

7.3 Angle Relationships in Polygons

Learning Goals:

You will extend your understanding of interior and exterior angles in triangles and quadrilaterals to polygons with any number of sides

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Sum of interior angles:

For a polygon with n sides, the sum of the interior angles, in degrees is $180(n-2)$.

For example, a triangle has 3 sides so $n = 3$:
 the sum of angles = $180(3 - 2)$
 = $180(1)$
 = 180

A quadrilateral has 4 sides so $n = 4$:
 the sum of angles = $180(4 - 2)$
 = $180(2)$
 = 360

Sum of exterior angles:

For any polygon, the sum of exterior angles is 360° .

Regular polygon: all sides are equal length and all interior angles are equal.

Ex. Find the sum of the interior angles of a polygon with 10 sides.

$$\begin{aligned} \text{Sum int ang} &= 180(n-2) \\ &= 180(10-2) \\ &= 180(8) \\ &= 1440 \end{aligned}$$

Ex. Find the measure of each interior angle of a regular octagon.

Octagon has 8 sides.

all \angle are
the same

$$\begin{aligned} \text{Sum int } \angle &= 180(n-2) \\ &= 180(8-2) \\ &= 180(6) \\ &= 1080 \end{aligned}$$

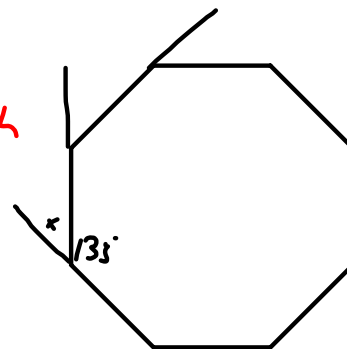
Since all angles are the same, each angle is $\frac{1080}{8} = 135^\circ$.

What is each ext \angle ?

$$45 \times 8 = 360$$

😊
math works!

$$\begin{aligned} \text{exterior } \angle: \\ 180 - 135 &= x \\ 45 &= x \end{aligned}$$



Ex. How many sides does a polygon have if the sum of its interior angles is 720° ?

we don't know if its regular.

BUT

$$\begin{aligned} \text{sum int } \angle &= 180(n-2) \\ 720 &= 180(n-2) \end{aligned}$$

$$\rightarrow 720 = 180n - 360$$

$$720 + 360 = 180n$$

$$\frac{1080}{180} = \frac{180n}{180}$$

$$6 = n$$

\therefore it has 6 sides

Ex. How many sides does a polygon have if each of its interior angles measures 144° ?

we know it's regular

$$180(n-2) = 144n$$

$$180n - 360 = 144n$$

$$144n \text{ gives sum of the int } \angle \quad 180n - 144n = 360$$

Practice pg 391 #1-5, 9, 10ab, 11, 20