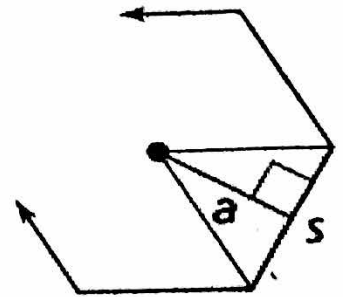


Finding Areas of Regular Polygons

You can find the area of any regular n-gon by dividing it into congruent triangles.

●

$$\begin{aligned}\text{Area} &= (\text{area of } 1 \triangle)(\# \text{ of } \triangle s) \\ &= \left(\frac{1}{2} a \cdot s\right)(n) \\ &= \left(\frac{1}{2} a\right)(s \cdot n) \\ &= \frac{1}{2} a P\end{aligned}$$



SOH - CAH - TOA

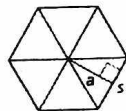
Area of a Regular Polygon

The area of a regular n-gon with side length s is:

$$A = \frac{1}{2} a P$$

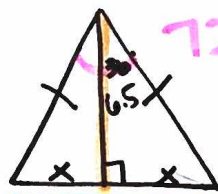
a = apothem

P = perimeter (s · n)



Examples:

3. Find the area of a regular pentagon with an apothem length of 6.5.

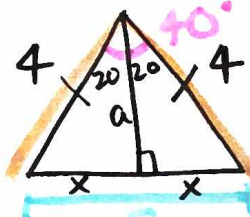


$$\begin{aligned} \tan 36^\circ &= \frac{x}{6.5} \\ 0.7265 &= \frac{x}{6.5} \end{aligned}$$

$$\begin{aligned} x &\approx 4.72225 \\ s &\approx 9.4445 \end{aligned}$$

$$\begin{aligned} A &= \frac{1}{2} (6.5) [(9.4445)(5)] \\ &\approx 153.47 \end{aligned}$$

4. A regular nonagon is inscribed in a circle with a radius of 4. Find the area of the nonagon.

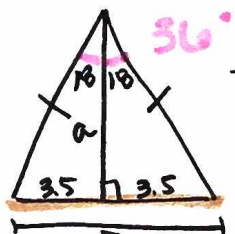


$$\begin{aligned} \cos 20^\circ &= \frac{a}{4} \\ 0.9397 &= \frac{a}{4} \\ a &\approx 3.7588 \end{aligned}$$

$$\begin{aligned} \sin 20^\circ &= \frac{x}{4} \\ 0.3420 &= \frac{x}{4} \\ x &\approx 1.3680 \\ s &\approx 2.7360 \end{aligned}$$

$$\begin{aligned} A &= \frac{1}{2} (3.7588) [(2.7360)(9)] \\ &\approx 46.28 \end{aligned}$$

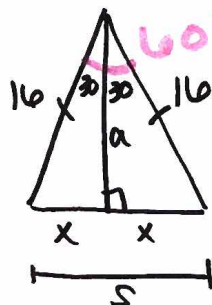
5. Find the area of a regular decagon with a side length of 7.



$$\begin{aligned} \tan 18^\circ &= \frac{3.5}{a} \\ 0.3249 &= \frac{3.5}{a} \\ 0.3249 a &= 3.5 \end{aligned}$$

$$\begin{aligned} a &\approx 10.7725 \\ A &= \frac{1}{2} (10.7725) [(7)(10)] \\ &\approx 377.04 \end{aligned}$$

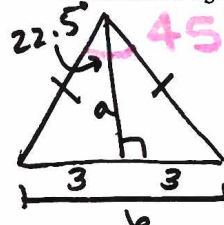
6. Find the area of a regular hexagon with a diameter of 32.



$$\begin{aligned} \sin 30^\circ &= \frac{x}{16} \\ x &= 8 \rightarrow s = 16 \\ \cos 30^\circ &= \frac{a}{16} \\ a &\approx 13.8564 \end{aligned}$$

$$\begin{aligned} A &= \frac{1}{2} (13.8564) [(16)(6)] \\ &\approx 665.11 \end{aligned}$$

7. Find the area of a regular octagon with side length 6.

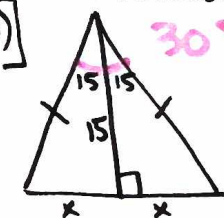


$$\begin{aligned} \tan 22.5^\circ &= \frac{3}{a} \\ a &\approx 7.2426 \end{aligned}$$

$$A = \frac{1}{2} (7.2426) [(6)(8)]$$

$$\approx 173.82$$

8. Find the area of a regular dodecagon with apothem 15.

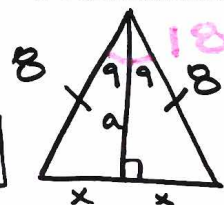


$$\begin{aligned} \tan 15^\circ &= \frac{x}{15} \\ x &\approx 4.0192 \\ s &\approx 8.0385 \end{aligned}$$

$$A = \frac{1}{2} (15) [(8.0385)(12)]$$

$$\approx 723.46$$

9. Find the area of a regular 20-gon with radius 8.



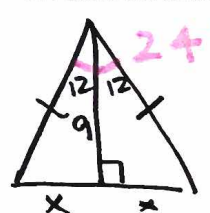
$$\begin{aligned} \sin 9^\circ &= \frac{x}{8} \\ x &\approx 1.2515 \\ s &\approx 2.5030 \end{aligned}$$

$$\begin{aligned} \cos 9^\circ &= \frac{a}{8} \\ a &\approx 7.9015 \end{aligned}$$

$$A = \frac{1}{2} (7.9015) [(2.5030)(20)]$$

$$\approx 197.77$$

10. Find the area of a regular 15-gon with apothem 9.

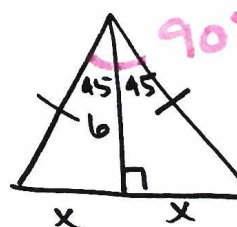


$$\begin{aligned} \tan 12^\circ &= \frac{x}{9} \\ x &\approx 1.9130 \\ s &\approx 3.8260 \end{aligned}$$

$$A = \frac{1}{2} (9) [(3.8260)(15)]$$

$$A \approx 258.26$$

11. Find the area of a square with apothem 6.



$$\tan 45^\circ = \frac{x}{6}$$

$$\begin{aligned} x &= 6 \\ s &= 12 \end{aligned}$$

$$A = \frac{1}{2} (6) [(12)(4)]$$

$$A = 144$$