Name ______________________________ Date ______________

LESSON 11.6

# Study Guide

*For use with pages 762–769*

**GOAL** **Find areas of regular polygons inscribed in circles.**

**Vocabulary**

The **center of a polygon** is the center of its circumscribed circle.

The **radius of a polygon** is the radius of its circumscribed circle.

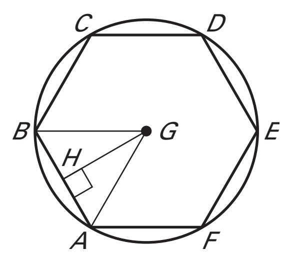
The **apothem of a polygon** is the distance from its center to any side of the polygon.

A **central angle of a regular polygon** is an angle formed by two radii drawn to consecutive vertices of the polygon.

**Theorem 11.11 Area of a Regular Polygon:** The area of a regular $n$-gon with side length $s$ is half the product of the apothem $a$ and the perimeter $P$.

**EXAMPLE 1** 
## Find angle measures in a regular polygon

**In the diagram, *ABCDEF* is a regular hexagon inscribed in ⊙*G*. Find each angle measure.**




**a.** *m*≥ *AGB* **b.** *m*≥ *AGH* **c.** *m*≥ *HAG*

### Solution

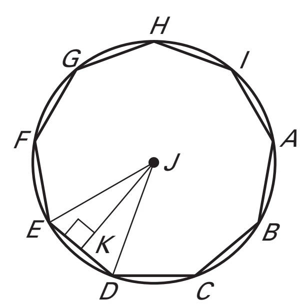
**a.** ≥ *AGB* is the central angle, so *m*≥ *AGB* $= \frac{360°}{6}$, or 60°.

**b.** $\overline{HG}$ is an apothem, which makes it an altitude of isosceles △*AGB*. So, $\overline{HG}$ bisects ≥ *AGB* and *m*≥ *AGH* $= \frac{1}{2}$*m*≥ *AGB* $= \frac{1}{2}(60°) = 30°$.

**c.** The sum of the measures of right △*HAG* is 180°. So, 90° + 30°+ *m*≥ *HAG* = 180°, and *m*≥ *HAG* = 60°.

## Exercises for Example 1

**Find the given angle measure for the regular nonagon inscribed in ⊙*J*.**




**1.** *m*≥ *DJE*

**2.** *m*≥ *DJK*

**3.** *m*≥ *JKD*

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LESSON 11.6 **Study Guide** *continued*
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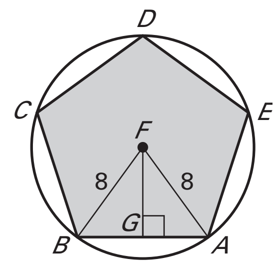
**EXAMPLE 2** 
## Find the perimeter and area of a regular polygon

**A regular pentagon is inscribed in a circle with radius 8 units. Find the perimeter and area of the pentagon.**




**Solution**

The measure of the central ≥ $AFB$ is $\frac{360°}{5}$, or 72°. Apothem $\overline{GF}$ bisects the central angle, so $m$≥ $AFG = 36°$. To find the lengths of the legs, use trigonometric ratios for right $\triangle AFG$.

| | | |
|---|---|---|
| Leg $\overline{AG}$: | $\sin 36° = \frac{AG}{AF}$ | Use sine ratio. |
| | $\sin 36° = \frac{AG}{8}$ | Substitute 8 for $AF$. |
| | $8 \cdot \sin 36° = AG$ | Cross Product Property |
| Leg $\overline{FG}$: | $\cos 36° = \frac{FG}{AF}$ | Use cosine ratio. |
| | $\cos 36° = \frac{FG}{8}$ | Substitute 8 for $AF$. |
| | $8 \cdot \cos 36° = FG$ | Cross Product Property |

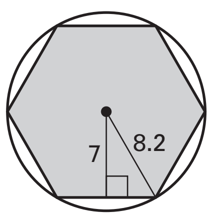
The regular hexagon has side length $s = 2AG = 2(8 \cdot \sin 36°) = 16 \cdot \sin 36°$ and apothem $a = FG = 8 \cdot \cos 36°$.

So, the perimeter is $P = 6s = 6(16 \cdot \sin 36°) = 96 \cdot \sin 36° \approx 56.43$ units, and the area is $A = \frac{1}{2}aP \approx \frac{1}{2}(8 \cdot \cos 36°)(96 \cdot \sin 36°) \approx 182.60$ square units.

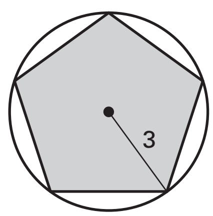
## Exercises for Example 2

**Find the perimeter and the area of the regular polygon.**

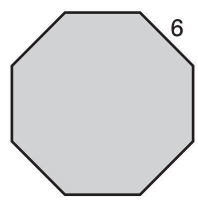
**4.**




**5.**




**6.**

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