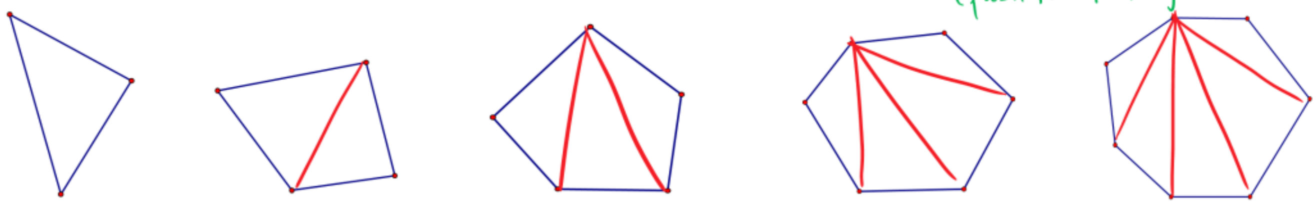
Notes Key

Wednesday, December 10, 2014
7:36 AM

7.3 – Relationships Involving Polygons

Today's Objective: To identify patterns and discover new formulas that apply to polygons

relationships/patterns?
Why are formulas important
(push for ↑ n-gons)



Polygon Name	# of sides (n)	# of triangles	Sum of interior angles
triangle	3	1	180
quadrilateral	4	2	360
pentagon	5	3	540
hexagon	6	4	720
heptagon	7	5	900
n – gon	n	n-2	180(n-2)

Sum of Exterior Angles *(one per vertex)*
360
360
360
360
360
360

Summarize:

Sum of interior angles of a polygon (n-gon):

$S_i = 180(n-2)$

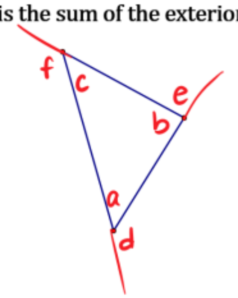
Sum of exterior angles of a polygon (n-gon):

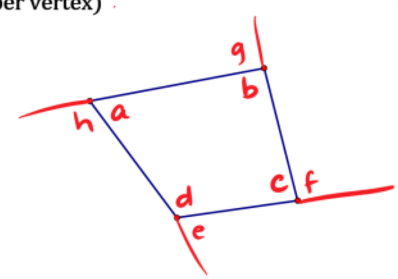
$S_E = 360$

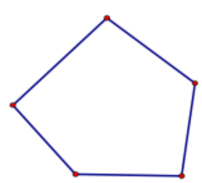
Is 5 cases enough to recognize a pattern?
Important to recognize how we came upon 'formula'

Let's explore the sum of the exterior angles:

What is the sum of the exterior angles (one per vertex)







$\underbrace{a+b+c}_{180} + \underbrace{d+e+f}_{S_E} = 540$

$180 + S_E = 540$

$S_E = 360$

$\underbrace{a+b+c+d}_{360} + \underbrace{e+f+g+h}_{S_E} = 720$

$360 + S_E = 720$

$S_E = 360$

you try ☺

Think about it:

Is it possible for the sum of the interior angles of a polygon to be 630° ?
If so, how many sides would the polygon have?

$S_i = 180(n-2)$
$630 = 180(n-2)$
$3.5 = n-2$
$5.5 = n$

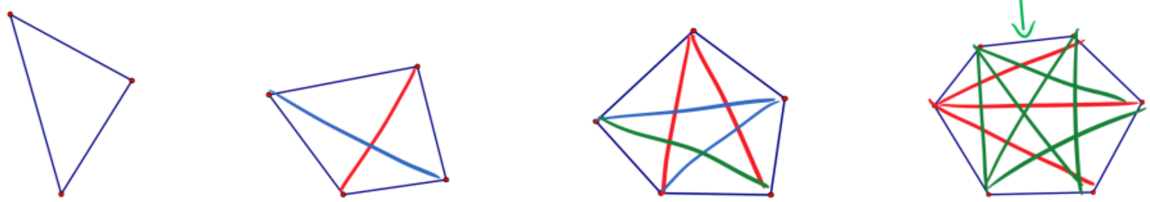
$630 = 180(n-2)$
$630 = 180n - 360$
$990 = 180n$
$5.5 = n$ ← Why not? CLOSED...

Use the table as a quick reference! →

Diagonal Formulas!

Why don't we just count the diagonals each time?

Why was this frustrating? Why is a formula useful



Shape Name	# of vertices	# of diagonals from a single vertex	Total number of diagonals
triangle	3	0	0
quadrilateral	4	1	2
pentagon	5	2	5
hexagon	6	3	9
n - gon	n	n - 3	$\frac{n(n-3)}{2}$

Is there an organized way to approach

Summarize:

Number of diagonals from a single vertex:

$D_s = n - 3$

Total number of diagonals in a polygon (n-gon):

$D = \frac{n(n-3)}{2}$

Always, Sometimes, Never

a. The number of diagonals of a polygon is the same as the number of sides.

b. As the number of sides of a polygon increases, the sum of the measures of the interior angles of a polygon increases.

Now let's come up with our own, and try to answer as a class!

Always	Sometimes	Never
As the # of sides of a polygon increases, the sum of the measures of the interior angles ↑ (b.)	The # of diagonals of a polygon is the same as the # of sides (a.)	

7.3 Practice Problems!

The **sum** of the measures of the **interior angles** of a polygon: $S_i =$ $180(n-2)$

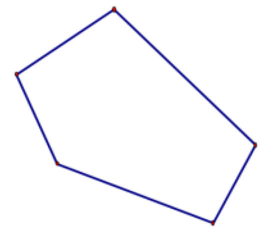
The **sum** of the measures of the ***exterior angles*** of a polygon: $S_e =$ 360

Number of diagonals in a polygon **(from a single vertex):** $D_s =$ $n-3$

The **total number** of diagonals in a polygon: $D =$ $\frac{n(n-3)}{2}$

Start each problem with a formula, and then solve!

1) Find the sum of the measure of the



   a. measures of the interior angles of the figure: $S_i = 180(5-2)$, $S_i = 180(3)$, $\boxed{S_i = 540}$

   b. measures of the exterior angles of the figure: $\boxed{S_e = 360}$

2) Find the sum of the measures of the interior angles of a 22-gon. $S_i = 180(22-2)$, $S_i = 180(20)$, $\boxed{S_i = 3600}$

3) Find the total number of diagonals in a dodecagon. $D = \frac{12(12-3)}{2} = 6(9) = \boxed{54}$

4) Find the sum of the measures of the exterior angles of a hexagon. $\boxed{S_e = 360}$

5) How many sides does a polygon have if the sum of the measures of its angles is 1620? $S_i = 180(n-2)$, $1620 = 180(n-2)$, $9 = n-2$, $\boxed{11 = n}$

6) What is the name of the polygon that has 54 diagonals? $54 = \frac{n(n-3)}{2}$, $108 = n^2 - 3n$, $0 = n^2 - 3n - 108$, $0 = (n-12)(n+9)$, $\boxed{n = 12}$, $n \neq -9$

7) The number of diagonals from a *single vertex* of a 20-gon. $D_s = 20-3$, $\boxed{D_s = 17}$

8) **Always, Sometimes, Never…**

   a. As the number of sides of a polygon increases, the number of exterior angles increases. $\boxed{A}$

   b. As the number of sides of a polygon increases, the sum of the measures of the exterior angles increases. $\boxed{N}$

   c. As the number of sides of a polygon increases, the number of diagonals increases $\boxed{A}$

   d. The sum of the interior angles of a polygon is divisible by 180. $\boxed{A}$

Just Extra!!! No need to print ☺

Practice:

1) How many diagonals are there from a single vertex in a pentadecagon?

2) How many total diagonals are there in a pentadecagon

3) What is the name of the polygon that has at has 40 diagonals?

4) What is the sum of the interior angles of a polygon with 102 sides?

Good Applets for Reference!!!

http://www.ies.co.jp/math/java/samples/gaikaku.html
http://www.mathopenref.com/polygonexteriorangles.html