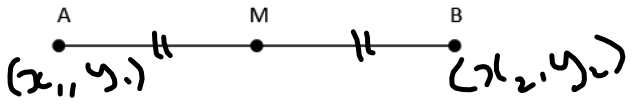
Lesson 1 – *Midpoint of a segment*

Definition: The point which divides a line segment into two equal parts is called the midpoint of that segment.



The coordinates of point M can be found using the following:

$$x_M = \frac{x_1 + x_2}{2} \qquad y_M = \frac{y_1 + y_2}{2}$$

Ex. Given A (-1,4) and B(5, -2) find the coordinates midpoint M of $\overline{AB}$.

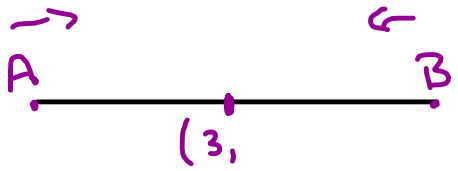
$$x_M = \frac{-1 + 5}{2} \qquad y_M = \frac{4 + -2}{2}$$

$$x_M = \frac{4}{2} \qquad y_M = \frac{2}{2}$$

$$x_M = 2 \qquad y_M = 1$$

Therefore the coordinates of M are (2,1).

Sometimes coordinates have negative numbers:



Find the midpoint

a) $(\underset{x_1}{-2}, \underset{y_1}{5})$ and $(\underset{x_2}{8}, \underset{y_2}{15})$

$x_m = \frac{-2+8}{2} = \frac{6}{2} = 3$ $y_M = \frac{5+15}{2} = \frac{20}{2} = 10$

$(3, 10)$

b) $(\underset{x_1}{-4}, \underset{y_1}{-6})$ and $(\underset{x_2}{-10}, \underset{y_2}{0})$

$x_m = \frac{-4+-10}{2} = \frac{-14}{2} = -7$ $y_M = \frac{y_1+y_2}{2} = \frac{-6+0}{2} = -3$

$(-7, -3)$

c) $(\underset{x_2}{0}, \underset{y_2}{0})$ and $(\underset{x_1}{-8}, \underset{y_1}{8})$

$x_m = \frac{-8+0}{2} = -4$ $y_M = \frac{8+0}{2} = 4$

$(-4, 4)$

d) (5, 4) and (2, 11)

Tricky....

What if you are given the midpoint and one of the endpoints and you have to solve for the other endpoint?

Example:

The midpoint is (3,6) x_m y_m

one endpoint is (-2, 4) x_1 y_1

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

$$2(3) = \left(\frac{-2 + x_2}{2}\right)2$$

$$6 = -2 + x_2$$

$$x_2 = 8$$

What is the other endpoint?

Use the same steps to solve.

$$y_m = \frac{y_1 + y_2}{2}$$

$$6 = \frac{4 + y_2}{2}$$

$$12 = 4 + y_2$$

$$y_2 = 8$$

(8,8)

Word problems.

Justin leaves his house located at $(15, 20)$ (x_1, y_1)

He walks to the store $(31, 50)$ (x_2, y_2)

He stopped at Peter's house which is halfway to the store. What are the coordinates of Peter's house? $(23, 35)$

$$x_m = \frac{x_1 + x_2}{2} = \frac{15 + 31}{2} = 23$$

$$y_m = \frac{y_1 + y_2}{2} = \frac{20 + 50}{2} = 35$$

Mathew and Liborio agree to meet halfway from their homes.

$x_m = \frac{x_1 + x_2}{2}$ $y_m = \frac{y_1 + y_2}{2}$

$\frac{28}{1} = \frac{10 + x_2}{2}$ $55 = \frac{30 + y_2}{2}$

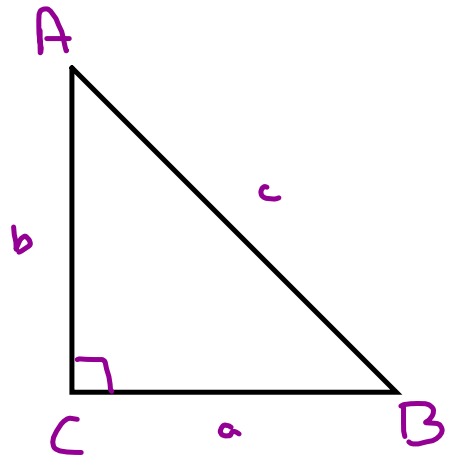
$56 = 10 + x_2$ $110 = 30 + y_2$

$46 = x_2$ $80 = y_2$

Mathieu lives at $(10,30)$ x_1 y_1

The midpoint is $(28, 55)$ x_m y_m

What are the coordinates of Liborio's house? $(46, 80)$



$a^2 + b^2 = c^2$

$c = \sqrt{a^2 + b^2}$

Ex $a = 4$ $b = 6$

$c = 7.2$

Ex. $a = 15$ $c = 20$

$b =$

$15^2 + b^2 = 20^2$

$b^2 = 20^2 - 15^2$

$= 400 - 225$

$\sqrt{b^2} = \sqrt{175} = 13.2$