

Lesson Objective **Angles of Polygons**
INBAT classify polygons as convex or concave; find ~~int~~ ~~measures~~ measures of interior and exterior LS of polygons.

Polygon: A polygon is a closed, plane figure formed by 3 or more line segments called sides

→ Classifying Polygons There are two different kinds of polygons, concave and convex

- If there is an indentation in a polygon, it is concave.
- If there is NO indentation in a polygon, it is convex.

Concave Polygon:



Convex Polygon:



String Test: Imagine a string wrapped around the polygon...

- If there is a gap between the string and a polygon, it is concave.
- If there is NOT a gap between the string and a polygon, it is convex.

Example:

1. Classify the figures below as: polygon (y/n); convex, or concave.

y, convex

y, concave

N

y, convex

y, convex

y, concave

y, convex

N

y, concave

N

You need to know the names of the special polygons from 3 sides to 12 sides and n-gon.

Number of Sides	Name of Polygon	Number of Sides	Name of Polygon
3	Triangle	8	Octagon
4	Quadrilateral	9	Nonagon
5	Pentagon	10	Decagon
6	Hexagon	12	Dodecagon
7	Heptagon	n	n-gon

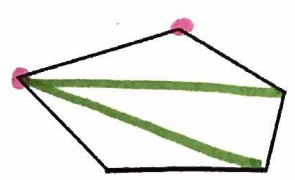
11-sided polygon is called a hendecagon.

n=15 15-gon

Interior Angle Measures of a Polygon

Consecutive vertices: In a polygon, two vertices that are endpoints of the same side are called consecutive vertices.

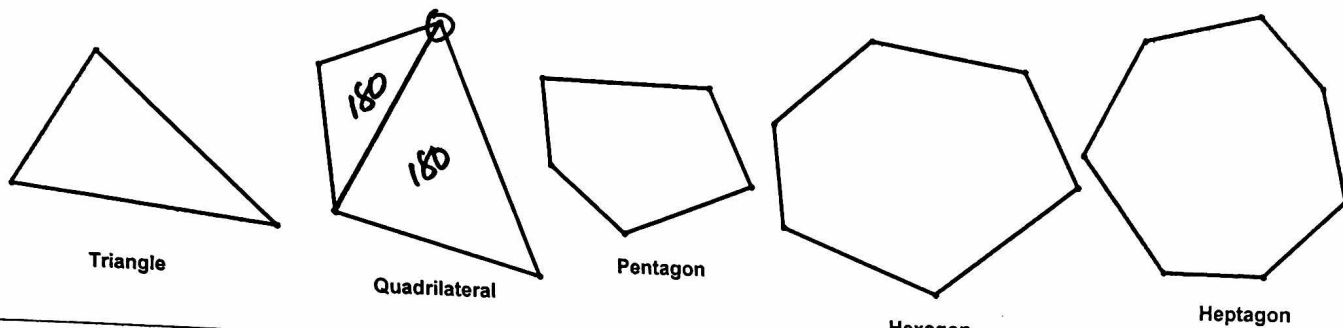
Diagonal: A diagonal of a polygon is a segment that joins two nonconsecutive vertices.



EXPLORATION

Use the diagrams below. Choose a vertex. Draw all diagonals from that vertex so that the figure is divided into non-overlapping triangles.

- Find the sum of the interior angles for each of the figures and record your result in the chart.
- Use your results and look for a pattern. Write a formula that can be used to find the sum of the interior angles in an n -gon.
- After you find the formula, check the formula with the book, then complete #2-6 below.

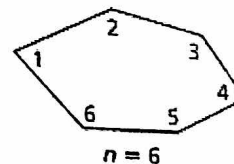


Polygons	Number of Sides	Number of Triangles	Sum of Interior Angles
Triangle	3		
Quadrilateral	4	1	180
Pentagon	5	2	$2(180) = 360$
Hexagon	6	3	$3(180) = 540$
Heptagon	7	4	$4(180) = 720$
n -gon	n	$n - 2$	$5(180) = 900$ $(n - 2)(180)$

Polygon Interior Angles Theorem

The formula for the sum of the measures of the interior angles of a convex n -gon is

$$(n - 2)180^\circ$$



Use your formula and answer the questions below.

- Find the sum of the measure of the interior angles of a
 - convex octagon.

$$6(180) = 1080^\circ$$

- convex 16-gon.

$$14(180) = 2520^\circ$$

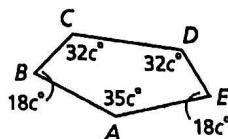
- Find the measure of an (one) interior angle of
 - a regular octagon.
 - a regular 15-gon

$$\frac{1080}{8}$$

$$= 135^\circ$$

$$\frac{13(180)}{15}$$

$$= 156^\circ$$



- Find $m\angle A$ in polygon ABCDE below.

$$135c = 540$$

$$c = 4$$

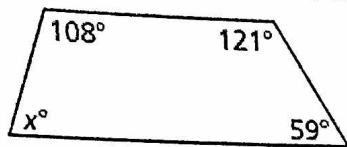
$$m\angle A = 140^\circ$$

5. The sum of the measures of the interior angles of a convex polygon is 900° . Classify the polygon by the number of sides.

$$(n-2)180 = 900 \rightarrow n = 7$$

heptagon

6. Find the value of x in the diagram.



$$360 - (108 + 121 + 59) \\ x = 72$$

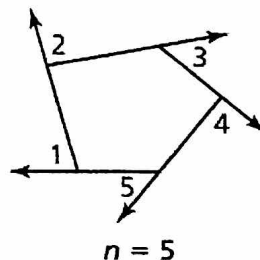
Types of Polygons		
Equilateral	Equiangular	Regular

Exterior Angle Measures of Polygons

measure of $\angle$ int. $\frac{(n-2)180}{n}$

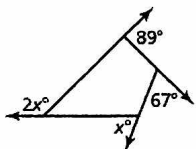
Polygon Exterior Angles Theorem

The sum of the measures of the exterior angles of a convex polygon (one angle at each vertex), is 360° .



Example:

7. Find the value of x in the diagram.



$$3x + 67 + 89 = 360$$

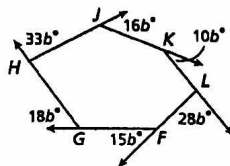
$$x = 68$$

reg. polygon
measure of
1 ext. $\angle$
 $= \frac{360}{n}$

8. Find the measure of an exterior angle in a regular dodecagon (12 sides).

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

9. Find the value of b in polygon FGHJKL



$$120b = 360$$

$$b = 3$$