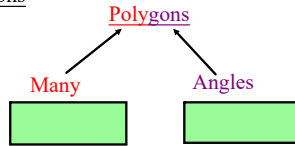


Unit 06 - Chapter 7 - Polygons

What are Polygons?

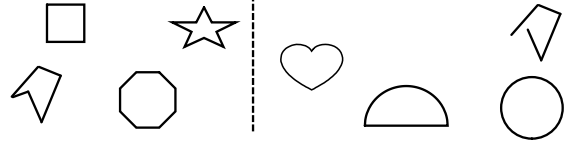


Polygons have/are:

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

Polygons

NOT Polygons



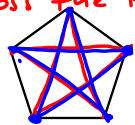
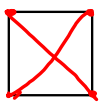
# of Sides	Polygon Name
3	Triangle
4	Quadrilateral
5	Pentagon
6	Hexagon
7	Heptagon
8	Octagon
9	Nonagon
10	Decagon
12	Dodecagon
15	Pentadecagon
$n$	$n$ -gon

## Angles of Polygons

How do we find the number of degrees in any polygon?

Most polygons also contain **diagonals**.

straight segments from one vertex to another across the figure

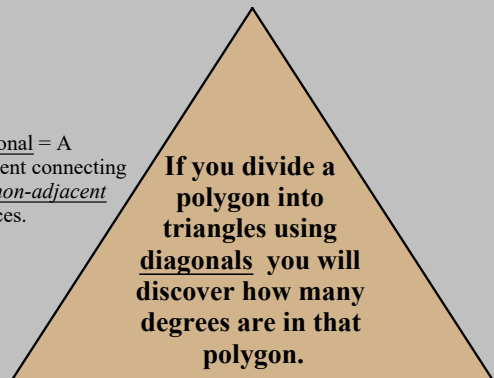


0 Diagonals    2 Diagonals    5 Diagonals

Any triangle is 180 degrees.

Diagonal = A segment connecting two non-adjacent vertices.


If you divide a polygon into triangles using diagonals you will discover how many degrees are in that polygon.



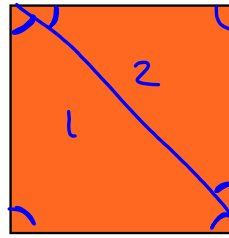
Polygon Formulas

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

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



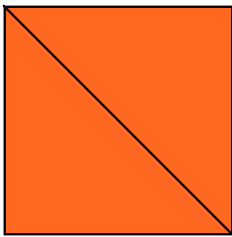
A quadrilateral equals 360°  
 2 triangles    2 · 180



Click Square for Video

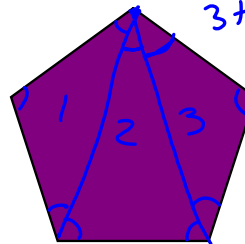
- Choose any vertex.
- Draw a straight line from that vertex to another vertex. (Repeat if possible)
- How many triangles can you make?

A quadrilateral equals 360°



When you divide a quadrilateral into triangles, you can make two triangles.  
 $2 \times 180 = 360$

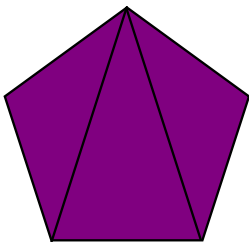
A pentagon equals 540°  
 3 triangles    3 · 180



Click Pentagon for Video

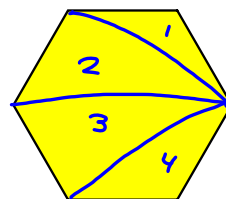
- Choose any vertex.
- Draw a straight line from that vertex to another vertex. (Repeat if possible)
- How many triangles can you make?

A pentagon equals 540°



When you divide a pentagon into triangles, you can make three triangles.  
 $3 \times 180 = 540$

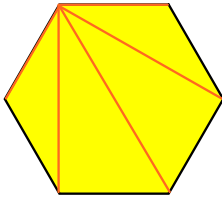
A hexagon equals 720°  
 4 · 180



Click Hexagon for Video

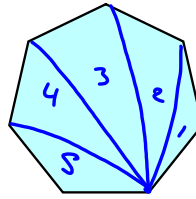
- Choose any vertex.
- Draw a straight line from that vertex to another vertex. (Repeat if possible)
- How many triangles can you make?

A hexagon equals 720°



When you divide a hexagon into triangles, you can make four triangles.  
 $4 \times 180 = 720$

A heptagon equals 900°

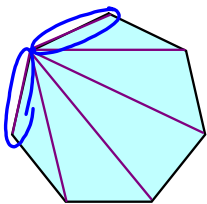


Click Heptagon for Video

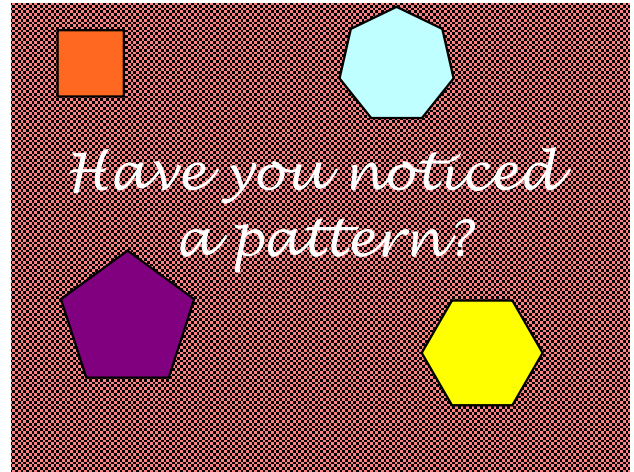
5 · 180

- Choose any vertex.
- Draw a straight line from that vertex to another vertex. (Repeat if possible)
- How many triangles can you make?

A heptagon equals 900°



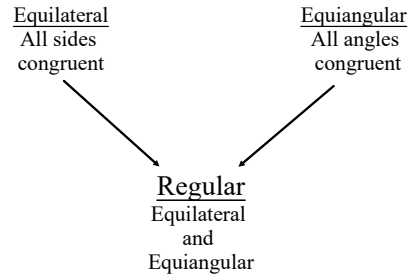
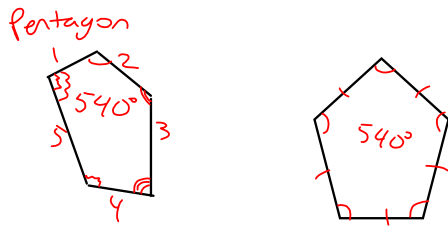
When you divide a heptagon into triangles, you can make five triangles.  
 $5 \times 180 = 900$



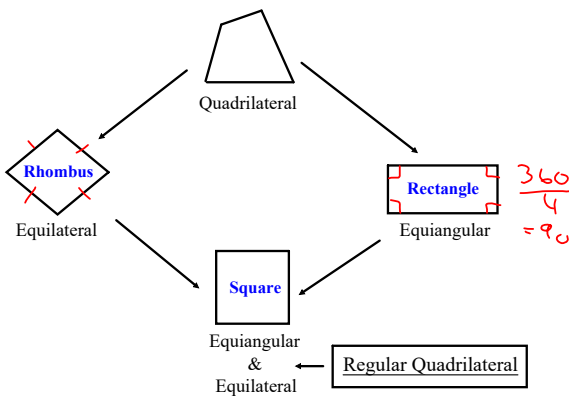
Name of polygon	Number of sides	Number of Triangles	Sum of Angles	One Regular Angle
Triangle	3	1	$1 \times 180 = 180^\circ$	$180 \div 3 = 60^\circ$
	4	2	$2 \times 180 = 360^\circ$	$360 \div 4 = 90^\circ$
	5	3	$3 \times 180 =$	$\div 5 = \text{ }^\circ$
	6	4	$4 \times 180 =$	
	7			
	8			
	9			
	10			
n-gon				

Name of polygon	Number of sides	Number of Triangles	Sum of Angles	One Regular Angle
Triangle	3	1	$1 \times 180 = 180^\circ$	$180 \div 3 = 60^\circ$
Quadrilateral	4	2	$2 \times 180 = 360^\circ$	$360 \div 4 = 90^\circ$
Pentagon	5	3	$3 \times 180 = 540^\circ$	$540 \div 5 = 108^\circ$
hexagon	6	4	$4 \times 180 = 720^\circ$	$720 \div 6 = 120^\circ$
heptagon	7	5	$5 \times 180 = 900^\circ$	$900 \div 7 = 128.5^\circ$
Octogon	8	6	$6 \times 180 = 1080^\circ$	$1080 \div 8 = 135^\circ$
Nonagon	n	7	$7 \times 180 = 1260^\circ$	$1260 \div 9 = 140^\circ$
Decagon	10	8	$8 \times 180 = 1440^\circ$	$1440 \div 10 = 144^\circ$
n-gon		n-2	$(n-2) \cdot 180^\circ$	$\frac{(n-2)180}{n} =$

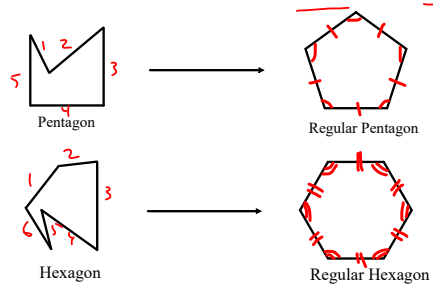
What if we want to find out the measure of one angle?



Regular Polygon = Polygon that is both equilateral and equiangular.



Regular Polygon = Polygon that is both equilateral and equiangular.

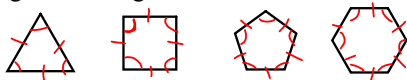


Regular or Irregular?

Polygons can also be classified as either regular or irregular.

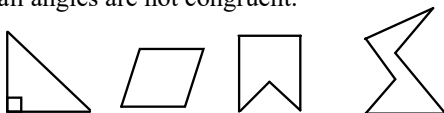
Regular

- All sides are congruent and
- all angles are congruent.



Irregular

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



The Interior Angle Sum

To find the total number of degrees in any polygon:

$$(N-2) \cdot 180$$

number of sides

Measure of **Each** Interior Angle

In a regular polygon, the measure of each interior angle is defined as :  
the sum of all the angles divided by the number of sides (which is the same as the number of angles).

<p>Measure of Each Interior Angle</p> $S = \frac{180(n-2)}{n}$
--

**What are they asking?**

1. Find the **sum** of the Measures of a 38-gon.

$180(n-2)$

2. Find the **measure of one** interior angle of a regular 38-gon.

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

Find the measure of **AN** interior angle of the regular polygon *one*

all angles =  
all sides =  
Formula:  $\frac{\text{sum of angles } 180(n-2)}{\text{number of angles } n}$

3. regular pentagon?

$n=5$  sides  
 $\frac{180(5-2)}{5} = \frac{540}{5} = 108^\circ$   
each angle is  $108^\circ$

4. regular nonagon?

$n=9$  sides  
 $\frac{180(9-2)}{9} = \frac{1260}{9} = 140^\circ$   
each angle is  $140^\circ$

5. regular 13-gon?

$\frac{180(13-2)}{13} = \frac{1980}{13} = 152.307$   
 $152.31$

6. regular 100-gon?

$176.4$   
regular 100-gon  
 $179.6$

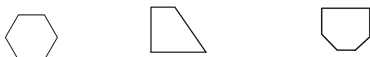
# Day 2

Convex or Concave?

Polygons can also be classified as either convex or concave.

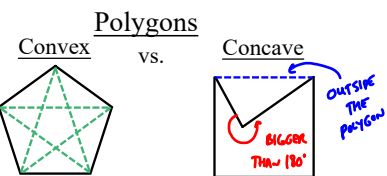
Convex

- No interior angles larger than  $180^\circ$
- No diagonals pass outside the polygon



Concave

- 1 or more interior angle is larger than  $180^\circ$
- 1 or more diagonal passes outside the polygon
- Has a "cave" in it, or one vertex seems to move into the figure



- Concave polygons "go in on themselves."
- You know this if you can draw any of the diagonals of the polygon and they lie outside the figure. (See above)
- Concave polygons also have 1 or more angles that have measures greater than 180 degrees. (See above)

Simple or Complex?

Polygons can also be classified as either simple or complex.

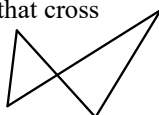
Simple

- 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



Practice

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

$$180(n-2) \quad n=10$$

$$180(10-2)$$

$$180(8)$$

$$1440^\circ$$

8) Find the name of the polygon whose angles add up to 1080°. *less than 10*

$$180 \cdot 7 = 1260$$

$$180 \cdot 6 = 1080 \quad \rightarrow n=8$$

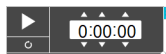
Octagon  $180(6) = 1080^\circ$

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

No Pentagon 5 sides sum = 540  
then hexagon 6 sides sum is 720  
you can't have part of a side

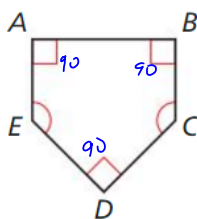
Practice

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



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

No not all the angles are equal



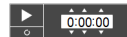
12.) Find the measures of  $\angle E$  and  $\angle C$ .

Pentagon Angles Sum: 540  
- 270 3 right angles

$$m\angle E = 135 = m\angle C$$

$270 \div 2 = 135^\circ$   
cut into 2 equal angles

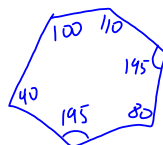
Examples



13.) 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?

Draw it

hexagon angle sum = 720°



$$720 - 40 - 100 - 110 - 80 = 390$$

$$390 \div 2 = 195^\circ$$



## Attachments

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quad.wmv

pentagon.wmv

hexagon.wmv

heptagon.wmv