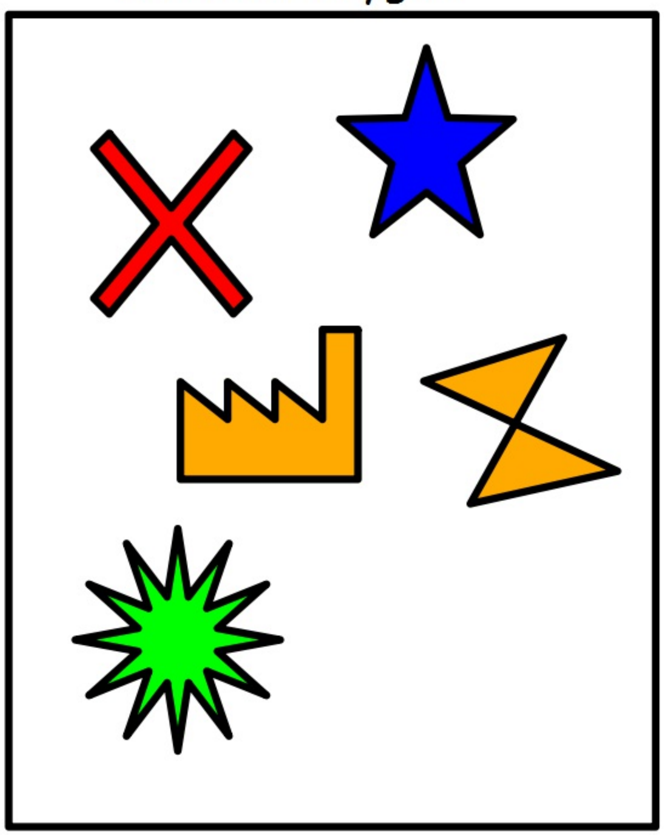
Polygon: Shape whose sides are line segments.

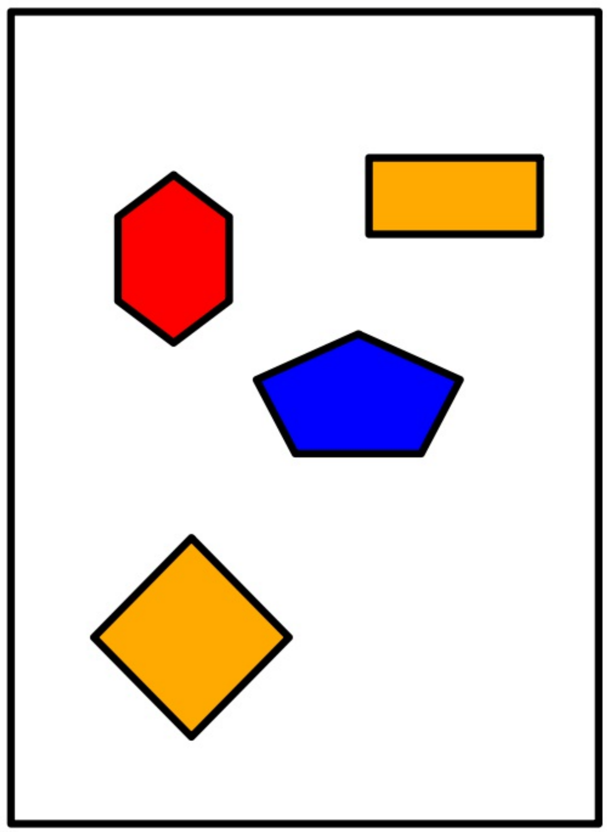
Convex Polygon: Has all diagonals inside. (No indentations)

Concave Polygon: Has at least 1 diagonal outside. (indentations)

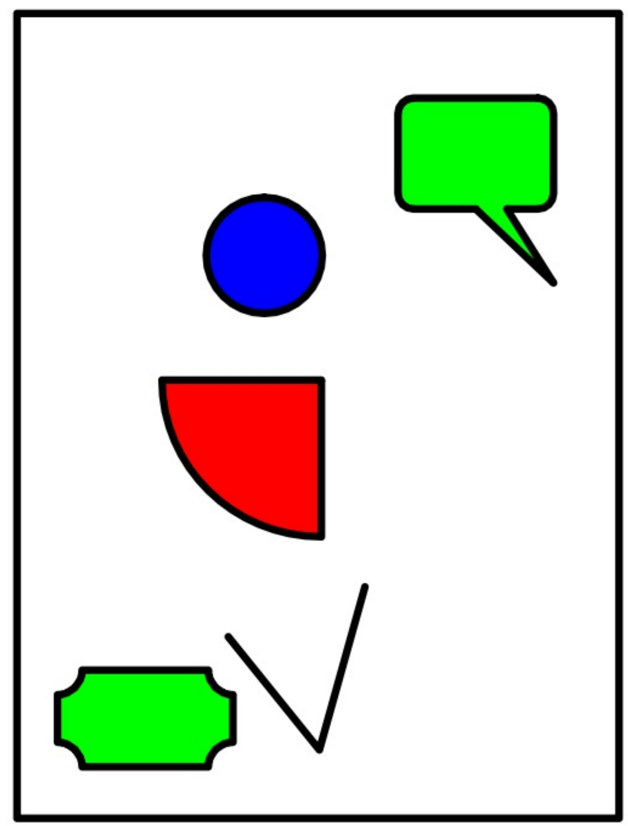
Concave Polygon



Convex Polygon



Not a Polygon



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Method 1

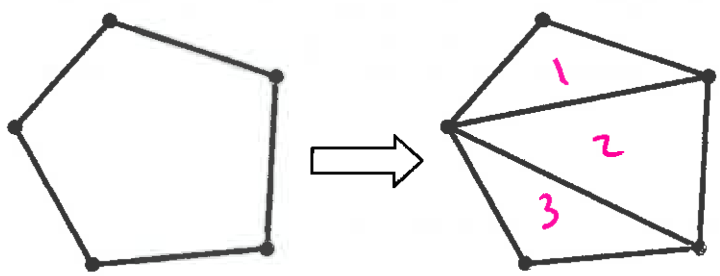
Polygon – Method 1

Directions: This is **method 1** for finding the interior angle sum of a polygon. When you and your partner have completed this method, move on to Method 2.

Please, read and follow each step carefully!

1. The interior angle sum of a triangle = 180°.

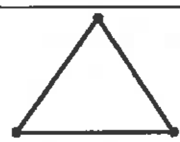
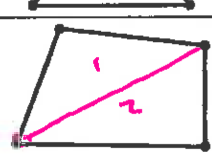
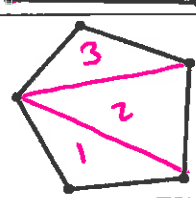
2. The interior angle sum of other polygons can be found by splitting the polygon into triangles. For example: A pentagon has 5 vertices. By choosing 1 vertex and connecting it to all other non-adjacent vertices, the pentagon is broken into 3 triangles:

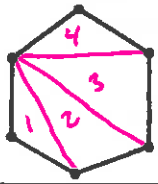
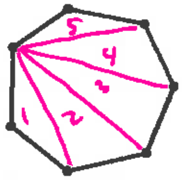
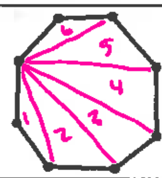


So, the **interior angle sum** of a pentagon = (3 Triangles)(180° in each)
= 540° total.

3. Complete the table below using the same method described above.

(#Δ's)(180)

Name	Picture	# of Sides	# of Triangles	Interior ∠ Sum
Triangle		3	1	·180(1) =180°
Quadrilateral		4	2	180(2) = 360°
Pentagon		5	3	180(3) = 540°

		# sides	# △'s	
Hexagon		6	4	$180(4) =$ $720°$
Septagon (Heptagon)		7	5	$180(5) =$ $900°$
Octagon		8	6	$180(6) =$ $1080°$

4. In the table, you will notice that there is a relationship between the **number of sides** of a polygon and the **number of triangles** formed. In the box below describe this relationship and then use your description to answer the questions that follow.

△'s = # sides − 2

a) How many triangles can be formed in a polygon with 12 sides? $12 - 2 = 10$

b) How many triangles can be formed in a polygon with 30 sides? $30 - 2 = 28$

c) How many triangles can be formed in a polygon with *n* sides? $n - 2$

5. In the table, the **interior angle sum** was found based on the **number of triangles** formed. In the box below, write a formula that gives the **interior angle sum** based on the **number of sides.** Use the variable n in your formula to represent the number of sides.

Interior angle sum = $180(n-2)$

6. Test your formula by letting *n* = 5 and n=8. Did you get the same values that are in the table? If not, revise your formula and try again.

$180(5-2) = 180(3) = 540°$ ✓

$180(8-2) = 180(6) = 1080°$ ✓

7. Move on to Method 2.

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Method 2

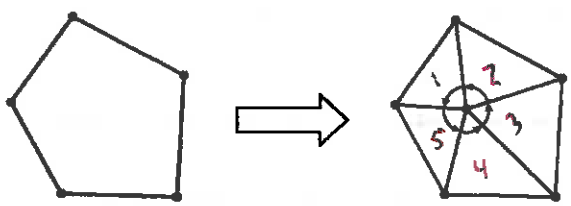
Polygon – Method 2

Directions: This is **Method 2** for finding the interior angle sum of a polygon. When you and your partner have completed this method, move on to the Activity Summary .

Please, read and follow each step carefully!

1. The interior angle sum of a triangle = 180°.

2. The interior angle sum of other polygons can be found by splitting the polygon into triangles. For example: A pentagon has 5 vertices. Draw a point anywhere inside the pentagon and connect it to each of the 5 vertices to form 5 triangles.

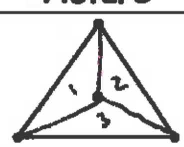
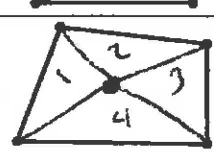
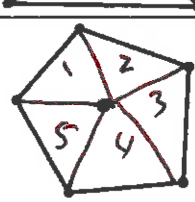


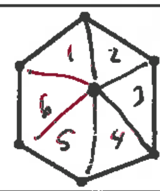
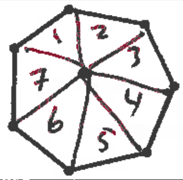
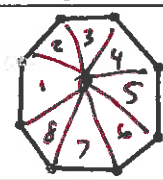
The 5 triangle vertices touching the interior point form a circle which is 360°.

So, the interior angle sum of a pentagon = (5 triangles)(180° each)-360°
=540°.

3. Complete the table below using the method described above.

(#Δ's)(180)-360

Name	Picture	# of Sides	# of Triangles	Interior ∠ Sum
Triangle		3	3	180(3)-360 = 180°
Quadrilateral		4	4	180(4) -360 = 360°
Pentagon		5	5	180(5)-360 = 540°

		#Sides	# $\triangle$'s	
Hexagon		6	6	180(6) - 360 = 720°
Septagon (Heptagon)		7	7	180(7) - 360 = 900°
Octagon		8	8	180(8) - 360 = 1080°

4. In the table, you will notice that there is a relationship between the **number of sides** of a polygon and the **number of triangles** formed. In the box below describe this relationship and then use your description to answer the questions that follow.

sides = # $\triangle$'s.

a) How many triangles are formed in a polygon with 12 sides? 12

b) How many triangles are formed in a polygon with 30 sides? 30

c) How many triangles are formed in a polygon with *n* sides? n

5. In the table, the **interior angle sum** was found based on the **number of triangles** formed. In the box below, write a formula that gives the **interior angle sum** based on the **number of sides**. Use the variable n in your formula to represent the number of sides.

Interior angle sum = 180(n) – 360

6. Test your formula by letting *n* = 5 and n=8. Did you get the same values that are in the table? If not, revise your formula and try again.

180(5) - 360 = 540° ✓

180(8) - 360 = 1080° ✓

7. Move on to the Activity Summary.

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Name: ____________________
Activity Summary

Polygon – Activity Summary

Directions: This is the ***Activity Summary*** for finding the interior angle sum of a polygon.

1. In the box below, briefly describe how to calculate the interior angle sum of a polygon using method 1.

int $\angle$ Sum $= 180(n-2)$ where n = #sides.

2. In the box below, briefly describe how to calculate the interior angle sum of a polygon using method 2.

int $\angle$ Sum $= 180(n) - 360$ where n = #Sides.

3. In the activity you created two formulas. Write the formulas in the boxes below.

Method 1 Formula	Method 2 Formula
$180(n-2)$	$180(n)-360$

What does n represent in each of the formulas?

n = # Sides.

4. Although the formulas look different, are they really different? Explain in this space.

No. $180(n-2) = 180(n) - 180(2)$ by distribution.

$= 180n - 360$

5. With your partner answer the following questions:

a) What is the interior angle sum of a 25-gon?

$n = 25$ $\quad$ int $\angle$ sum $= 180(25-2) = 4140°$

b) What is the measure of one angle of a ***regular*** 15-gon?
(Hint: regular = all sides ≅ & all angles ≅.)

int $\angle$ sum $= 180(15-2) = 2340°$

1 int $\angle$ $= 2340/15 = 156°$

c) How many sides does a polygon have if the interior angle sum is 7020°?

$7020 = 180n - 360$

$7380 = 180n$

$n = 41$

or

$\frac{7020}{180} = 39$

$39 + 2 = 41$

d) How many sides does a **regular** polygon have if one angle measures 175°?

$\frac{180(n-2)}{n} = 175°$

$180(n-2) = 175°(n)$

$180n - 360 = 175n$

$5n = 360$

$n = 72$

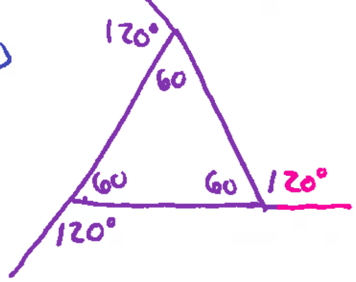
or

$180 - 175 = 5$

$\frac{360°}{5} = 72°$

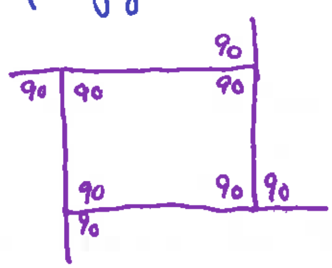
Exterior angle sum of any polygon = 360°

ex)



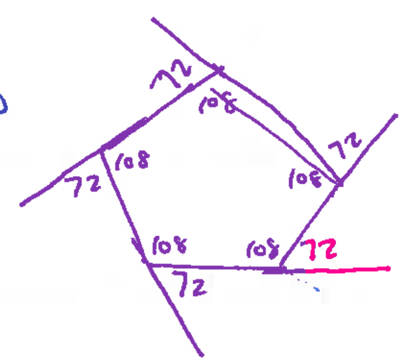
$3(120) = 360°$

ex)



$4(90) = 360°$

ex)



$5(72) = 540°$