Unit 5.3 - Polygons Angle Formulas

Mental Floss: Tue, Jan 18th

Solve the following system of equations.

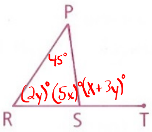
① $x + 3y = 10$

② $2x - 5y = -24$

$-2 \cdot ①$ $-2x - 6y = -20$
$2x - 5y = -24$
$-11y = -44$
$\boxed{y = 4}$
① $x + 3(4) = 10$
$\boxed{x = -2}$

$5 \cdot ①$ $5x + 15y = 50$
$3 \cdot ②$ $6x - 15y = -72$
$11x = -22$
$\boxed{x = -2}$
① $-2 + 3y = 10$
$3y = 12$
$\boxed{y = 4}$

18 Given: $\angle PST = (x + 3y)°$,
$\angle P = 45°$, $\angle R = (2y)°$,
$\angle PSR = (5x)°$
Find: $m\angle PST$



$(x+3y)°$
$45°$
$(2y)°$
$(5x)°$

Sum △
$5x + 2y + 45 = 180$
Ⓐ $5x + 2y = 135$

Supp ∠'s
$5x + x + 3y = 180$
$6x + 3y = 180$
Ⓑ $2x + y = 60$

Ext ∠ Thm
$x + 3y = 2y + 45$
Ⓒ $x + y = 45$

Ⓑ $2x + y = 60$
$-1 \cdot$ Ⓒ $-x - y = -45$
$\boxed{x = 15}$

Ⓒ $15 + y = 45$
$\boxed{y = 30}$

$m\angle PST = x + 3y$
$= 15 + 3(30)$
$= \boxed{105°}$

5.1-5.2 Quiz

- Thursday 1/20, Section 5.1 and 5.2
- Topics:
  - Classifying triangles
  - Sum of the interior angles in a triangle
  - Exterior angle theorem
  - Perimeter of triangles
- Algebra:
  - Solving equations
  - Ratios
  - System of equations
  - Factoring

Unit 05 - Section 3 - Polygons

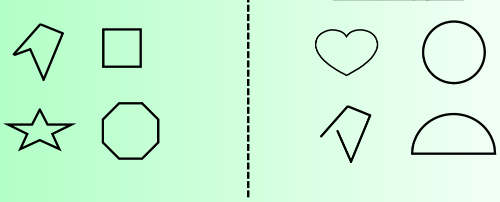
What are Polygons?

Polygons
Many — Angles

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

13-gon
100-gon

Unit 5.3 - Polygons Angle Formulas

Angles of a Polygon - Work with a partner/group

1.) Each student will need a protractor and a ruler/straightedge.

2.) Draw 1 triangle, 1 quadrilateral, and 1 pentagon (Not too small!)
(triangle: 3 sides; quadrilateral: 4 sides; pentagon: 5 sides)

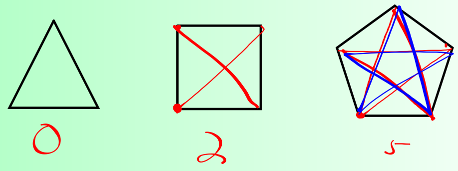
3.) Using your protractor, find the measure of each angle in all 3 figures.
Be as accurate as possible to the nearest degree.

4.) Find the sum of all the angles in each figure.

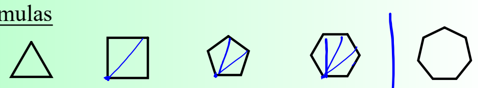
5.) In your groups, come up with a prediction for what you think the sum of the angles in a hexagon (6 sides) will be. Be able to explain!

Most polygons also contain **diagonals**.

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



Polygon Formulas

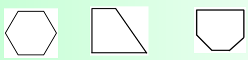


# Sides	3	4	5	6	7
# Triangles Inside	1	2	3	4	5
Sum of Angles	180°	360°	540°	720°	900°

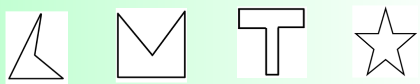
Sum of Angles
$S = 180(n-2)$ n = number of sides

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

Convex
- No interior angles larger than 180^0
- No diagonals pass outside the polygon



Concave
- 1 or more interior angle is larger than 180^0
- 1 or more diagonal passes outside the polygon
- Has a "cave" in it, or one vertex seems to move into the figure



Mental Floss: Mon, Jan 24th

a.) Find the sum of the angles in a dodecagon.

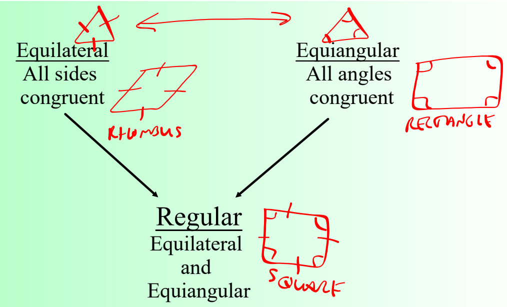
$180(12-2) = 1800°$

b.) Find the name of the polygon whose angles add up to 1980°.

$\frac{180(n-2)}{180} = \frac{1980}{180}$ $n-2 = 11$ $n = 13$ 13-gon

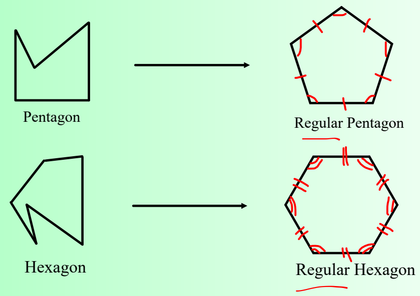
c.) Can a polygon have angles whose sum is 2000°?

$\frac{2000}{180} = 11.\overline{1}$ NO. CANNOT HAVE DECIMAL # OF SIDES.



Unit 5.3 - Polygons Angle Formulas

Regular Polygon = Polygon that is both equilateral and equiangular.



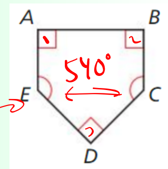
Examples

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

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

– NO. NOT EQUIANGULAR. 90 ≠ 135
– NO. NOT EQUILATERAL (TICK MARKS)

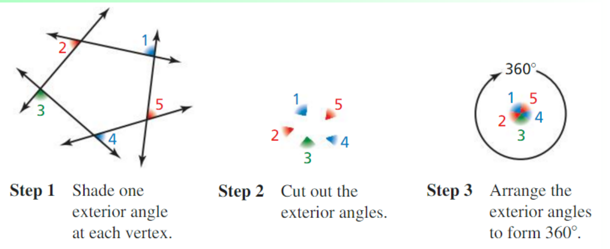
b.) Find the measures of $\angle E$ and $\angle C$.

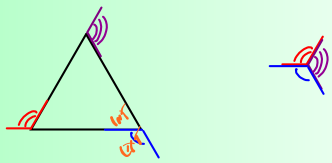


$540 - 270 = \frac{270}{2}$

$135°$

Exterior Angles (Do not copy this slide)





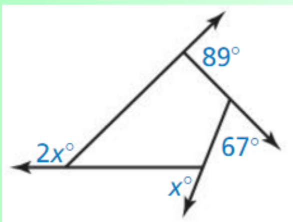
If one exterior angle is drawn at each of the vertices, the sum of all the exterior angles is 360°.

Sum of Exterior Angles

$S = 360°$

Examples

2.) Find the value of x in the diagram.



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

$x = 68$

Examples

3.) A ***polygon*** 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?

HEXAGON → 6 SIDES

$40 + 100 + 110 + 80 = 330$

$S = 180(6-2)$

$S = 720$

$720 - 330$

390

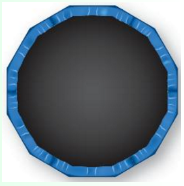
$390/2 = 195°$

Unit 5.3 - Polygons Angle Formulas

Regular Polygons

Examples

4.) The trampoline to the right is a regular dodecagon. (12)



a.) Find the measure of each interior angle.

$S = 180(12-2)$

$S = 1{,}800°$

ALL ≅

$\frac{1800}{12} = 150°$

b.) Find the measure of each exterior angle.

2 METHODS

EACH INT = 150°

EACH EXT = 180 - 150 = 30°

OR

SUM EXT = 360 ALWAYS

EACH EXT = $\frac{360}{12}$ = 30°

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 (or equiangular) polygons

3.) Measure of Each Interior Angle .... $A_I = \frac{180(n-2)}{n}$ or $180 - \frac{360}{n}$

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