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Interior Angle Measures of Polygons

Lesson Objective IWBAT classify polygons by their sides; derive/apply formulas for interior ∠s of polygons

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

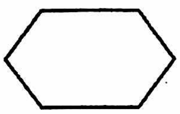
➔ **Classifying Polygons** There are two different kinds of polygons, convex and concave

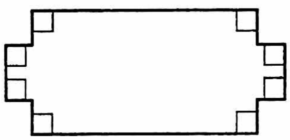
String Test: Imagine a string wrapped around the polygon…

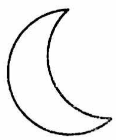
- If there is a gap between the string and a polygon, it is concave.
- If there is NOT a gap between the string and a polygon, it is convex.

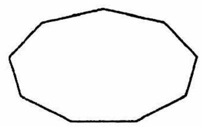
Example:

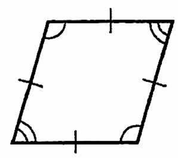
1. Imagine placing a string around each of the polygons below. Which are convex? Which are concave? Which are not even polygons? Label them below.

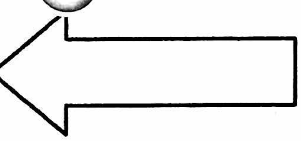

Y; convex

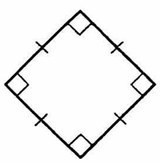

Y; concave

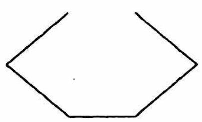

N


Y; convex


yes; convex


Y; concave


Y; convex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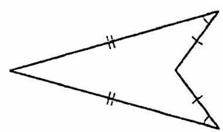
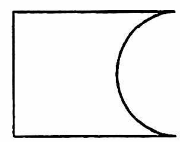

Y; concave

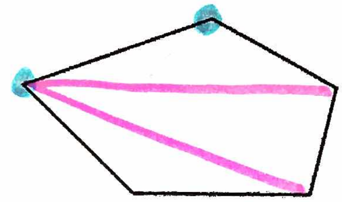

N

Number of sides	Name of polygon
3	triangle
4	quadrilateral
5	pentagon
6	hexagon
7	heptagon (septagon)
8	octagon
9	nonagon
10	decagon
11	hendecagon
12	dodecagon
n	n-gon

EXPLORATION!!!!!!

First let's look at some more vocabulary that will help us with the Exploration.

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.

It's now time to complete the exploration with your group. Follow the instructions on the worksheets. When your group thinks you have the general case figured out (for the n-gon), have Ms. Gerling check your work ☺

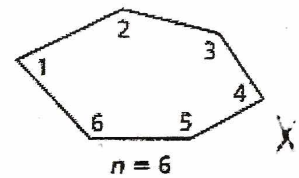
In the exploration, we noticed that the diagonals break up the polygon with n sides into $n-2$ triangles.

To find the total degrees in a polygon, multiply the # of Δs by 180.

Polygon Interior Angles Theorem

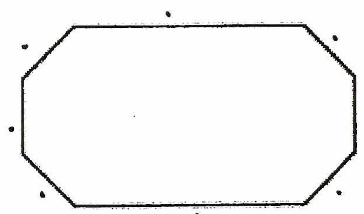
The formula for the sum of the measures of the interior angles of a convex n-gon is

$(n-2)180$



Example:

1. Find the sum of the measures of the interior angles of the figure.



$(8-2)180$

$6(180)$

$\boxed{1080}$

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

$\boxed{\text{heptagon}}$

$900 = (n-2)180$

$900 = 180n - 360$

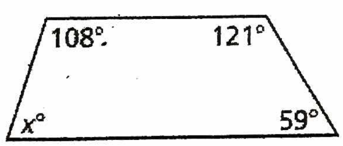
$1260 = 180n$

$\boxed{n=7}$

$5 = n-2$

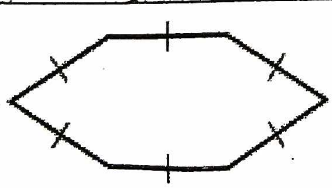
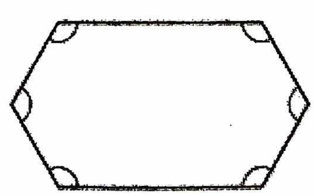
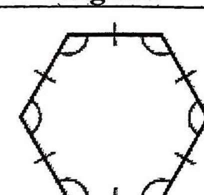
$\boxed{n=7}$

3. Find the value of x in the diagram.



$108+121+59+x=360$

$\boxed{x=72}$

Types of Polygons		
Equilateral	**Equiangular**	**Regular**
		

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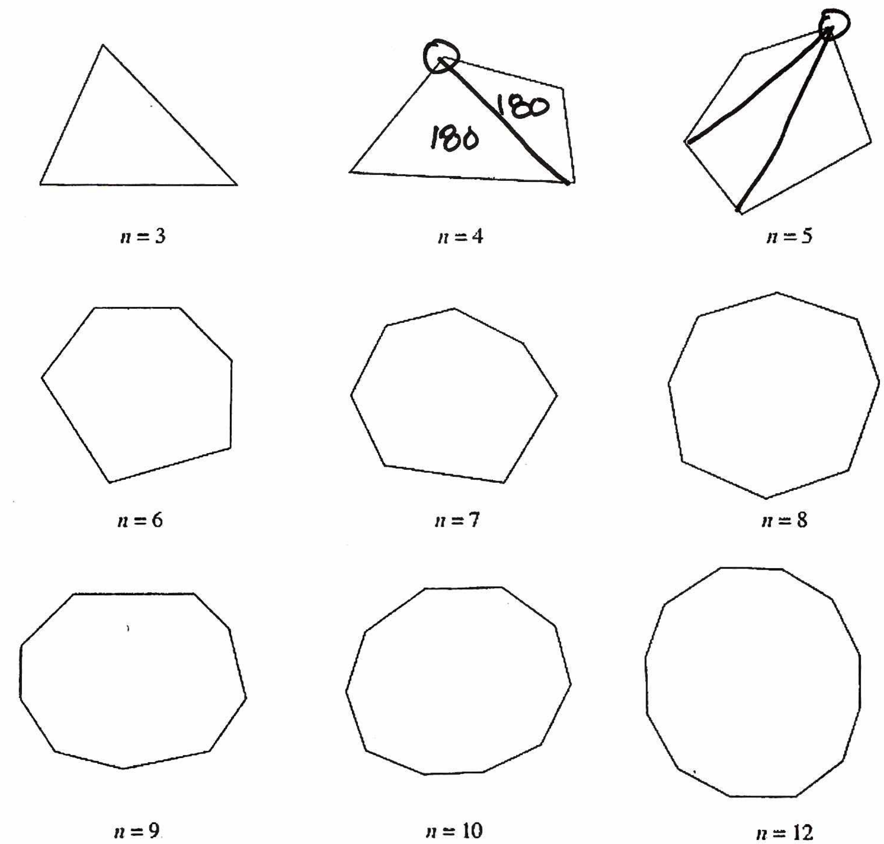
Exploration: Interior Angles of Polygons

1. Use the diagrams on the back side. Divide each polygon into triangles that extend from the same vertex.
2. Find the sum of the interior angles in each of the polygons.
3. Record your result in the chart below.
4. Use your results and look for a pattern to fill in the last row.

REMEMBER
The sum of the interior angles in a triangle is 180

Polygon	Number of Sides	Number of Triangles (from wkst)	Sum of ALL Interior Angles (show work! This helps identify the pattern ☺)
Triangle	3	1	180
Quadrilateral	4	2	2(180) = 360
Pentagon	5	3	3(180) = 540
Hexagon	6	4	4(180) = 720
Heptagon	7	5	5(180) = 900
Octagon	8	6	6(180) = 1080
Nonagon	9	7	7(180) = 1260
Decagon	10	8	8(180) = 1440
Dodecagon	12	10	10(180) = 1800
n-gon	n	n-2	(n-2)(180)

Interior Angle Sum of Polygons

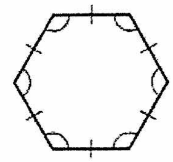


Think About It...How could you find the measure of ONE interior angle of a REGULAR polygon?

$\div$ sum by # of sides

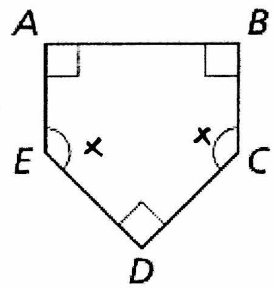
Formula: Measure of One Interior Angle of a Regular Polygon

$$\frac{(n-2)180}{n}$$



Example:

4. A home plate for a baseball field is shown.



   a. Is the polygon regular? Briefly explain your reasoning.

   no - not equiangular

   b. Find the measures of $\angle C$ and $\angle E$.

   $(5-2)180 = 540$

   $3(90) + 2x = 540$
   $270 = 2x$
   $x = 135$

   $\boxed{m\angle C = m\angle E = 135°}$

5. Find the measure of ONE interior angle of a regular 15-gon.

$$\frac{(13)180}{15} = \boxed{156°}$$

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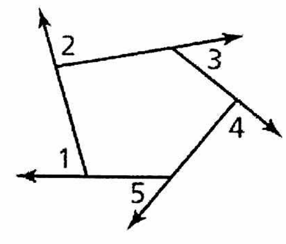
Exterior Angle Measures of Polygons

Lesson Objective IWBAT apply the exterior ∠s thm

Polygon Exterior Angles Theorem

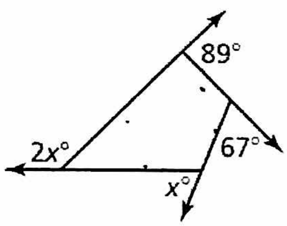
form linear pairs w/ int. ∠s

The sum of the measures of the exterior angles of a convex polygon (one angle at each vertex), is $\underline{360^\circ}$.



Example:

1. Find the value of x in the diagram.



$2x + x + 89 + 67 = 360$

$3x = 204$

$\boxed{x = 68}$

Think About It...How could you find the measure of ONE exterior angle in a REGULAR polygon?

÷ 360 by # of sides

$\frac{360}{n} = \text{ext. } \angle$

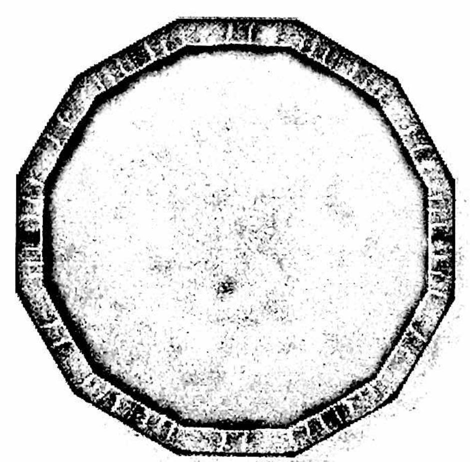
Examples:

2. A trampoline shown is shaped like a regular dodecagon.
   a. Find the measure of each interior angle.

   $\frac{(12-2)180}{12} = \frac{1800}{12} = \boxed{150^\circ}$

   b. Find the measure of each exterior angle.

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



3. A convex hexagon has exterior angles with measures 34°, 49°, 58°, 67°, and 75°. What is the measure of an exterior angle at the sixth vertex?

   $34 + 49 + 58 + 67 + 75 + x = 360$

   $\boxed{x = 77^\circ}$