# Partitioning Line Segments NOTES

**Coordinates of point which partitions a directed line segment AB at the ratio of $a:b$ from $A(x_1, y_1)$ to $B(x_2, y_2)$**

$$(x, y) = \left(\frac{bx_1 + ax_2}{b+a}, \frac{by_1 + ay_2}{b+a}\right)$$

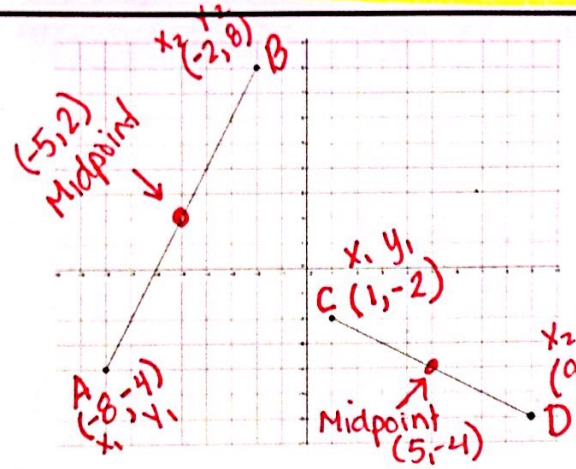
**OR**

$$(x, y) = \left(x_1 + \frac{a}{a+b}(x_2 - x_1), y_1 + \frac{a}{a+b}(y_2 - y_1)\right)$$

run rise

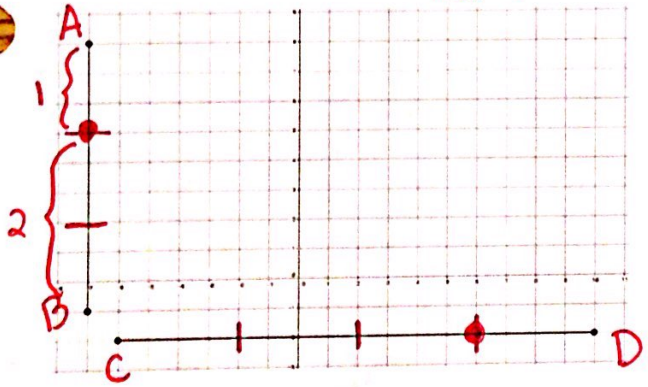
**Midpoint Formula** = $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$

The **midpoint** divides or "**partitions**" a segment in **half**, so the lengths have a **ratio** of **1 : 1.**




The midpoint of AB = $\left(\frac{-8+-2}{2}, \frac{-4+8}{2}\right) = \boxed{(-5, 2)}$

The midpoint of CD = $\left(\frac{1+9}{2}, \frac{-2+-6}{2}\right) = \boxed{(5, -4)}$

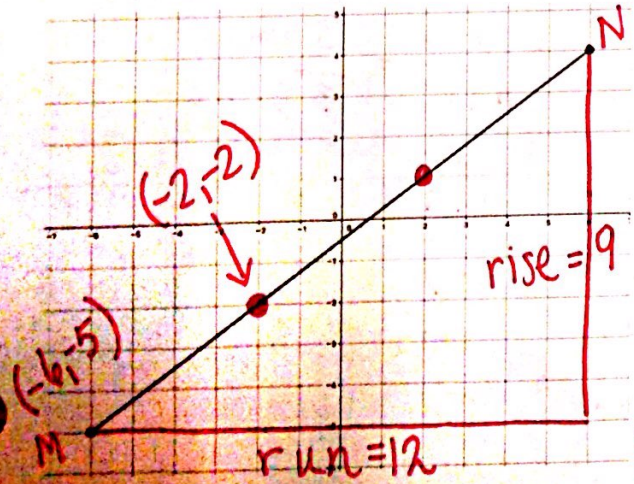



Find the point $\frac{1}{3}$ of the way from A to B.

(-7,5) partitions AB in a ratio of 1:2.

Find the point $\frac{3}{4}$ of the way from C to D.

(6,-2) partitions ~~AB~~ CD in a ratio of 3:1.




Find the point $\frac{1}{3}$ of the way from M to N.

*Add $\frac{1}{3}$ of the "**run**" to the **x-value** of M

*Add $\frac{1}{3}$ of the "**rise**" to the **y-value** of M

M = (-6,-5)

P = $\left(-6 + \frac{1}{3}(12), -5 + \frac{1}{3}(9)\right) = (-2, -2)$

(-2,-2) partitions MN in a ratio of 1:2.

1. Find the midpoint of $\overline{AB}$, where A(-12, 18) and B(-6, 24).

$$M = \left(\frac{-12+-6}{2}, \frac{18+24}{2}\right)$$

$$\boxed{M = (-9, 21)}$$

2. Find the point P that partitions the line segment $\overline{AB}$ in the given ratio.

$A(-3, 7)$ $B(5, -9)$ Ratio $1:3$

$x_1\ y_1$ $x_2\ y_2$ $a:b$

$$\left(x_1 + \frac{a}{a+b}(x_2 - x_1), y_1 + \frac{a}{a+b}(y_2 - y_1)\right)$$

$$\left(-3 + \frac{1}{1+3}(5 - -3), 7 + \frac{1}{1+3}(-9 - 7)\right)$$

$$\boxed{(-1, 3)}$$

3. Find the point that is $\frac{2}{3}$ the distance from the endpoint (-4, -6) of the segment with endpoint (-4, -6) and (2, 9).

$x_1\ y_1$ $x_2\ y_2$ $a:b$ $2:1$

$$\frac{a}{a+b} = \frac{2}{3}$$

$$\frac{2}{2+1}$$

$$\left(x_1 + \frac{a}{a+b}(x_2 - x_1), y_1 + \frac{a}{a+b}(y_2 - y_1)\right)$$

$$\left(-4 + \frac{2}{3}(2 - -4), -6 + \frac{2}{3}(9 - -6)\right)$$

$$\boxed{(0, 4)}$$