**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** |  | **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 |

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.** |  | **b.**  |  | **c.** |  |
|  | The figure is a convex polygon. |  | Part of the figure is not a segment, so it is not a polygon. |  | 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.

**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.** |
|  |  |  |  |  |  |

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

|  |  |  |  |
| --- | --- | --- | --- |
| **a.** | $$ C D$$$$ 2x-6 $$$$ A x+12 B$$ | **b.** | $$ T R$$$$ S N $$$$ x^{2}+x+3 x^{2}+2x $$$$ Z Q $$ |
|  | $$\overbar{AB}=x+12$$$$\overbar{BD}=2x-6$$$$\overbar{AB}=\overbar{BD}$$$$x+12=2x-6$$$$x+12-x=2x-6-x$$$$12=x-6$$$$12+6=x-6+6$$$$x=18$$$$\overbar{AB}=x+12 \overbar{BD}=2x-6$$$$\overbar{AB}=18+12 \overbar{BD}=2\*18-6 $$$$\overbar{AB}=30 \overbar{BD}=36-6 $$$$ \overbar{BD}=30$$ |  | $$\overbar{ZS}=x^{2}+x+3$$$$\overbar{QN}=x^{2}+2x$$$$\overbar{ZS}=\overbar{QN}$$$$x^{2}+x+3=x^{2}+2x$$$$x^{2}+x+3-x^{2}=x^{2}+2x-x^{2}$$$$x+3=2x$$$$x+3-x=2x-x$$$$x=3$$$$\overbar{ZS}=x^{2}+x+3 \overbar{QN}=x^{2}+2x$$$$\overbar{ZS}=3^{2}+3+3 \overbar{QN}=3^{2}+2\*3 $$$$\overbar{ZS}=15 \overbar{QN}=15 $$$$ $$ |