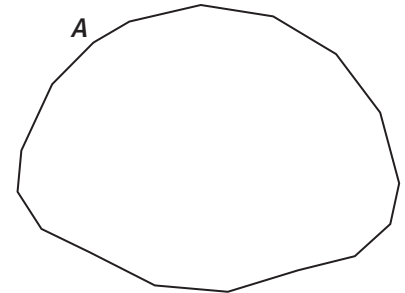**10.** When $n - 2 = 2$, the polygon is a(n) __?__.

✔ **Problem 1** Finding a Polygon Angle Sum

Got It? What is the sum of the interior angle measures of a 17-gon?

11. Use the justifications below to find the sum.

$$\text{sum} = \left(\boxed{} - 2\right)180 \qquad \text{Polygon Angle-Sum Theorem}$$

$$= \left(\boxed{} - 2\right)180 \qquad \text{Substitute for } n.$$

$$= \boxed{} \cdot 180 \qquad \text{Subtract.}$$

$$= \boxed{} \qquad \text{Simplify.}$$

12. Draw diagonals from vertex A to check your answer.

A

13. The sum of the interior angle measures of a 17-gon is $\boxed{}$.

✔ **Problem 2** Using the Polygon Angle-Sum Theorem

Got It? What is the measure of each interior angle in a regular nonagon?

Underline the correct word or number to complete each sentence.

14. The interior angles in a regular polygon are congruent / different .

15. A regular nonagon has 7 / 8 / 9 congruent sides.

16. Use the Corollary to the Polygon Angle-Sum Theorem to find the measure of each interior angle in a regular nonagon.

$$\text{Measure of an angle} = \dfrac{\left(\boxed{} - 2\right)180}{\boxed{}}$$

$$= \dfrac{\left(\boxed{}\right)180}{\boxed{}}$$

$$= \boxed{}$$

17. The measure of each interior angle in a regular nonagon is $\boxed{}$.

Lesson 6-1

Problem 3 **Using the Polygon Angle-Sum Theorem**

Got It? What is $m\angle G$ in quadrilateral *EFGH*?

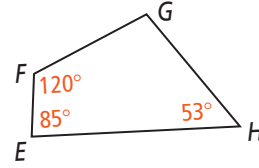**18.** Use the Polygon Angle-Sum Theorem to find $m\angle G$ for $n = 4$.

$$m\angle E + m\angle F + m\angle G + m\angle H = (n - 2)180$$

$$m\angle E + m\angle F + m\angle G + m\angle H = \left(\boxed{} - 2\right)180$$

$$\boxed{} + \boxed{} + \boxed{} + \boxed{} = \boxed{} \cdot 180$$

$$m\angle G + \boxed{} = \boxed{}$$

$$m\angle G = \boxed{}$$

19. $m\angle G$ in quadrilateral *EFGH* is $\boxed{}$.
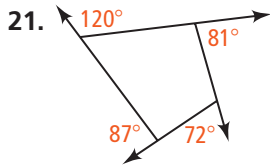

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take note

Theorem 6-2 Polygon Exterior Angle-Sum Theorem

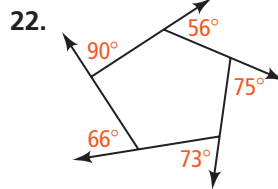The sum of the measures of the exterior angles of a polygon, one at each vertex, is 360.

20. In the pentagon below, $m\angle 1 + m\angle 2 + m\angle 3 + m\angle 4 + m\angle 5 = \boxed{}$.
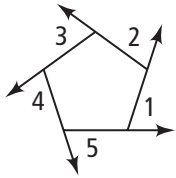
Use the Polygon Exterior Angle-Sum Theorem to find each measure.

21.

$$120 + 81 + \boxed{} + 87 = 360$$

22.

$$90 + \boxed{} + 75 + 73 + 66 = \boxed{}$$

Problem 4 **Finding an Exterior Angle Measure**

Got It? What is the measure of an exterior angle of a regular nonagon?

Underline the correct number or word to complete each sentence.

23. Since the nonagon is regular, its interior angles are congruent / right .

24. The exterior angles are complements / supplements of the interior angles.

25. Since the nonagon is regular, its exterior angles are congruent / right .

26. The sum of the measures of the exterior angles of a polygon is 180 / 360 .

27. A regular nonagon has 7 / 9 / 12 sides.

28. What is the measure of an exterior angle of a regular nonagon? Explain.

Error Analysis Your friend says that she measured an interior angle of a regular polygon as 130. Explain why this result is impossible.

29. Use indirect reasoning to find a contradiction.

Assume temporarily that a regular n-gon has a $130°$ interior angle.

angle sum $=$ ☐ $\cdot\, n$		A regular n-gon has n congruent angles.
angle sum $=$ (☐)180		Polygon Angle-Sum Theorem
☐ $=$ (☐)180		Use the Transitive Property of Equality.
☐ $=$ ☐ $-$ ☐		Use the Distributive Property.
☐ $=$ ☐		Subtract $180n$ from each side.
$n =$ ☐		Divide each side by -50.
$n \neq$ ☐		The number of sides in a polygon is a whole number ≥ 3.

30. Explain why your friend's result is impossible.

✔️ **Math Success**

Check off the vocabulary words that you understand.

☐ equilateral polygon ☐ equiangular polygon ☐ regular polygon

Rate how well you can _find angle measures of polygons._

Need to review | 0   2   4   6   8   10 → | **Now I get it!**