

Classifying Polygons Guide Notes

A **polygon** is a closed figure made of line segments. Polygons have at least three angles and at least three line segments.

A polygon is named by the number of sides it has.

Number of Sides	Name of Polygon
3	Triangle
4	Quadrilateral
5	Pentagon
6	Hexagon
7	Heptagon

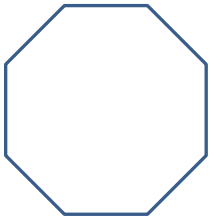
Number of Sides	Name of Polygon
8	Octagon
9	Nonagon
10	Decagon
12	Dodecagon
<i>n</i>	<i>n</i> -gon

A polygon is **convex** if no line that contains a side of the polygon contains a point in the interior of the polygon. Every interior angle in a convex polygon is less than 180° .

A polygon that is not convex is called **non convex** or **concave**.

Sample Problem 1: Tell whether the figure is a polygon and whether it is convex or concave.

a.



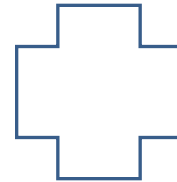
The figure is a **convex polygon**.

b.



Part of the figure is not a segment, so it is **not a polygon**.

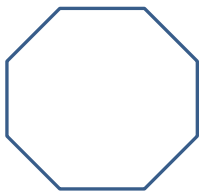
c.



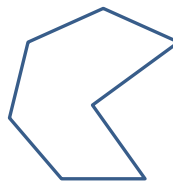
The figure is a **concave polygon**.

Sample Problem 2: Draw a figure that fits the description.

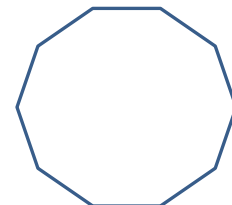
a. Convex octagon



b. Concave heptagon



c. Convex decagon



In an **equilateral polygon**, all sides are congruent.

In an **equiangular polygon**, all angles in the interior of the polygon are congruent.

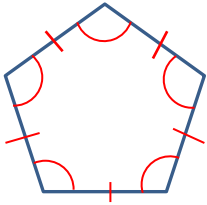
A **regular polygon** is a convex polygon that is both equilateral and equiangular.

Irregular polygon is one that does not have all sides equal and all angles equal.

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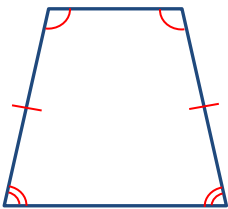
Sample Problem 3: Classify the polygon by the number of sides. Tell whether the polygon is equilateral, equiangular, or regular.

a.



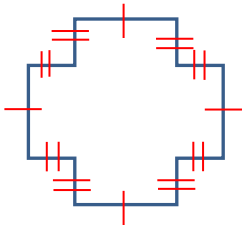
The polygon has 5 sides.
It is equilateral and equiangular.
Regular pentagon

b.



The polygon has 4 sides, so it is a quadrilateral.
It is not equilateral or equiangular, so it is not regular.
Irregular quadrilateral (Isosceles trapezoid)

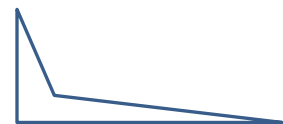
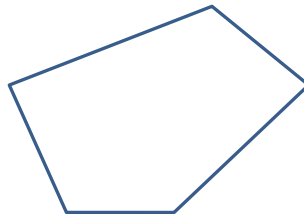
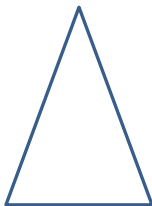
c.



The polygon has 12 sides, so it is a dodecagon.
The sides are not congruent, so it is not equilateral.
The interior angles are not congruent so it is not equiangular.
Irregular dodecagon

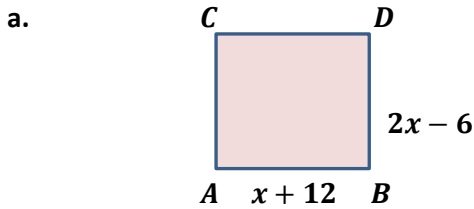
Sample Problem 4: Draw a figure that fits the description.

- a. A triangle that is not regular. b. A pentagon that is not regular. c. A concave quadrilateral.



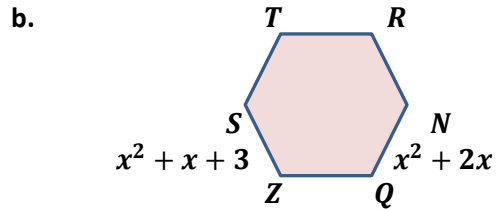
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Sample Problem 5: Each figure is a regular polygon. Expressions are given for two side lengths. Find the value of x .



$$\begin{aligned} \overline{AB} &= x + 12 \\ \overline{BD} &= 2x - 6 \\ \overline{AB} &= \overline{BD} \\ x + 12 &= 2x - 6 \\ x + 12 - x &= 2x - 6 - x \\ 12 &= x - 6 \\ 12 + 6 &= x - 6 + 6 \\ \mathbf{x} &= \mathbf{18} \end{aligned}$$

$$\begin{aligned} \overline{AB} &= x + 12 & \overline{BD} &= 2x - 6 \\ \overline{AB} &= 18 + 12 & \overline{BD} &= 2 * 18 - 6 \\ \mathbf{\overline{AB}} &= \mathbf{30} & \mathbf{\overline{BD}} &= \mathbf{36 - 6} \\ & & \mathbf{\overline{BD}} &= \mathbf{30} \end{aligned}$$



$$\begin{aligned} \overline{ZS} &= x^2 + x + 3 \\ \overline{QN} &= x^2 + 2x \\ \overline{ZS} &= \overline{QN} \\ x^2 + x + 3 &= x^2 + 2x \\ x^2 + x + 3 - x^2 &= x^2 + 2x - x^2 \\ x + 3 &= 2x \\ x + 3 - x &= 2x - x \\ \mathbf{x} &= \mathbf{3} \end{aligned}$$

$$\begin{aligned} \overline{ZS} &= x^2 + x + 3 & \overline{QN} &= x^2 + 2x \\ \overline{ZS} &= 3^2 + 3 + 3 & \overline{QN} &= 3^2 + 2 * 3 \\ \mathbf{\overline{ZS}} &= \mathbf{15} & \mathbf{\overline{QN}} &= \mathbf{15} \end{aligned}$$