

7.1 - Polygon Formulas

Mental Floss: Mon, Jan 8th

The angles in a triangle are in a ratio of 3:5:8.

Find the measure of the smallest angle.

$$3x + 5x + 8x = 180$$

$$16x = 180$$

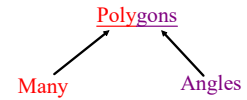
$$x = \frac{180}{16} \text{ or } 11.25$$

3(11.25)

33.75°
SMALLEST ∠

Chapter 7 - Polygons

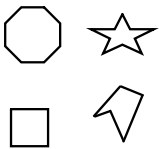
What are Polygons?



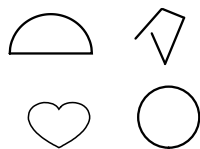
Polygons have/are:

1. Plane figures (2-dimensional)
2. At least 3 sides (triangles, quadrilaterals,...)
3. Closed figures - all sides connected with no gaps
4. All "sides" are segments - no curves!

Polygons



NOT Polygons



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

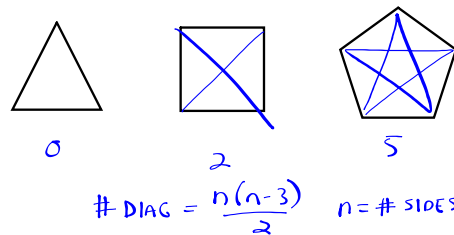
Polygon Formulas

# Sides	3	4	5	6	7
# Triangles Inside	1	2	3	4	5
Sum of Angles	180°	360°	540°	720°	900°

Sum of Angles
 $S = 180(n-2)$ $n = \text{number of sides}$

Most polygons also contain **diagonals**.

Diagonal = A segment connecting two *non-adjacent* vertices.



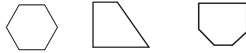
7.1 - Polygon Formulas

Convex or Concave?

Polygons can also be classified as either *convex* or *concave*.

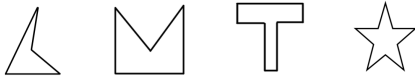
Convex

- No interior angles larger than 180°
- No diagonals pass outside the polygon



Concave

- 1 or more interior angle is larger than 180°
- 1 or more diagonal passes outside the polygon
- Has a "cave" in it, or it bends in on itself



Equilateral
All sides congruent

Equiangular
All angles congruent

Regular
Equilateral and Equiangular

Mental Floss: Wed, Jan 10th

1.) Find the sum of the angles in a decagon.

$$S = 180(n-2) \quad S = 1440^\circ$$

2.) Find the name of the polygon whose angles add up to 1080° .

$$\frac{1080}{180} = \frac{180(n-2)}{180} \quad 6 = n-2 \quad n = 8 \quad \text{OCTAGON}$$

3.) Can a polygon have angles whose sum is 600° ?

NO. NOT A MULTIPLE OF 180° .

$$600 = 180(n-2)$$

$$3.\bar{3} = n-2$$

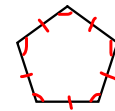
$$n = 5.\bar{3}$$

→ CAN'T HAVE $5.\bar{3}$ SIDES!

Regular Polygon = Polygon that is both equilateral and equiangular.



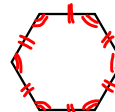
Pentagon



Regular Pentagon



Hexagon



Regular Hexagon

Examples

3.) A home plate for a baseball field is shown to the right.

a.) Is the polygon regular? Explain your reasoning.

NO. NOT EQUIANGULAR!

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

PENTAGON \rightarrow 5 SIDES

$$S = 180(5-2)$$

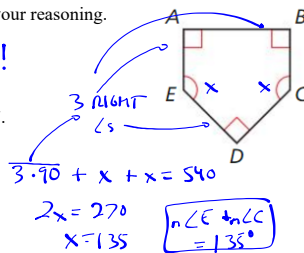
$$S = 540^\circ$$

$$3 \cdot 90 + x + x = 540$$

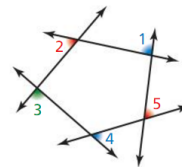
$$2x = 270$$

$$x = 135$$

$$m\angle E + m\angle C = 135^\circ$$



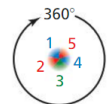
Exterior Angles



Step 1 Shade one exterior angle at each vertex.

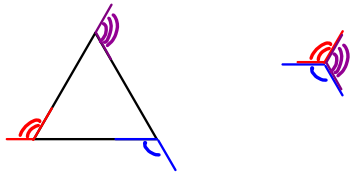


Step 2 Cut out the exterior angles.



Step 3 Arrange the exterior angles to form 360° .

7.1 - Polygon Formulas



If one exterior angle is drawn at each of the vertices, the sum of all the exterior angles is 360° .

<p>Sum of Exterior Angles</p> $S = 360^\circ$

Regular Polygons

Examples

5.) The trampoline to the right is a regular dodecagon.

a.) Find the measure of each interior angle.

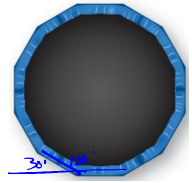
$$S_i = 180(n-2) \quad \frac{1800}{12} = 150^\circ$$

$$S = 1800$$

b.) Find the measure of each exterior angle.

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

SUPPLEMENTARY!!



Summary of all Formulas

#1 and 2 apply to all polygons

1.) Sum of Interior Angles $S_i = 180(n-2)$

2.) Sum of Exterior Angles $S_e = 360$

#3 and 4 apply to only regular polygons

3.) Measure of Each Interior Angle $A_i = \frac{180(n-2)}{n}$

4.) Measure of Each Exterior Angle $A_e = \frac{360}{n}$

Homework

7.1 p.364 #5,6,9,10,13-16,20
#26-28,34,50,52

Mental Floss: Thurs, Jan 11th

Part 1: A hexagon has 4 angles with measures of 40° , 100° , 110° , and 80° . What is the measure of each of the remaining two angles if they are congruent to each other?

$$40 + 100 + 110 + 80 = 330^\circ$$

$$S = 180(6-2)$$

$$S = 720^\circ$$

$$720 - 330 = 390$$

$$390 \div 2 = 195^\circ \text{ EACH}$$

Mental Floss: Thurs, Jan 11th

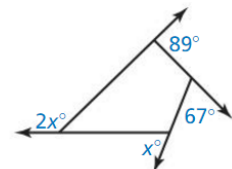
Part 2: Find the value of x in the diagram.

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

$$3x + 156 = 360$$

$$3x = 204$$

$$x = 68$$



7.1 - Polygon Formulas

Simple or Complex?

Polygons can also be classified as either *simple* or *complex*.

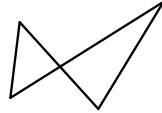
Simple

- Have 1 boundary and do not pass over themselves or have sides that cross.



Complex

- Do not have 1 distinct boundary and/or have sides that cross

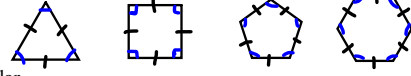


Regular or Irregular?

Polygons can also be classified as either *regular* or *irregular*.

Regular

- All sides are congruent and all angles are congruent.



Irregular

- All sides are not congruent or all angles are not congruent.

