Points, Lines, and Planes

Point: A point in geometry is a location. It has no size i.e. no width, no length and no depth. A point is shown by a dot.

Line: A line of points that extends infinitely in two directions. It has one dimension, length. Points that are on the same line are called collinear points.

A line is defined by two points and is written as shown below with an arrowhead.

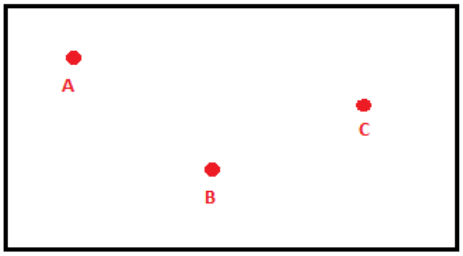
$$\overleftrightarrow{AB}$$

Two lines that meet in a point are called intersecting lines.

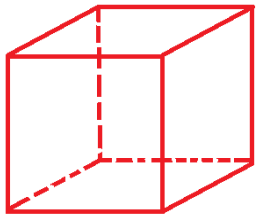
A part of a line that has defined endpoints is called a line segment. A line segment as the segment between A and B above is written as:

$$\overline{AB}$$

Plane: A plane extends infinitely in two dimensions. It has no thickness. An example of a plane is a coordinate plane. A plane is named by three points in the plane that are not on the same line. Here below we see the plane ABC.



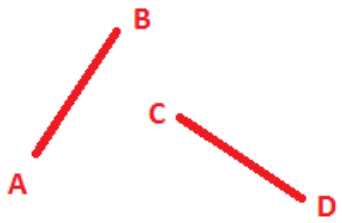
A space extends infinitely in all directions and is a set of all points in three dimensions. You can think of a space as the inside of a box.



The length of a line segment can be measured (unlike a line) because it has two endpoints.

While the length or the measure is simply written AB. The length could either be determined in Metric units (e.g. millimeters, centimeters or meters) or Customary units (e.g. inches or foot).

Two lines could have the same measure but still not be identical.



AB and CD have the exact same measure and are said to be congruent and is noted as

$$\overline{AB} \cong \overline{CD}$$

This is read as the line AB is congruent to the line CD.

If we want to find the distance between two points on a number line we use the distance formula:

$$AB = |b-a| \text{ or } |a-b|$$

Example

Point A is on the coordinate 4 and point B is on the coordinate -1.

$$AB=|4-(-1)|=|4+1|=|5|=5$$

If we want to find the distance between two points in a coordinate plane we use a different formula that is based on the Pythagorean Theorem where (x_1,y_1) and (x_2,y_2) are the coordinates and d marks the distance:

$$d = \sqrt{(x2 - x1) + (y2 - y1)}$$

The point that is exactly in the middle between two points is called the midpoint and is found by using one of the two following equations.

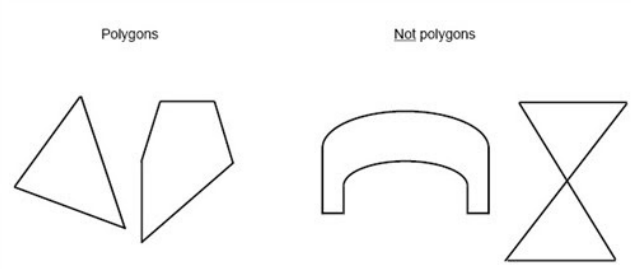
Method 1: For a number line with the coordinates a and b as endpoints:

$$midpoint = a + b / 2$$

Method 2: If we are working in a coordinate plane where the endpoints has the coordinates (x_1,y_1) and (x_2,y_2) then the midpoint coordinates is found by using the following formula:

$$midpoint = ([x1 + x2 / 2] , [y1 + y2 / 2]$$

Polygon: A polygon is a closed figure where the sides are all line segments. Each side must intersect exactly two others sides but only at their endpoints. The sides must be noncollinear and have a common endpoint.



A polygon is usually named after how many sides it has, a polygon with n-sides is called a n-gon. E.g. The building which houses the United States Department of Defense is called pentagon since it has 5 sides.

Sides	Polygon
3	triangle
4	quadrilateral
5	pentagon
6	hexagon
7	heptagon
9	nonagon
10	decagon

A regular polygon is a polygon in which all sides are congruent and all the angles are congruent.