

Geometry

Chapter 8: Area of Regular Polygons

Name: _____

🎯 Students will be able to identify the radius and apothem of a regular polygon and find the area.

Regular Polygon:

All sides are equal; all angles are equal.

Radius:

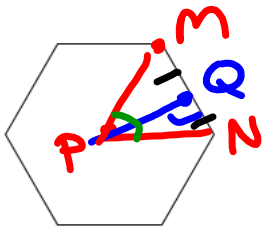
PN segment from center to a vertex

Apothem:

PQ distance from center

Central angle:

to middle of any side of polygon
 Ex: $\angle MPN$
 angle formed by 2 radii
 drawn to consecutive vertices



center = P

FINDING CENTRAL ANGLES**Example 1:** Find the measure of a central angle of a regular polygon with 20 sides.All central angles add up to 360°

$$\frac{360}{20} = 18^\circ$$

Example 2: Find the given angle measure of the regular dodecagon (12 sides) shown.a. $m \angle TWU$

$$\frac{360^\circ}{12} = 30^\circ$$

b. $m \angle TWX$

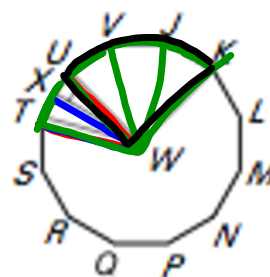
$$\frac{30^\circ}{2} = 15^\circ$$

c. $m \angle TWK$

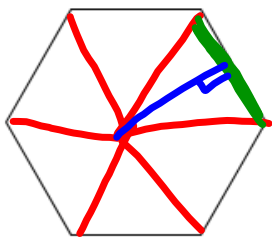
$$30^\circ \cdot 4 = 120^\circ$$

d. $m \angle UWK$

$$30^\circ \cdot 3 = 90^\circ$$



Area of a Regular Polygon



Hexagon - 6 sides

s = Side length

a = apothem

n = # of sides

Area = 1 triangle \cdot # of Δ 's

$$A = \frac{1}{2} \cdot s \cdot a \cdot n$$

$$P = s \cdot n$$

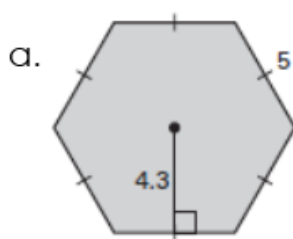
So,

Area =

$$\frac{s \cdot a \cdot n}{2}$$

$$P = s \cdot n \quad A = \frac{s \cdot a \cdot n}{2}$$

Example 3: Find the **perimeter** and **area** of the regular polygon.



$$P = s \cdot n$$

$$P = 5 \cdot 6 = 30 \text{ units}$$

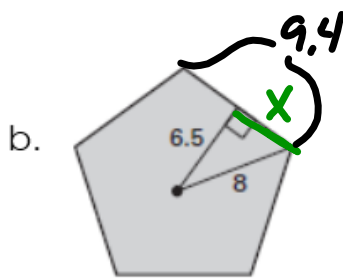
$$s = 5$$

$$n = 6$$

$$a = 4.3$$

$$A = \frac{s \cdot a \cdot n}{2}$$

$$A = \frac{5 \cdot 4.3 \cdot 6}{2} = 64.5 \text{ units}^2$$



$$P = S \cdot n$$

$$P = 9.4 \cdot 5$$

$$P = 47 \text{ units}$$

$$S = 9.4$$

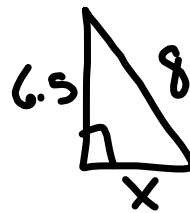
$$n = 5$$

$$a = 6.5$$

$$A = \frac{S \cdot a \cdot n}{2}$$

$$A = \frac{9.4 \cdot 6.5 \cdot 5}{2}$$

$$A = 152.75 \text{ units}^2$$



$$a^2 + b^2 = c^2$$

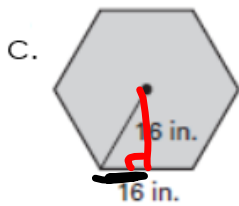
$$6.5^2 + x^2 = 8^2$$

$$42.25 + x^2 = 64$$

$$\begin{array}{r} - 42.25 \quad - 42.25 \\ \hline x^2 = 21.75 \end{array}$$

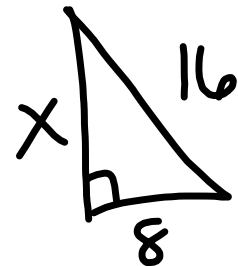
$$x \approx 4.7$$

$$\frac{\text{Side length}}{2(4.7) = 9.4}$$



$$P = S \cdot n$$

$$P = 16 \cdot 6 = 96 \text{ in}$$



$$S = 16$$

$$n = 6$$

$$a = 13.9$$

$$A = \frac{S \cdot a \cdot n}{2}$$

$$A = \frac{16 \cdot 13.9 \cdot 6}{2}$$

$$A = 667.2 \text{ in}^2$$

$$a^2 + b^2 = c^2$$

$$8^2 + x^2 = 16^2$$

$$64 + x^2 = 256$$

$$\begin{array}{r} - 64 \\ \hline x^2 = 192 \\ x \approx 13.9 \end{array}$$