Midpoint and Distance in the Coordinate Plane

UNIT 1 LESSON 7

Midpoint and Distance in the Coordinate Plane

Students will be able to:

find the midpoint of any line segment and the distance between two points on a coordinate plane.

Key Vocabulary

- Midpoint
- Line segment, number line and coordinate plane
- Distance formula

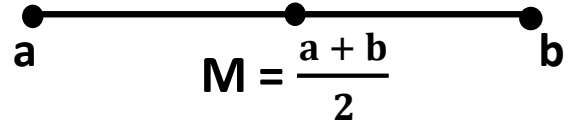# Midpoint and Distance in the Coordinate Plane

The **midpoint** refers to the center of a line segment or two points and divides them equally into two parts.

- A **line segment** refers to a set of points having two fixed end points.
- A **number line** is a line extending from both ends without ending.
- A **coordinate plane** refers to a 2-D plane having both x-coordinates and y-coordinates.
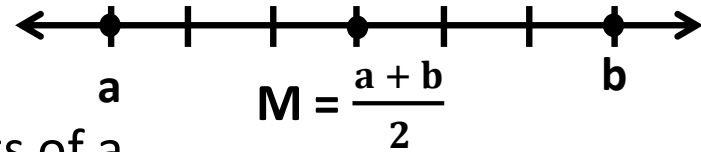
Midpoint and Distance in the Coordinate Plane

To find the **midpoint** of a line segment or a number line given the two end points, the formula is given by:

$$\text{Midpoint M} = \frac{a + b}{2}$$
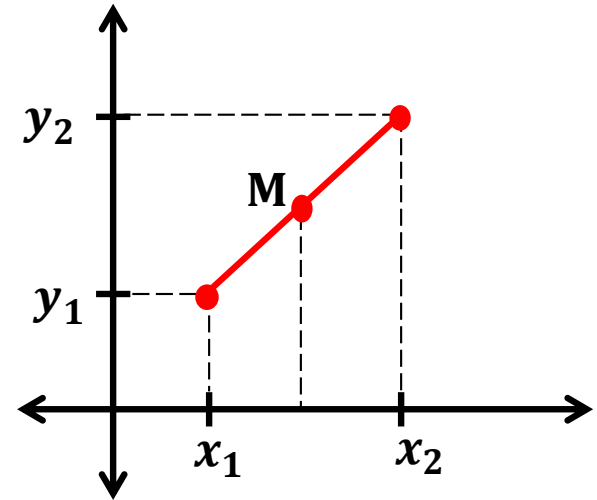

Where, **a** and **b** are two end points.

The midpoint is the **average** of the two end points of a line segment.

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To find the **midpoint** of a line segment on coordinate plane given the end points with their (x,y) coordinates:

$$\text{Midpoint M} = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$$

Where, (x_1, y_1) and (x_2, y_2) refer to the end points on the coordinate plane.

The (x,y) coordinates can be positive or negative depending on the position of the end points on the coordinate plane.

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Problem 1:

Find the midpoint of:
a) the line segment AB in figure 1.
b) the line segment PQ if P(1,3) and Q(3,3)

A = 5   B = 13

Figure 1

a)

$$\text{Midpoint M} = \frac{a+b}{2} = \frac{5+13}{2} = \frac{18}{2} = 9$$

b) $\text{Midpoint M} = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right) = \left(\frac{1+3}{2}, \frac{3+3}{2}\right) = (2, 3)$
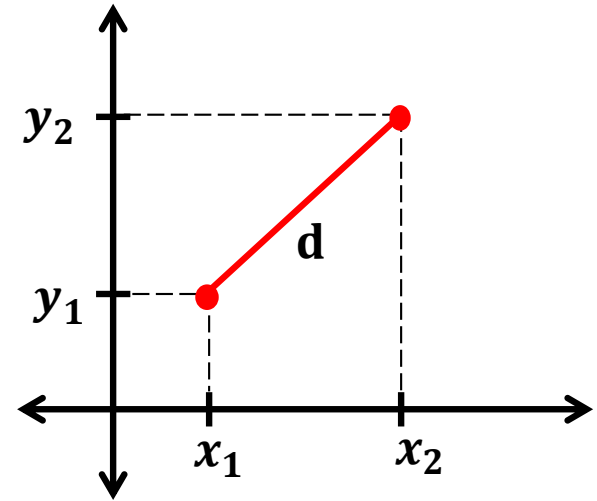
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The distance between two points tells us how much far one point is from another.

To find the **distance** of between two points on a coordinate plane given the points with their (x,y) coordinates:

$$\text{distance } \mathbf{d} = \sqrt{(\boldsymbol{x_2} - \boldsymbol{x_1})^2 + (\boldsymbol{y_2} - \boldsymbol{y_1})^2}$$

Where, (x_1, y_1) and (x_2, y_2) refer to the end points on the coordinate plane.
Note that the distance is always a positive number.

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Problem 2:

Find the distance between:
a) P(2,4) and Q(5,6).
b) X(-1,-2) and Y(-5,8)

a)

$$\text{distance } \mathbf{d} = \sqrt{(5-2)^2 + (6-4)^2} = \sqrt{13}$$

b) $\qquad \text{distance } \mathbf{d} = \sqrt{(-5+1)^2 + (8+2)^2} = \sqrt{116} = 2\sqrt{29}$