Midpoint and Distance in the Coordinate Plane
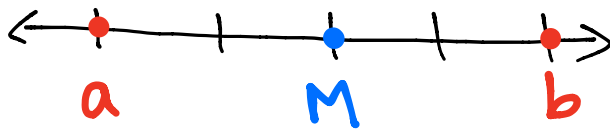
Goal: You can use formulas to find the midpoint and length of any segment in the coordinate plane.

Finding the Midpoint of a Segment on a Number Line

On a number line, the midpoint of a segment is just the average (or mean) of its endpoints.
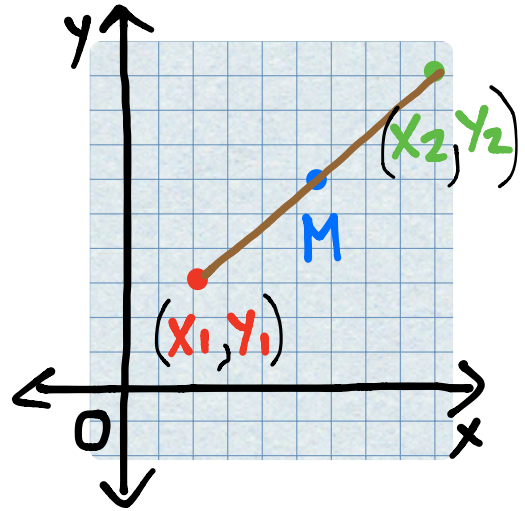
$$M = \frac{a+b}{2}$$

Finding the Midpoint of a Segment in the Coordinate Plane:

In the coordinate plane, you average the x-values of the end points to get the new x-value of the midpoint, and then you average the y-values of the endpoints to get the new y-value for the midpoint.

"Midpoint Formula"

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

Ex 1a) $\overline{AB}$ has endpoints as shown. What is the coordinate of the midpoint?
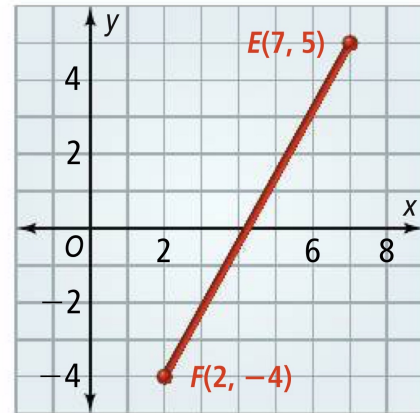

$$M = \frac{a + b}{2}$$

Ex 1b) $\overline{JK}$ has endpoints at -12 and 4 on a number line. What is the coordinate of its midpoint?
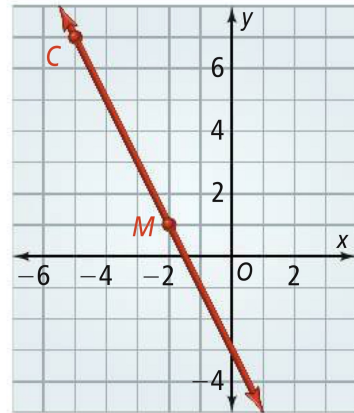
Ex 2a) $\overline{EF}$ has endpoints $E(7,5)$ and $F(2,-4)$.
What are the coordinates of midpoint M?

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

Ex 2b) What is the midpoint of $\overline{RS}$ with endpoints
$R(5,-10)$ and $S(3,6)$?

Ex 3a) The midpoint of $\overline{CD}$ is $M(-2,1)$. One endpoint is $C(-5,7)$. What are the coordinates of the other endpoint D?

Ex 3b) The midpoint of $\overline{AB}$ has coordinates $(4,-9)$. Endpoint A has coordinates $(-3,-5)$. What are the coordinates of B?
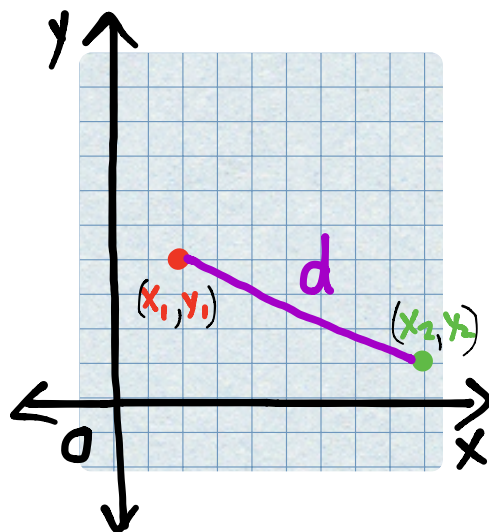
Finding the Length of a Segment in the Coordinate Plane:

To find the length of a segment in the coordinate plane, you must find the distance between the two points. To do this we use the "Distance Formula." The Distance Formula is derived from using the Pythagorean Theorem $(a^2 + b^2 = c^2)$ on the coordinate plane.

"Distance Formula"

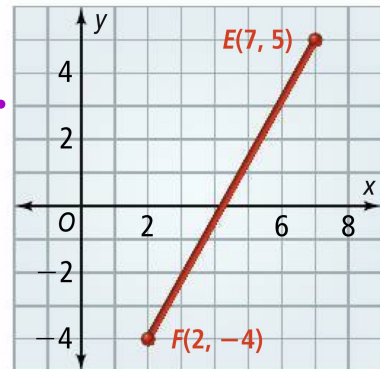$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

★ Need to memorize for MCAS ★

Ex 4a) What is the distance between
N(-7,5) and V(4,-3)? Round to the
nearest tenth.

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

Ex 4b) What is FE? Use graph shown.
Round your answer
to the nearest tenth.

E(7, 5)

F(2, −4)

Ex 4c) Would you get the same result for distance if you switched the order of the points in example 4b and found EF? Explain.

Ex 5) On a zip-line course, you are harnessed to a cable that travels through the treetops. You start at Platform A and zip to each of the other platforms. Each grid unit represents 5 meters.
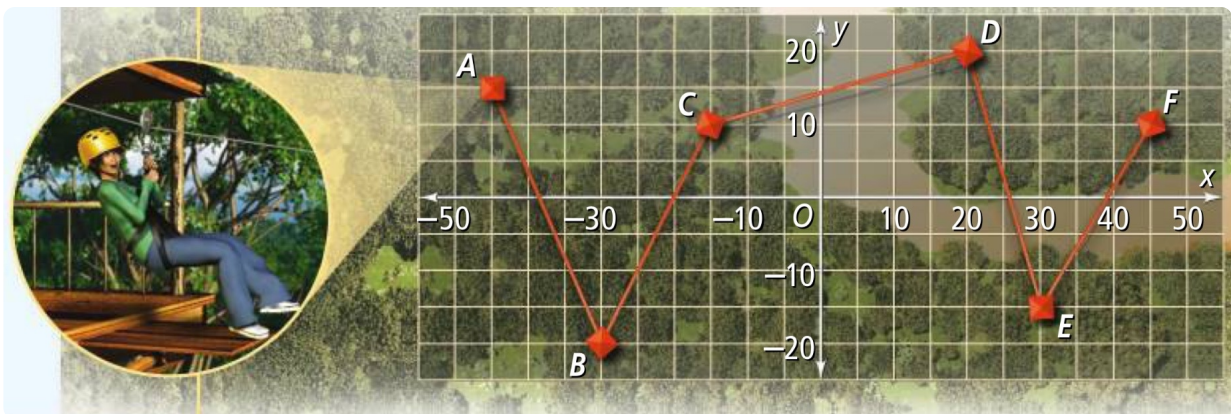
a) How far do you have to travel from Platform B to Platform C? Round your answer to the nearest hundredth.

b) How far do you have to travel from Platform D to Platform E? Round your answer to the nearest hundredth.

Lesson Check

Lesson Check

Do you know HOW?

1. $\overline{RS}$ has endpoints $R(2, 4)$ and $S(-1, 7)$. What are the coordinates of its midpoint M?

2. The midpoint of $\overline{BC}$ is $(5, -2)$. One endpoint is $B(3, 4)$. What are the coordinates of endpoint C?

3. What is the distance between points $K(-9, 8)$ and $L(-6, 0)$?

Do you UNDERSTAND? MATHEMATICAL PRACTICES

4. **Reasoning** How does the Distance Formula ensure that the distance between two different points is positive?

5. **Error Analysis** Your friend calculates the distance between points $Q(1, 5)$ and $R(3, 8)$. What is his error?

$$d = \sqrt{(1 - 8)^2 + (5 - 3)^2}$$
$$= \sqrt{(-7)^2 + 2^2}$$
$$= \sqrt{49 + 4}$$
$$= \sqrt{53} \approx 7.3$$

Homework:

Textbook

p. 54-55 #8-9, 19-20, 31, 36-37, 46, 49-50

(10 problems total)