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Midpoint and Distance in the Coordinate Plane

Unit 1 Lesson 7

Students will be able to:

Calculate midpoint and distance from two endpoints of a line segment both on and off of the coordinate plane.

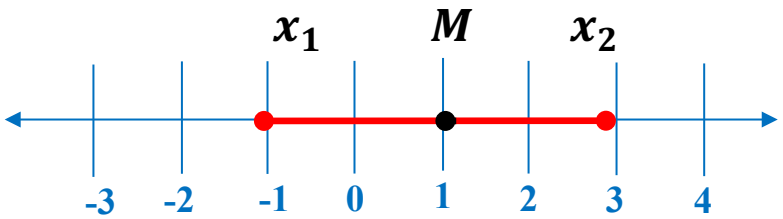
Key Vocabulary:

Midpoint

Distance

Coordinate Plane

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



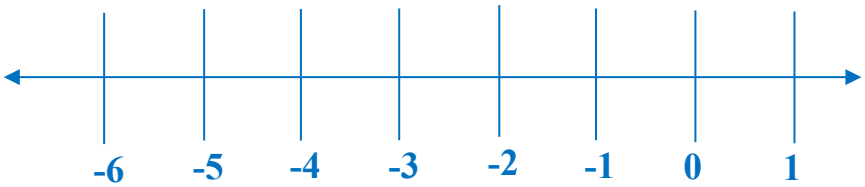
On a number line the coordinates of the midpoint of a segment whose endpoints have coordinates x_1 and x_2 is:

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

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

a. Segment $\overline{AB}$

$x_1 = -5$ $x_2 = 1$ $M = ?$



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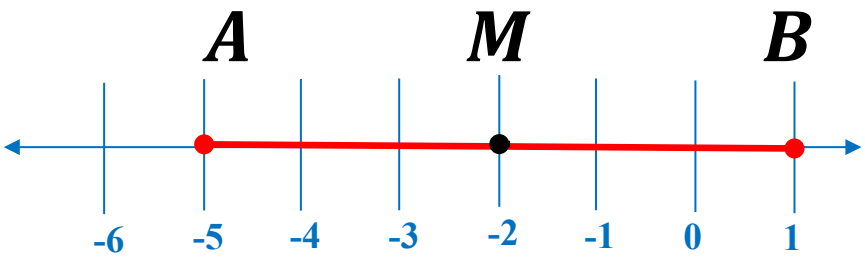


$$M = \frac{x_1 + x_2}{2}$$

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

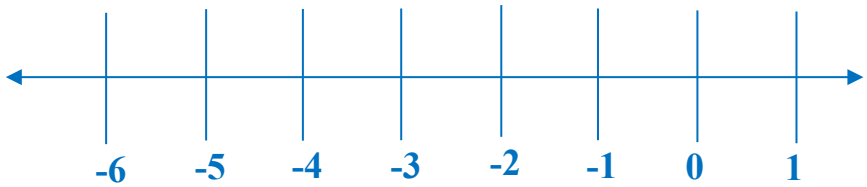
$$M = \frac{-4}{2}$$

$$M = -2$$

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

b. Segment $\overline{KL}$

$x_1 = -4$ $x_2 = -2$ $M = ?$



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

b. Segment $\overline{KL}$

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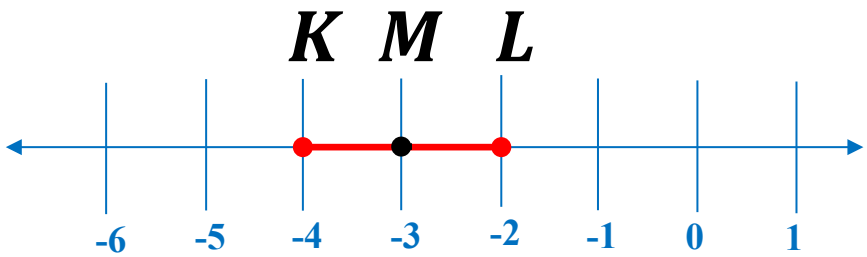


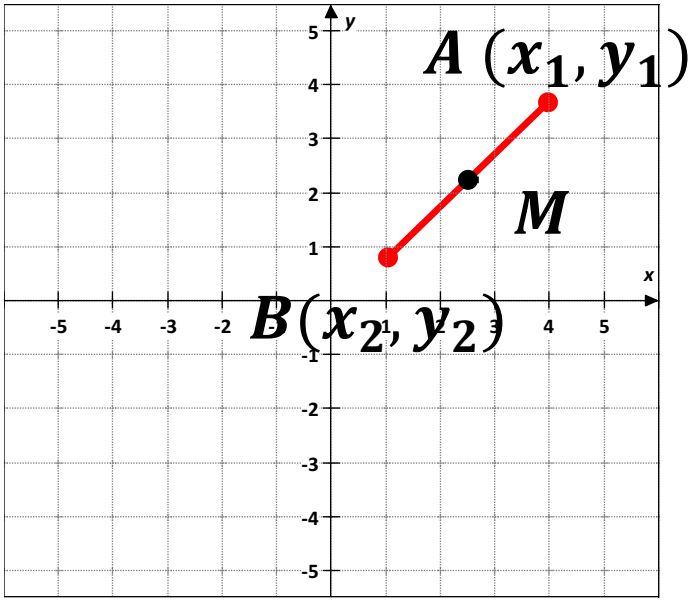
$$M = \frac{x_1 + x_2}{2}$$

$$M = \frac{-4 + (-2)}{2}$$

$$M = \frac{-6}{2}$$

$$M = -3$$

The Midpoint Formula

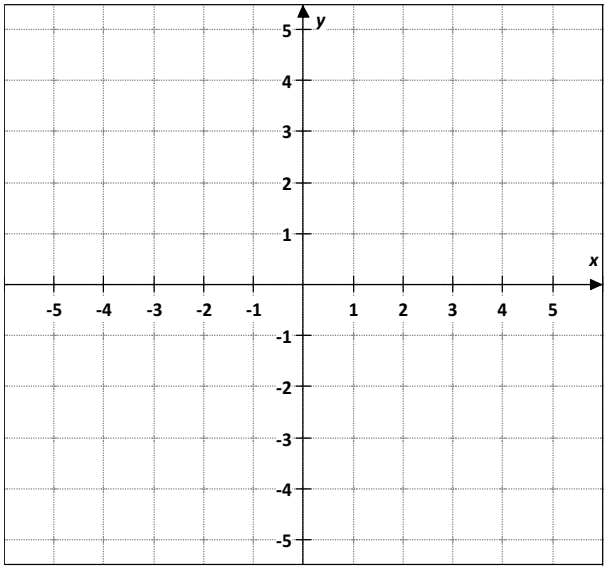


In a coordinate plane, the coordinates of the midpoint of segments whose endpoints have coordinates $A\ (x_1, y_1)$ and $B(x_2, y_2)$ are:

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

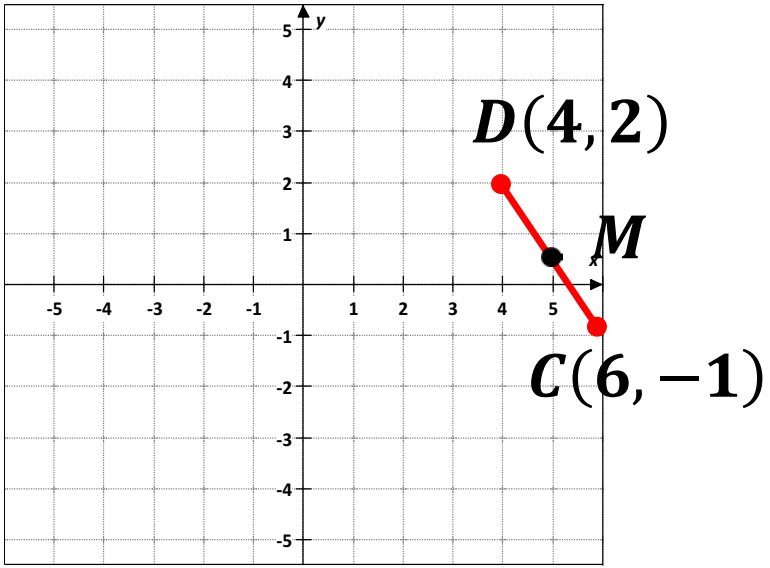
Sample Problem 2: **Find the coordinate of the midpoint of the segment with the given endpoints.**

a. Segment $\overline{CD}$ $C(6, -1)$ $D(4, 2)$ $M = ?$



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

a. Segment $\overline{CD}$



$C(6,-1)$ $D(4,2)$ $M=?$

(x_1,y_1) (x_2,y_2)

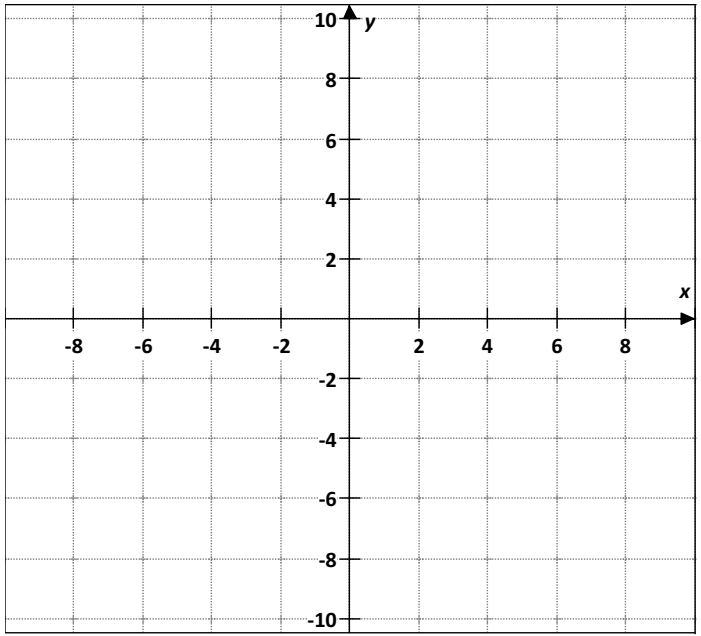
$$M=\left(\frac{x_1+x_2}{2},\frac{y_1+y_2}{2}\right)$$

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

$$M=\left(\frac{10}{2},\frac{1}{2}\right) \qquad M=\left(5,\frac{1}{2}\right)$$

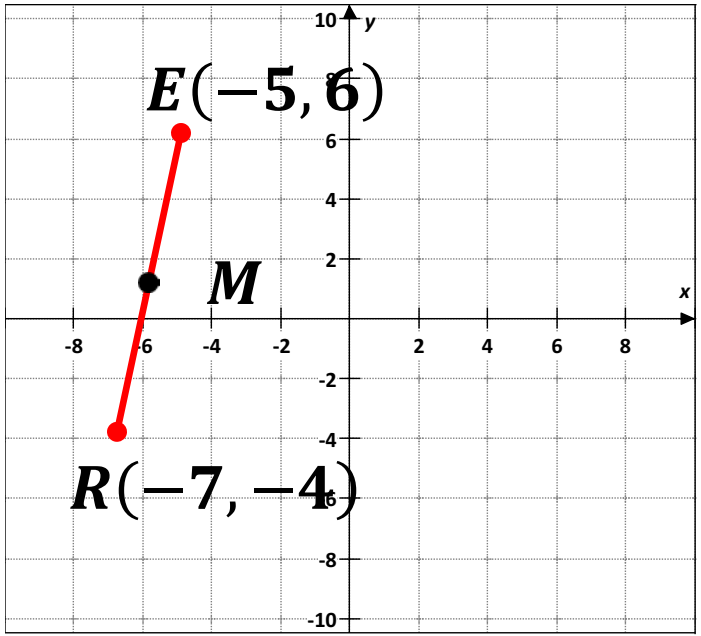
Sample Problem 2: Find the coordinate of the midpoint of the segment with the given endpoints.

b. Segment $\overline{ER}$ $E(-5, 6)$ $R(-7, -4)$ $M = ?$



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

b. Segment $\overline{ER}$



$E(-5, 6)$ $R(-7, -4)$ $M = ?$

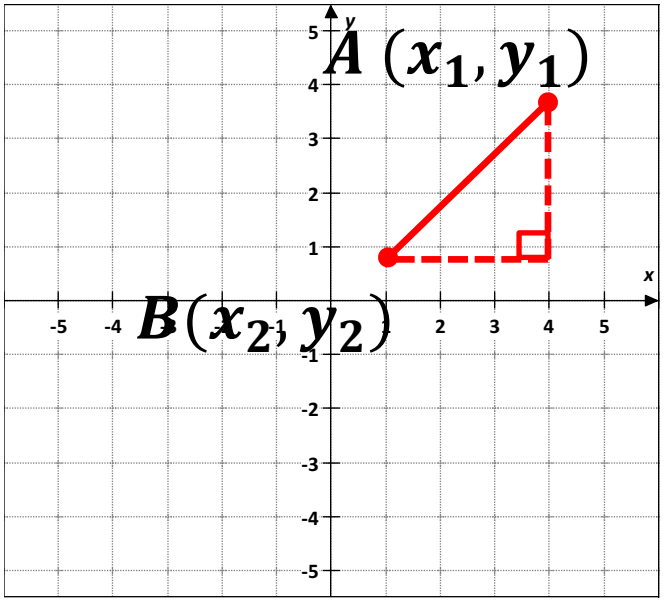
(x_1, y_1) (x_2, y_2)

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

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

$$M = \left(\frac{-12}{2}, \frac{2}{2}\right) \qquad M = (-6, 1)$$

The Distance Formula



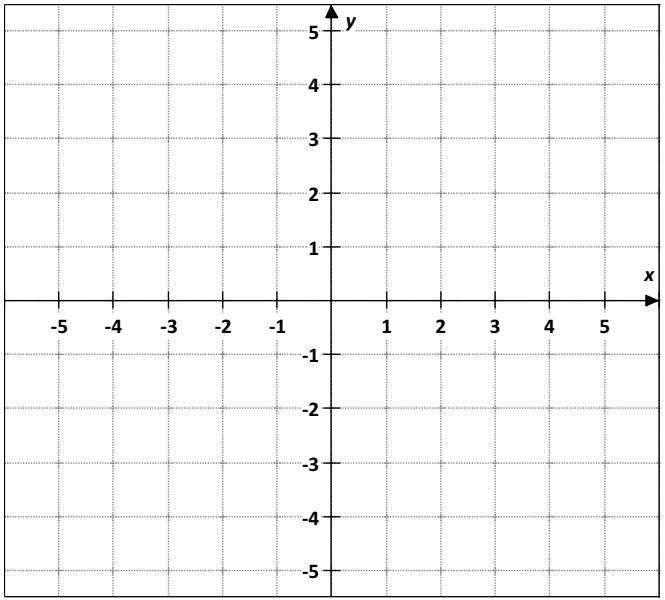
To calculate the distance $\boldsymbol{d}$ between points $\boldsymbol{A\ (x_1, y_1)}$ and $\boldsymbol{B(x_2, y_2)}$ use the formula:

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

The Distance Formula is based on the Pythagorean Theorem.

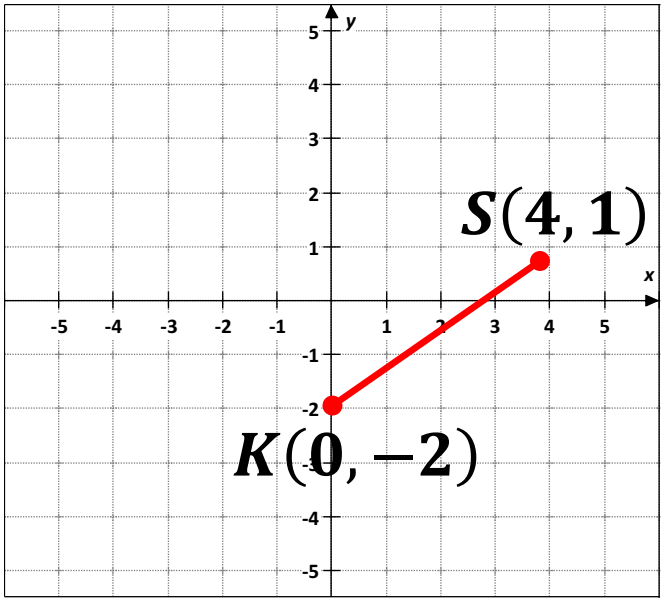
Sample Problem 3: Find the distance between each pair of points. Round to the nearest tenth.

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



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

a. $S(4,1)$ (x_1, y_1) $K(0,-2)$ (x_2, y_2) $d(S,K) = ?$



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

$$d(S,K) = \sqrt{(0-4)^2 + (-2-1)^2}$$

$$d(S,K) = \sqrt{(-4)^2 + (-3)^2}$$

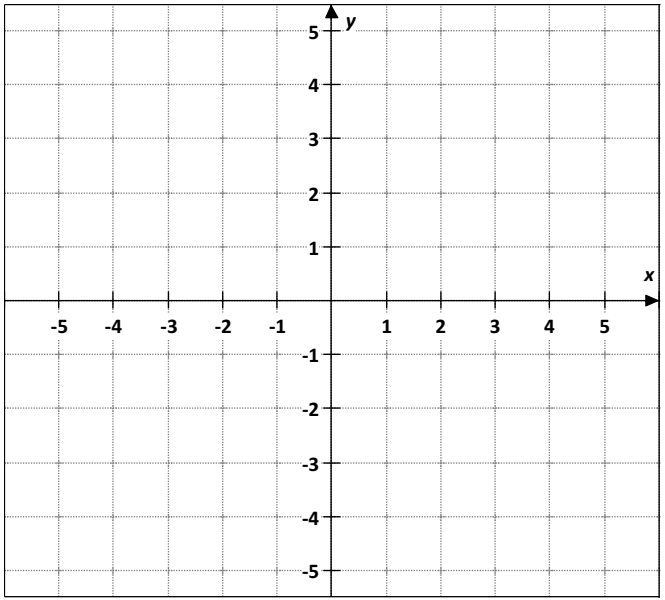
$$d(S,K) = \sqrt{16+9}$$

$$d(S,K) = \sqrt{25}$$

$$d(S,K) = 5$$

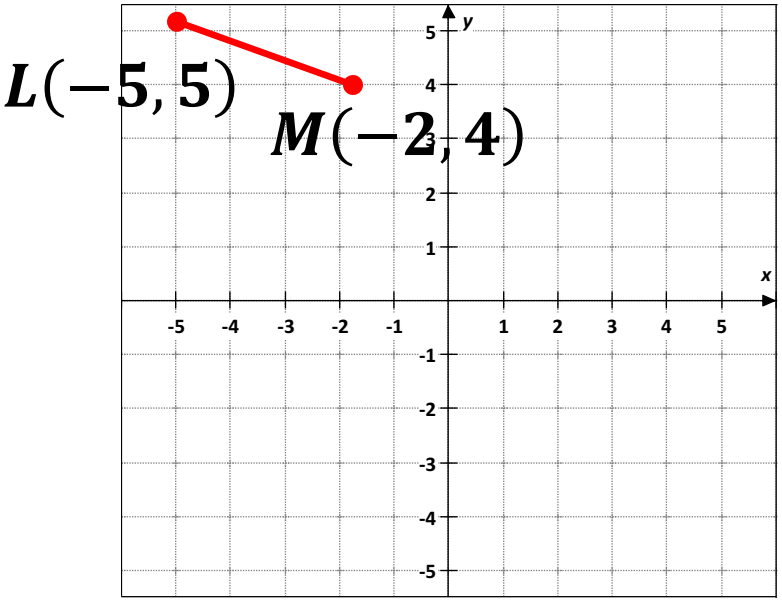
Sample Problem 3: **Find the distance between each pair of points. Round to the nearest tenth.**

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



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

b. $L(-5,5)$ (x_1,y_1) $M(-2,4)$ (x_2,y_2) $d(L,M)=?$



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

$$d(L,M)=\sqrt{(-2-(-5))^2+(4-5)^2}$$

$$d(L,M)=\sqrt{(-2+5)^2+(-1)^2}$$

$$d(L,M)=\sqrt{(3)^2+(-1)^2}$$

$$d(L,M)=\sqrt{9+1}$$

$$d(L,M)=\sqrt{10}\approx 3.2$$