

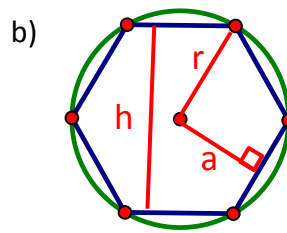
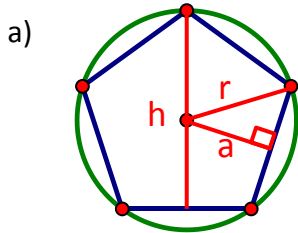
**REGULAR POLYGONS:** A polygon with all congruent sides/angles

**Center** - A point equidistant from all vertices

**Radius** - Distance from center to vertices (corners)

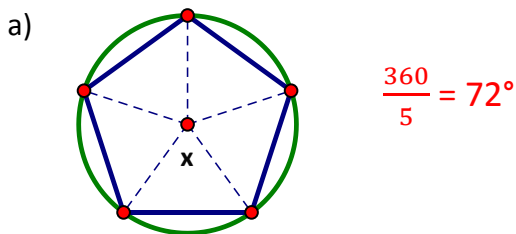
**Apothem** - Distance from center to midpoint of side → forms right angle

1. Draw and label a radius (r), an apothem (a) and a height (h) of the given regular polygon.

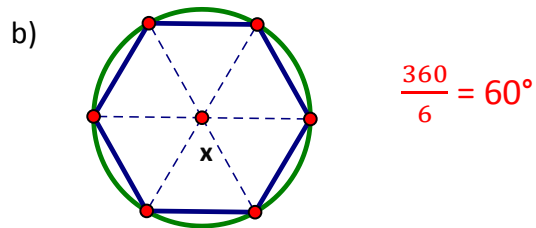


**Central Angle** - Angle formed at the center by 2 radii

2. What is the central angle for these regular polygons?

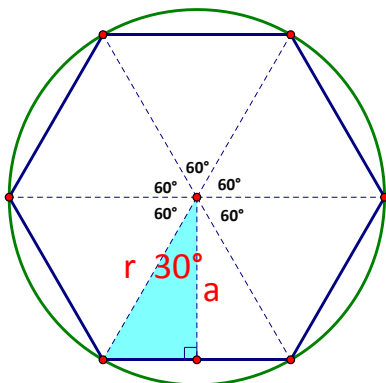


Central Angle = 72°



Central Angle = 60°

3. In the shaded triangle, label the radius (r), the apothem (a) and the angles within the triangle.



Use the special right triangle to solve the following:

Given an apothem of  $8\sqrt{3}$  cm, what is the length of the side?

$8(2) = 16 \text{ cm}$

Given a side of 12 cm, what is the apothem?

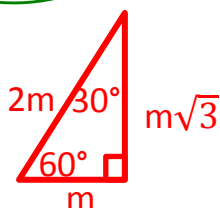
$6\sqrt{3} \text{ cm}$

Given an apothem of 9 cm, what is the length of the side?

$3\sqrt{3} (2) = 6\sqrt{3} \text{ cm}$

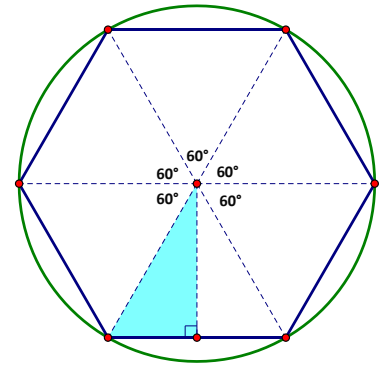
Given side of  $10\sqrt{3}$  cm, what is the apothem?

$5\sqrt{3} (\sqrt{3}) = 15 \text{ cm}$

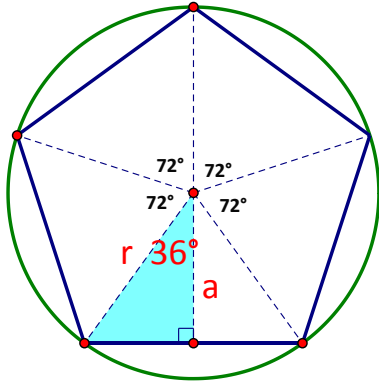


The area of the hexagon can be thought of as:

$$A = \frac{1}{2} (\text{apothem})(\text{perimeter}) = \frac{1}{2} \underbrace{ap}_{(\text{length of one side})(\# \text{ of sides})}$$



4. In the shaded triangle, label the radius (r), the apothem (a) and the angles within the triangle.



Use trig to solve for the following values to 2 decimal. (Why?)

Given a radius of 10 cm, what is the length of the side?

$$\sin 36 = \frac{x}{10}$$

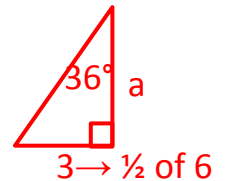
$$x = 5.88$$

$$5.88(2) = \text{side}$$

Side = 11.76 cm

Given a side length of 6 cm, what is the length of the apothem?

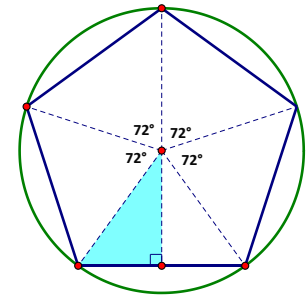
$$\tan 36 = \frac{3}{a}$$



Apothem = 4.13 cm

The area of the pentagon can be thought of as:

$$A = \frac{1}{2} ap$$



## PRACTICE

5. Find the apothem of a hexagon with radius 8 cm

$$\frac{360}{6} = 60^\circ$$

$$a = 4\sqrt{3} \text{ cm}$$

6. Find the perimeter of a hexagon with radius  $12\sqrt{3}$

$$\frac{360}{6} = 60^\circ$$

$$p = (6)12\sqrt{3} = 72\sqrt{3} \text{ cm}$$

7. Find the area of a nonagon with apothem of 4 cm

$$\frac{360}{9} = 40^\circ$$

$$\tan 20 = \frac{x}{4}$$

$$x = 1.46$$

$$A = \frac{1}{2} ap$$

$$A = \frac{1}{2} (4)(26.28)$$

$$A = 52.56 \text{ cm}^2$$

Each side =  $2(1.46) = 2.92$   
Perimeter =  $9(2.92) = 26.28$

8. Find the area of an octagon with perimeter of 80

$$\frac{360}{8} = 45^\circ$$

$$\tan 22.5 = \frac{5}{a}$$

$$a = 12.07$$

$$A = \frac{1}{2} ap$$

$$A = \frac{1}{2} (12.07)(80)$$

$$A = 482.84 \text{ cm}^2$$

$$\frac{80}{8} = 10$$