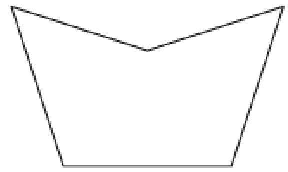
Math 2201 Date:__________________

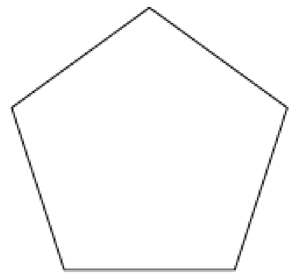
2.4 Angle Properties in Polygons

A **concave polygon** is defined as a polygon with one or more interior angles greater than 180°.



concave polygon

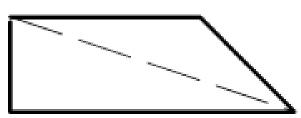
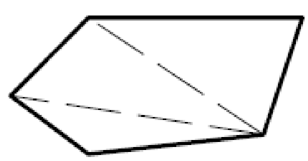
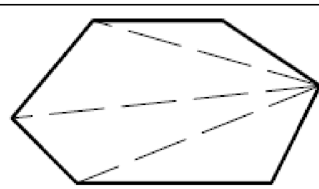
A **convex polygon** is defined as a polygon with all its interior angles less than 180°.



convex polygon

The focus of this chapter, however, will be on convex polygons. We will now discover the relationship between the sum of the interior angles and the number of sides in a convex polygon using the angle sum property. You already know that the sum of the angles in a triangle is 180°.

If we separate each polygon into triangles by drawing diagonals we can then use the following table to make our conjecture. Each vertex of a triangle must be a vertex of the original polygon.

Number of Sides	Diagram	Number of Triangles Formed	Sum of Angles
4		2	360°
5		3	540°
6		4	720°

The focus of this investigation is for you to recognize that the sum of the angles increases by 180° as the number of sides increase by one.

Name	**Number of Sides**	**Number of Triangles in Diagram**	**Sum if Interior Angles**
Triangle	3	1	180°
Quadrilateral	4	2	360°
Pentagon	5	3	540°
Hexagon	6	4	720°
Heptagon	7	5	900°
Octogon	8	6	1080°

Make a conjecture about the relationship between the sum of the measures of the interior angles of a polygon, S, and the number of sides of the polygon, n.

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

Example 1:
Determine the sum of the measures of the interior angles of a regular 15 sided figure.

$n = 15$

$S = ?$

$S = 180(n-2)$

$S = 180(15-2)$

$S = 180(13)$

$S = 2340^\circ$

Example 2:
The sum of the interior angles in a regular polygon is 1980°. Determine the number of sides in the figure.

$S = 1980^\circ$

$n = ?$

$S = 180(n-2)$

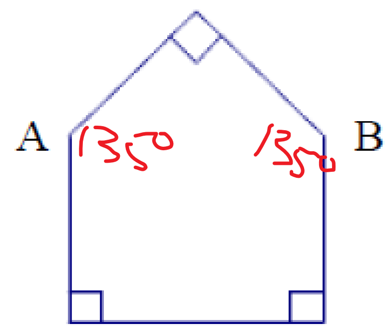
$$\frac{1980^\circ}{180^\circ} = \frac{180^\circ(n-2)}{180^\circ}$$

$11 = n-2$

$11+2 = n$

$n = 13$

Example 3:
In baseball, the home plate is shaped like the one shown. It has 3 right angles and 2 other congruent angles (A and B). Find the measures of $\angle A$ and $\angle B$.



$S = 180(n-2)$
$S = 180(5-2)$
$S = 180(3)$
$S = 540°$

$540° - 3(90°)$
$= 540° - 270°$
$= 270°$

$\frac{270°}{2} = 135°$

Regular Polygons
For a regular polygon, where all sides equal, all angles will be equal.

Example 4:

(A) Determine the sum of the interior angles in an 18 sided regular polygon.

$n = 18$
$S = ?$

$S = 180(n-2)$
$S = 180(18-2)$
$S = 180(16)$
$S = 2880°$

(B) Determine the measure of each individual interior angle in this polygon.

$\frac{2880°}{18} = 160°$

Textbook Questions: page 99 - 100 #1, 2, 3, 6, 7a