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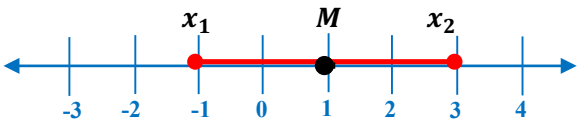
Midpoint and Distance in the Coordinate Plane Guide Notes

A midpoint of a segment is a point that divides the segment into two congruent segments.



On a number line the coordinates of the midpoint of a segment whose endpoints have coordinates x_1 and x_2 is:

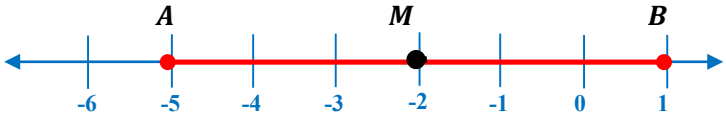
$$M = \frac{x_1 + x_2}{2}$$

Sample Problem 1: **Find the coordinate of the midpoint of the segment with the given endpoints.**

a. **Segment $\overline{AB}$**

$x_1 = -5$ $x_2 = 1$

M =?

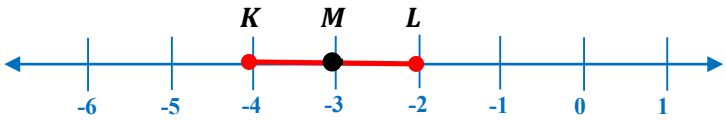


$$M = \frac{x_1 + x_2}{2}$$
$$M = \frac{-5 + 1}{2}$$
$$M = \frac{-4}{2}$$
$$M = -2$$

b. **Segment $\overline{KL}$**

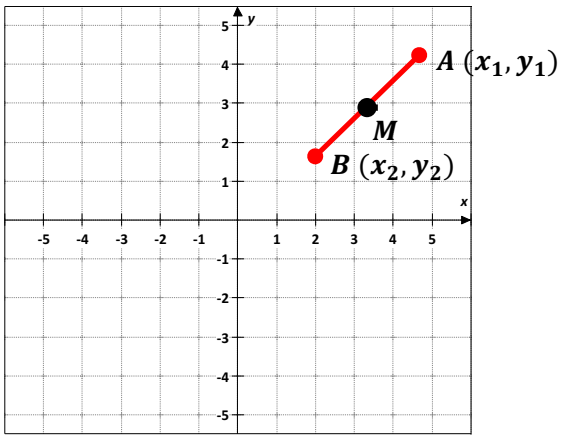
$x_1 = -4$ $x_2 = -2$

M =?



$$M = \frac{x_1 + x_2}{2}$$
$$M = \frac{-4 + (-2)}{2}$$
$$M = \frac{-6}{2}$$
$$M = -3$$

The Midpoint Formula



In a coordinate plane, the coordinates of the midpoint of segments whose endpoints have coordinates $A\ (x_1, y_1)$ and $B(x_2, y_2)$ are:

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

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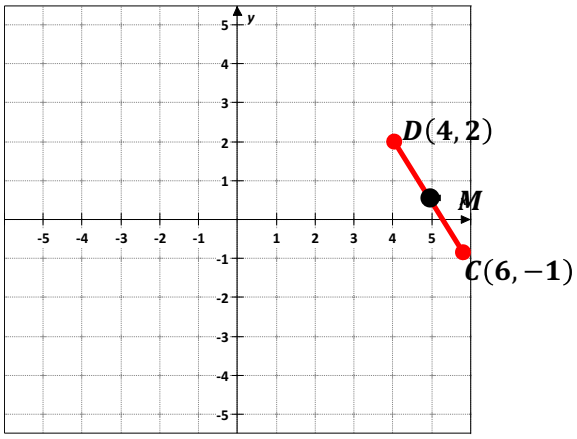
Midpoint and Distance in the Coordinate Plane Guide Notes

Sample Problem 2: Find the coordinate of the midpoint of the segment with the given endpoints.

a. **Segment $\overline{CD}$**

$C(6,-1)$ $D(4,2)$

M =?



Segment $\overline{CD}$

$C(6,-1)$ $D(4,2)$

$(x_1, y_1) = (6,-1)$ $(x_2, y_2) = (4,2)$

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

$$M = \left(\frac{6+4}{2}, \frac{-1+2}{2}\right)$$

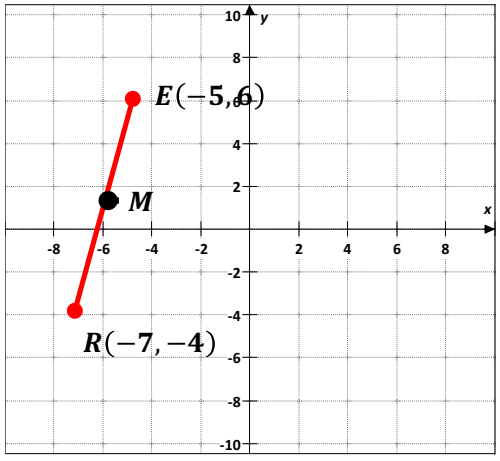
$$M = \left(\frac{10}{2}, \frac{1}{2}\right)$$

$$M = \left(5, \frac{1}{2}\right)$$

b. **Segment $\overline{ER}$**

$E(-5,6)$ $R(-7,-4)$

M =?



Segment $\overline{ER}$

$E(-5,6)$ $R(-7,-4)$

$(x_1, y_1) = (-5,6)$ $(x_2, y_2) = (-7,-4)$

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

$$M = \left(\frac{-5+(-7)}{2}, \frac{6+(-4)}{2}\right)$$

$$M = \left(\frac{-12}{2}, \frac{2}{2}\right)$$

$$M = (-6,1)$$

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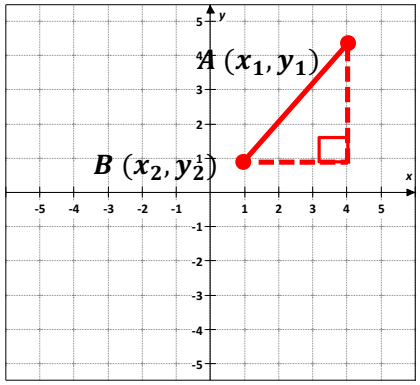
Midpoint and Distance in the Coordinate Plane Guide Notes

The Distance Formula



To calculate the distance d between points $A\ (x_1, y_1)$ and $B\ (x_2, y_2)$ use the formula:

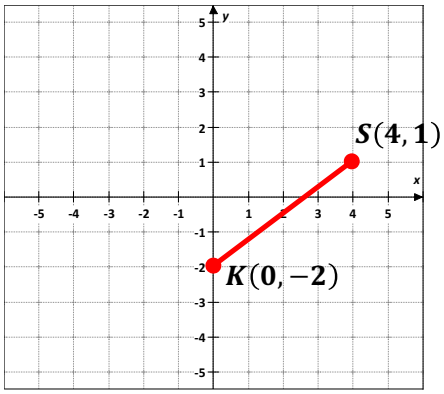
$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

The Distance Formula is based on the Pythagorean Theorem.

Sample Problem 3: Find the distance between each pair of points. Round to the nearest tenth.

a. $S(4, 1)$ $K(0, -2)$

$d(S, K) = ?$



$S(4, 1)$ $K(0, -2)$

$(x_1, y_1) = (4, 1)$ $(x_2, y_2) = (0, -2)$

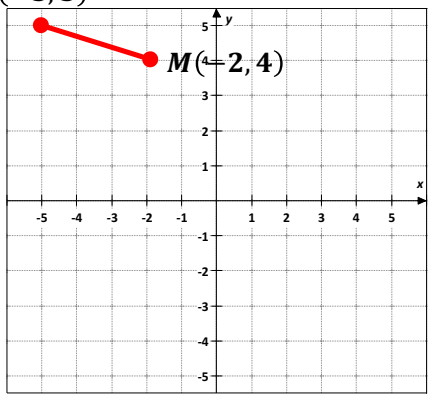
$d(S, K) = ?$

$$d(S, K) = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$
$$d(S, K) = \sqrt{(0 - 4)^2 + (-2 - 1)^2}$$
$$d(S, K) = \sqrt{(-4)^2 + (-3)^2}$$
$$d(S, K) = \sqrt{16 + 9}$$
$$d(S, K) = \sqrt{25}$$
$$d(S, K) = 5$$

b. $L(-5, 5)$ $M(-2, 4)$

$d(L, M) = ?$

$L(-5, 5)$



$L(-5, 5)$ $M(-2, 4)$

$(x_1, y_1) = (-5, 5)$ $(x_2, y_2) = (-2, 4)$

$d(L, M) = ?$

$$d(L, M) = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$
$$d(L, M) = \sqrt{(-2 - (-5))^2 + (4 - 5)^2}$$
$$d(L, M) = \sqrt{(-2 + 5)^2 + (-1)^2}$$
$$d(L, M) = \sqrt{(3)^2 + (-1)^2}$$
$$d(L, M) = \sqrt{9 + 1}$$
$$d(L, M) = \sqrt{10}$$
$$d(L, M) \approx 3,2$$

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Midpoint and Distance in the Coordinate Plane Guide Notes

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