Geometry
Notes: Classifying Polygons
Interior and Exterior Angle Measures of Polygons

Essential Questions: How do we classify polygons? What are the steps to finding the measure of interior and exterior angles of a polygon?

A _____ is a plane figure that meets the following conditions:

a.

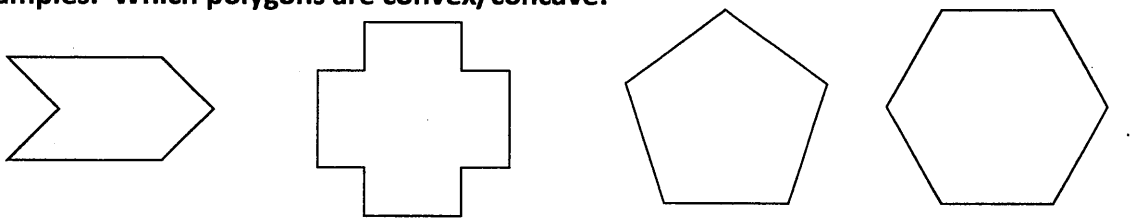
b.

Vertex-

Concave polygon-

Convex polygon-

Examples: Which polygons are convex/concave:



Equilateral polygon-

Equiangular polygon-

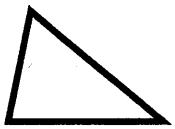
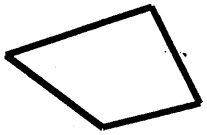
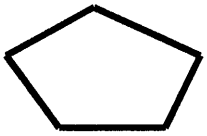
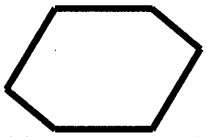
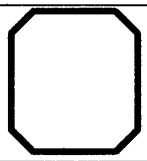
Regular polygon-

Fill in the chart below.

Number of Sides	Name of Polygon		Number of Sides	Name of Polygon
3				Octagon
	Quadrilateral		9	
	Pentagon			Decagon
6			12	
	Heptagon		n	

Recall: The three angles of a triangle_____

Diagonal-

Polygon	Diagram	Number of Sides	Number of Triangles Made from Diagonals	Sum of the measures of the Interior Angles
Triangle				
Quadrilateral				
Pentagon				
Hexagon				
Octagon				
n-gon				

If a polygon has *n* sides, how many triangles can be drawn inside it using diagonals drawn from one vertex? _____

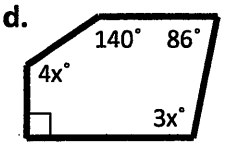
If a polygon has *n* sides, what is the **sum of the measures of its interior angles?**

Examples: Find the sum of the measures of the interior angles of a ...

a. ... Nonagon **b.** ... 14-gon **c.** ... 37-gon

Find the value of x.

d.



Examples: The sum of the measures of the interior angles of a polygon is given. Classify the polygon by the number of sides.

e. 900°

Examples: Find the measure of one interior angle of each regular polygon. One angle =

h. hexagon **i.** octagon **j.** 20-gon

Example: One interior angle of a regular polygon is given. Find the number of sides.

f. 108° **g.** 120°

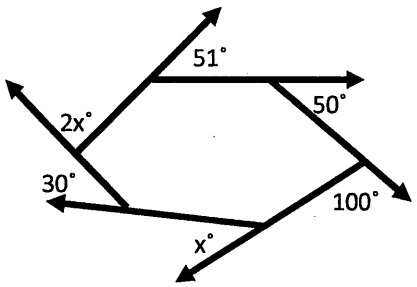
The **exterior angles** of a polygon can be dilated together to all fit around a single point, no matter how many sides the polygon has.

http://www.geogebra.org/material/simple/id/152420

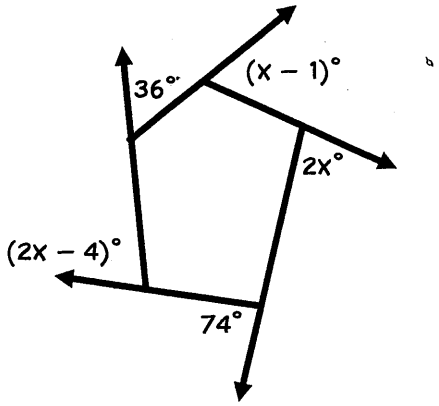
If a polygon has *n* sides, what is the **sum of the measures of the exterior angles?**

Examples:

k.



l.



Examples: Find the measure of one exterior angle of each regular polygon. One angle =

m. heptagon **n.** decagon

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6-1 Skills Practice

Angles of Polygons

Find the sum of the measures of the interior angles of each convex polygon.

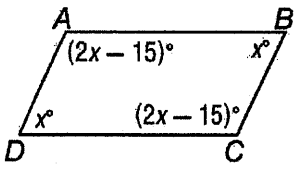
1. nonagon **2.** heptagon **3.** decagon

The measure of an interior angle of a regular polygon is given. Find the number of sides in the polygon.

4. 108 **5.** 120 **6.** 150

Find the measure of each interior angle.

7.



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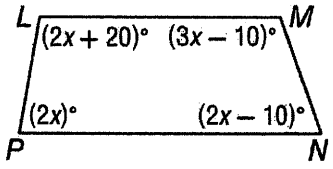

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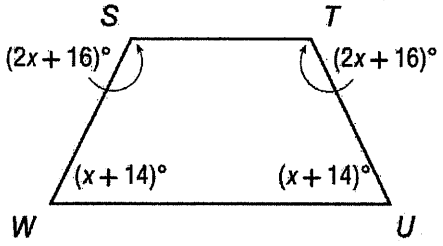

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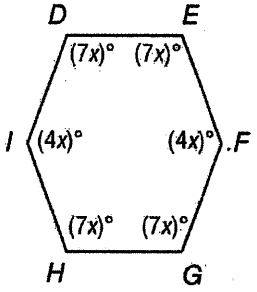

Find the measures of each interior angle of each regular polygon.

11. quadrilateral **12.** pentagon **13.** Dodecagon

Find the measures of each exterior angle of each regular polygon.

14. octagon **15.** nonagon **16.** 12-gon

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Key

Essential Questions: How do we classify polygons?
What are the steps to finding the measure of interior and exterior angles of a polygon?

A polygon is a plane figure that meets the following conditions:

a. formed by 3 or more segments called sides such that no 2 sides with a common endpt are collinear (not along same line)

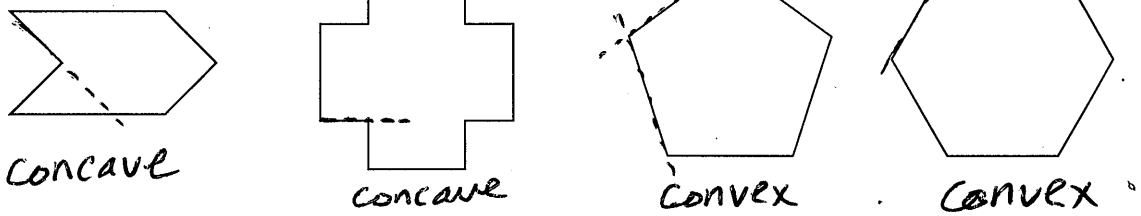
b. each side intersects exactly 2 other sides, one at each endpoint.

Vertex- endpoint of a side

Concave polygon- not convex - a line containing a side contains a point in the interior

Convex polygon- no line that contains a side contains a point in the interior of the polygon.

Examples: Which polygons are convex/concave:



concave concave convex convex

Equilateral polygon- all sides are congruent

Equiangular polygon- all angles are congruent

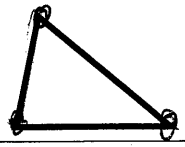
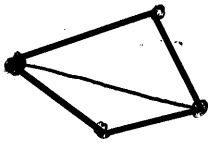
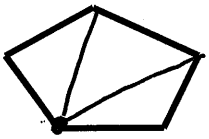
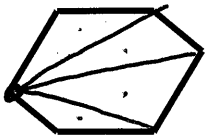
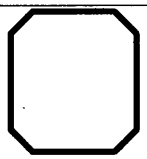
Regular polygon- all sides are congruent ($\cong$) and all angles congruent ($\angle$'s $\cong$)

Fill in the chart below.

Number of Sides	Name of Polygon	Number of Sides	Name of Polygon
3	triangle	8	Octagon
4	Quadrilateral	9	nonagon
5	Pentagon	10	Decagon
6	hexagon	12	dodecagon
7	Heptagon	n	n-gon

Recall: The three angles of a triangle add to be 180°

Diagonal-

Polygon	Diagram	Number of Sides	Number of Triangles Made from Diagonals	Sum of the measures of the Interior Angles
Triangle		3	1	180°
Quadrilateral		4	2	360°
Pentagon		5	3	540°
Hexagon		6	4	720°
Octagon		8	6	1080°
n-gon		n	n-2	180(n-2)

If a polygon has *n* sides, how many triangles can be drawn inside it using diagonals drawn from one vertex? n-2

If a polygon has *n* sides, what is the **sum of the measures of its interior angles?**

180(n-2)

Examples: Find the sum of the measures of the interior angles of a ...

a. ... Nonagon n = 9 **b.** ... 14-gon n = 14 **c.** ... 37-gon

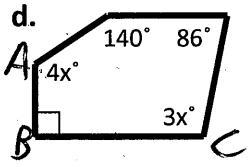
180(n-2)

180(9-2) = 1260° 180(12) = 2160° 180(35)

6360°

Find the value of x.

d.



n = 5

180(n-2)

180(3) = 540°

$\angle A = 4(32) = 128°$

$\angle C = 3(32) = 96°$

$7x + 140° + 86 + 90 = 540$

$7x + 316 = 540$

$7x = 224$

$x = 32$

Examples: The sum of the measures of the interior angles of a polygon is given. Classify the polygon by the number of sides.

e. 900°

$Sum = 180(n-2)$

$\frac{900}{180} = \frac{180(n-2)}{180}$

$5 = n-2$

$+2 \quad +2$

$7 = n$

$\frac{900}{7} \quad 128.57$

Examples: Find the measure of one interior angle of each regular polygon. One angle = $\frac{180(n-2)}{n}$

h. hexagon $n=6$

$\frac{180(6-2)}{6} = 120°$

i. octagon $n=8$

$\frac{180(8-2)}{8} = 135°$

j. 20-gon

$\frac{180(18)}{20} = 162°$

Example: One interior angle of a regular polygon is given. Find the number of sides.

f. 108° $\frac{108}{1} = \frac{180(n-2)}{n}$

$108n = 180(n-2)$

$108n = 180n - 360$ ~~$-120°$~~

$-180n \quad -180n$

$-72n = -360$

$\frac{-72n}{-72} = \frac{-360}{-72}$

$n = 5$

The **exterior angles** of a polygon can be dilated together to all fit around a single point, no matter how many sides the polygon has.

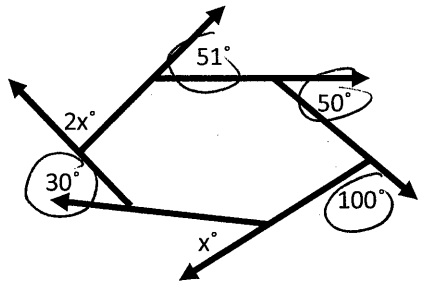
http://www.geogebra.org/material/simple/id/152420

If a polygon has *n* sides, what is the **sum of the measures of the exterior angles?**

$Sum = 360°$

Examples: $Sum = 360$

k.



$3x + 30 + 51 + 50 + 100 = 360$

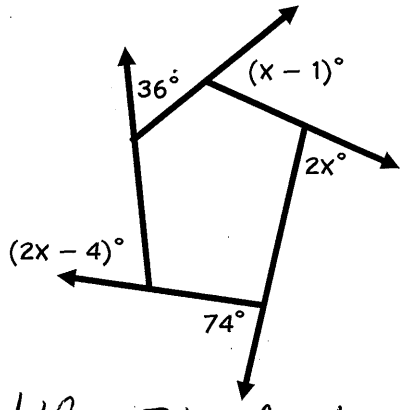
$3x + 231 = 360$

$-231 \quad -231$

$3x = 129$

$x = 43$

l.



$36 + x - 1 + 2x + 74 + 2x - 4 = 360$

$5x + 105 = 360$

$5x = 255$

$x = 51$

Examples: Find the measure of one exterior angle of each regular polygon. One angle = $\frac{360}{n}$

m. heptagon $n=7$

$\frac{360}{7} = 51.429°$

n. decagon $n=10$

$\frac{360}{10} = 36°$

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6-1 Skills Practice

Angles of Polygons

Find the sum of the measures of the interior angles of each convex polygon.

1. nonagon $7 \cdot 180$ 1260°

2. heptagon $5 \cdot 180$ 900°

3. decagon $8 \cdot 180$ 1440°

The measure of an interior angle of a regular polygon is given. Find the number of sides in the polygon. $\frac{180(n-2)}{n}$

4. 108 $\frac{108}{1} = \frac{180(n-2)}{n}$

$108n = 180n - 360$

$-72n = -360$ $n = 5$

5. 120 $\frac{120}{1} = \frac{180(n-2)}{n}$

$120n = 180n - 360$

$-60n = -360$

$n = 6$

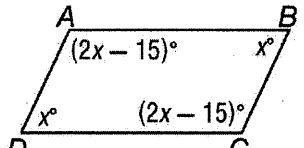
6. 150 $\frac{150}{1} = \frac{180(n-2)}{n}$

$150n = 180n - 360$

$-30n = -360$ $n = 12$

Find the measure of each interior angle.

7.



$4x - 30 + 2x = 360$

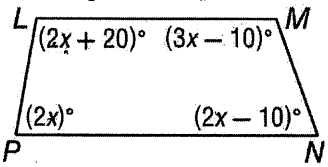
$6x = 390$

$x = 65$

$\angle A = 115^\circ$ $\angle B = 65^\circ$

$\angle D = 65^\circ$ $\angle C = 115^\circ$

8. Total: 360°



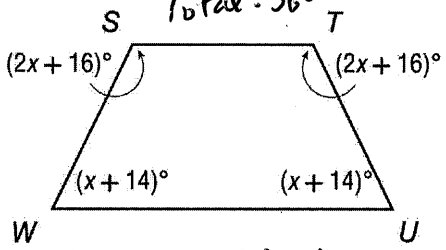
$9x = 360$

$x = 40$

$\angle L = 100^\circ$ $\angle M = 110^\circ$

$\angle P = 80^\circ$ $\angle N = 70^\circ$

9. Total: 360°



$6x + 60 = 360$

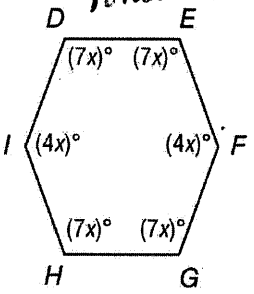
$6x = 300$

$x = 50$

$\angle S = 116^\circ$ $\angle T = 116^\circ$

$\angle W = 64^\circ$ $\angle U = 64^\circ$

10. Total: 720°



$36x = 720$ $x = 20$

$\angle D = 140^\circ$ $\angle E = 140^\circ$

$\angle I = 80^\circ$ $\angle F = 80^\circ$

$\angle H = 140^\circ$ $\angle G = 140^\circ$

Find the measures of each interior angle of each regular polygon. $\frac{180(n-2)}{n}$

11. quadrilateral $n = 4$ $\frac{360}{4} = 90^\circ$

12. pentagon $n = 5$ $\frac{540}{5} = 108^\circ$

13. Dodecagon $n = 12$ $\frac{180 \cdot 10}{12} = 150^\circ$

Find the measures of each exterior angle of each regular polygon. $\frac{360}{n}$

14. octagon $\frac{360}{8} = 45^\circ$

15. nonagon $\frac{360}{9} = 40^\circ$

16. 12-gon $\frac{360}{12} = 30^\circ$