



Lesson #2.3 – Angles Properties of Polygons

A **polygon** is a closed geometric figure made up on 'n' straight sides.

A **convex polygon** has all interior angles less than 180° . A **concave polygon** has at least one interior angle greater than 180° . A **regular polygon** has equal sides and equal angles.

# of Sides	Shape	# of Triangles Formed	Sum of Interior Angles
3 <i>Triangle</i>		1	$1 \times 180^\circ = 180^\circ$
4 <i>Quadrilateral</i>		2	$2 \times 180^\circ = 360^\circ$
5 <i>Pentagon</i>		3	$3 \times 180^\circ = 540^\circ$
6 <i>Hexagon</i>		4	$4 \times 180^\circ = 720^\circ$
7 <i>Heptagon</i>		5	$5 \times 180^\circ = 900^\circ$
8 <i>Octagon</i>		6	$6 \times 180^\circ = 1080^\circ$
9 <i>Nonagon</i>		7	$7 \times 180^\circ = 1260^\circ$
10 <i>Decagon</i>		8	$8 \times 180^\circ = 1440^\circ$
n <i>Polygon</i>	$n = \# \text{ of sides}$	$n - 2$	$(n - 2) \times 180^\circ$ $180^\circ(n - 2)$



In any polygon with n sides, the **sum of the interior angles is $180^\circ(n-2)$** .

Example 1: Determine the measures of each interior angle of a regular 17-sided polygon.

Sum "Sigma" $\rightarrow \sum$ of interior \angle 's = $180(n-2)$ $n=17$ or 15 Δ 's

$$= 180(17-2)$$

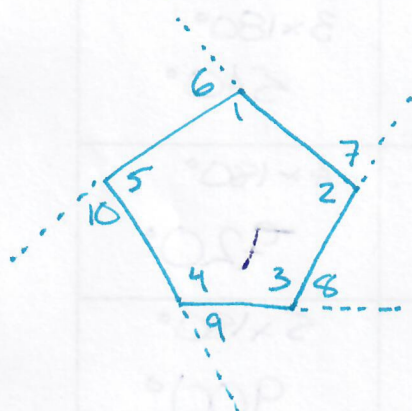
$$= 180(15)$$

$$= 2700^\circ$$

\therefore each $\angle \Rightarrow \frac{2700}{17} = 158.8^\circ$ for each int. \angle

The **sum of the exterior angles of any convex polygon is 360°** . Each exterior angle of a regular polygon is $360^\circ \div n$ sides.

Example 2: Show that the sum of the exterior angles of a pentagon is 360° .



$$1+6=180^\circ$$

$$2+7=180^\circ$$

$$3+8=180^\circ$$

$$4+9=180^\circ$$

$$5+10=180^\circ$$

$$1+2+\dots+10 = 5(180^\circ)$$

sum of all int! ext angles

$$\sum \text{ of int. } \angle \text{'s} = 540^\circ$$

$$5(180^\circ) = 540 + \text{Ext } \angle \text{'s}$$

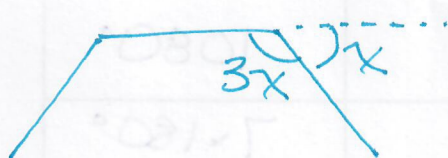
$$900 - 540 = \text{Ext } \angle \text{'s}$$

$$\text{Ext } \angle \text{'s} = 360^\circ$$

$$6, 7, 8, 9, 10 = \frac{360^\circ}{5}$$

$$= 72^\circ \text{ each}$$

Example 3: What type of regular polygon has an interior angle of 3 times the exterior angle?



$$3x + x = 180^\circ$$

$$4x = 180^\circ$$

$$x = \frac{180^\circ}{4} = 45^\circ$$

$$n \cdot \frac{360^\circ}{n} = x \cdot n$$

$$360 = 45n$$

$$n = \frac{360}{45} = 8$$

$$n = 8 \Rightarrow \text{octagon}$$

Practice Questions: Page 99, #'s 1-4, 6-11, 14*, 18*