1) Find the equation of the line with a slope of 5/4, through the point $(-8, -9)$.

Solution:

$$y = mx + b$$

$$y = \frac{5}{4}x + b$$

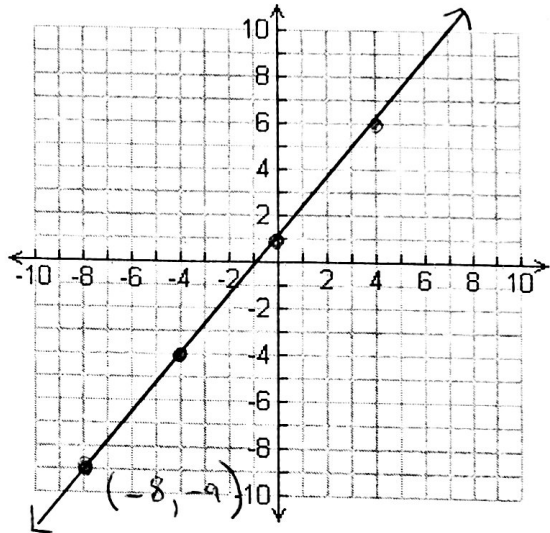$$-9 = \frac{5}{4}(-8) + b$$

$$-9 = -10 + b$$

$$\boxed{b = 1}$$

$$\boxed{y = \frac{5}{4}x + 1}$$

Visual:

$(-8, -9)$

2) Find the equation of the line that is perpendicular to $y = \frac{2}{3}x - 5$ through the point $(1, 4)$.

Solution:

$$m_\perp = {}^{-3}/_2$$

$$y = \frac{-3}{2}x + b$$
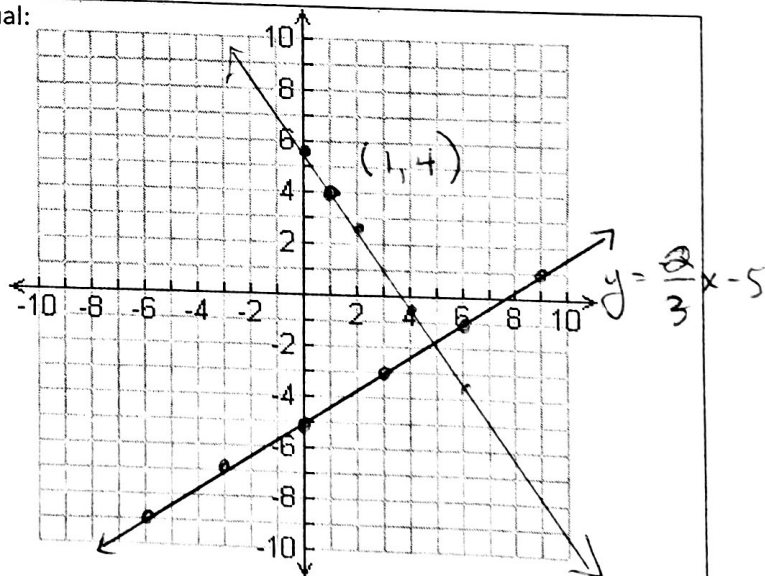
$$4 = \frac{-3}{2}(1) + b$$

$$4 = {}^{-3}/_2 + b$$

$$4 + \frac{3}{2} = b$$

$$\frac{8}{2} + \frac{3}{2} = b$$

$$\boxed{{}^{11}/_2 = b}$$

$$\boxed{y = \frac{-3}{2}x + {}^{11}/_2}$$

Visual:

$(1, 4)$

$y = \frac{2}{3}x - 5$

3) Find the equation of the line that passes through the points $A(2, -3)$ and $B(-1, -4)$

$\overset{x_1 \ \ y_1}{}$ $\overset{x_2 \ \ y_2}{}$

Solution:

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-4 - (-3)}{-1 - 2} = \frac{-1}{-3} = \frac{1}{3}$$
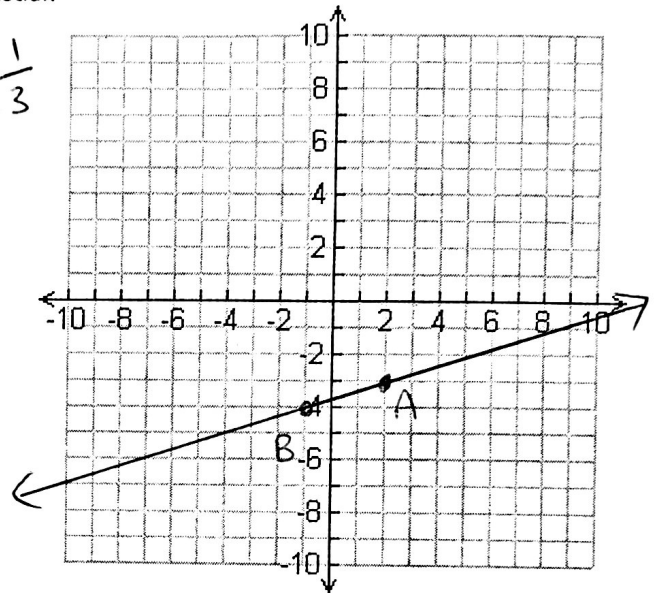
$$y = \frac{1}{3}x + b$$

$$-4 = \frac{1}{3}(-1) + b$$

$$-4 = \frac{-1}{3} + b$$

$$\frac{-12}{3} + \frac{1}{3} = b$$

$$\boxed{-11/3 = b}$$

$$\boxed{y = \frac{1}{3}x - 11/3}$$

Visual:

Coordinates on a Cartesian Plane are a convenient way to specify a location. Machinists use coordinates to control machines that shape and machine parts. People that work in construction and design use coordinates in a computer program to simplify their design work and calculations.

Today we want to develop a formula that will find the midpoint of a line segment.

Midpoint: A point that divides a line segment into 2 equal parts.

Example: Using slope to find a midpoint

$$\overset{x_1 \ y_1}{} \qquad \overset{x_2 \ y_2}{}$$

Determine the rise and run of the line segment joining $A(-2,-3)$ and $B(8,5)$. Use these to determine the midpoint of this line segment.

$$\text{rise} = y_2 - y_1 = 5 - (-3) = 8$$

$$\text{run} = x_2 - x_1 = 8 - (-2) = 10$$

$$\text{Midpoint} \quad M = \left(-2 + \frac{\text{run}}{2}, -3 + \frac{\text{rise}}{2}\right)$$

$$= \left(-2 + \frac{10}{2}, -3 + \frac{8}{2}\right)$$

$$= (3, 1)$$

Example: Using a formula to find a midpoint

Formula:
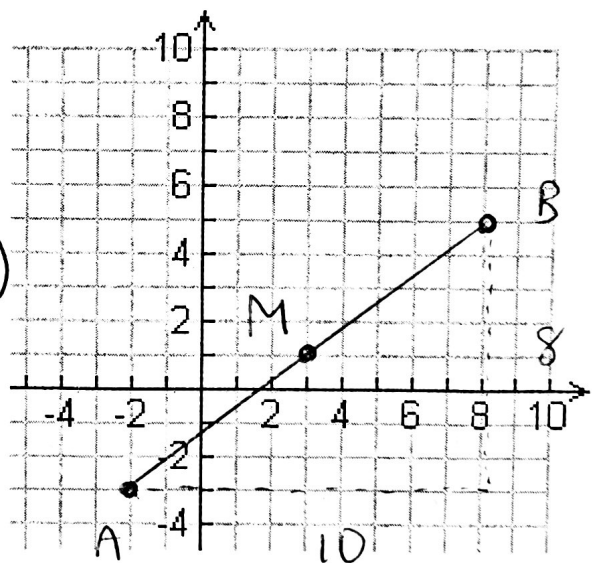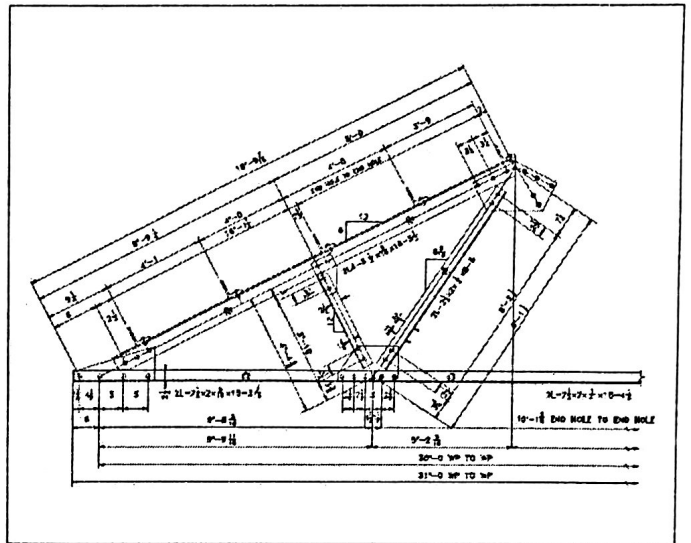
Given 2 points

$$A(x_1, y_1) \ \& \ B(x_2, y_2)$$

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

Sample Calculation:

$$M = \left(\frac{-2 + 8}{2}, \frac{-3 + 5}{2}\right)$$

$$= \left(\frac{6}{2}, \frac{2}{2}\right)$$

$$= (3, 1)$$

You try it: Use the midpoint formula to find the midpoint of the following line segments.

$\overset{x_1}{} \overset{y_1}{} \quad \overset{x_2}{} \overset{y_2}{}$

a) $A(1, -3)$ and $B(4, 3)$.

$\overset{x_1}{} \overset{y_1}{} \quad \overset{x_2}{} \overset{y_2}{}$

b) $C(12, 33)$ and $D(48, -15)$.

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

$\quad = \left(\dfrac{1 + 4}{2}, \dfrac{-3 + 3}{2} \right)$

$\quad = \left(\dfrac{5}{2}, \dfrac{0}{2} \right)$

$\quad = \left(\dfrac{5}{2}, 0 \right)$

$M = \left(\dfrac{12 + 48}{2}, \dfrac{33 + (-15)}{2} \right)$

$\quad = \left(\dfrac{60}{2}, \dfrac{18}{2} \right)$
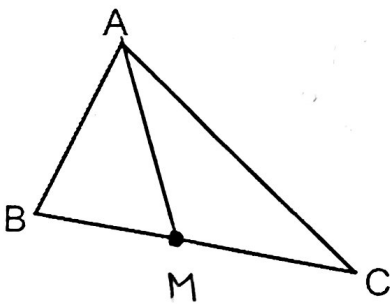
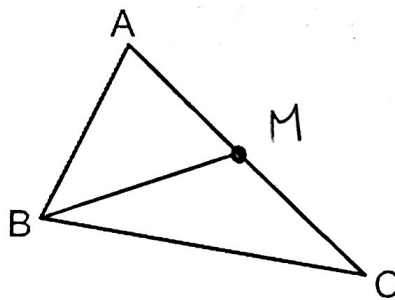$\quad = (30, 9)$

Example 3: Medians of Triangles

A median of a triangle is... a line from a vertex of the triangle to the midpoint of the opposite side.
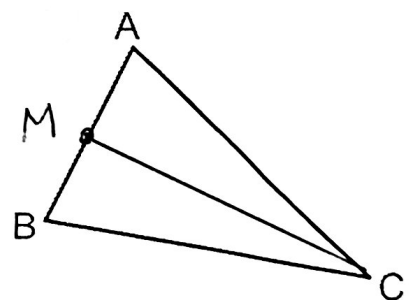
Draw the three medians for triangle ABC shown below:

From vertex A:

From vertex B:

From vertex C:

Notes:

- Every triangle has 3 medians

- The 3 medians of triangle always meet at a point.

The Midpoint of a Line Segment | MPM2D

Example: Find the equation of all 3 medians in the triangle formed by the points $A(4,4)$, $B(10,6), and\ C(6,0)$.

Median from A:

$$M_{BC} = \left(\frac{10+6}{2}, \frac{6+0}{2}\right) = (8,3)$$

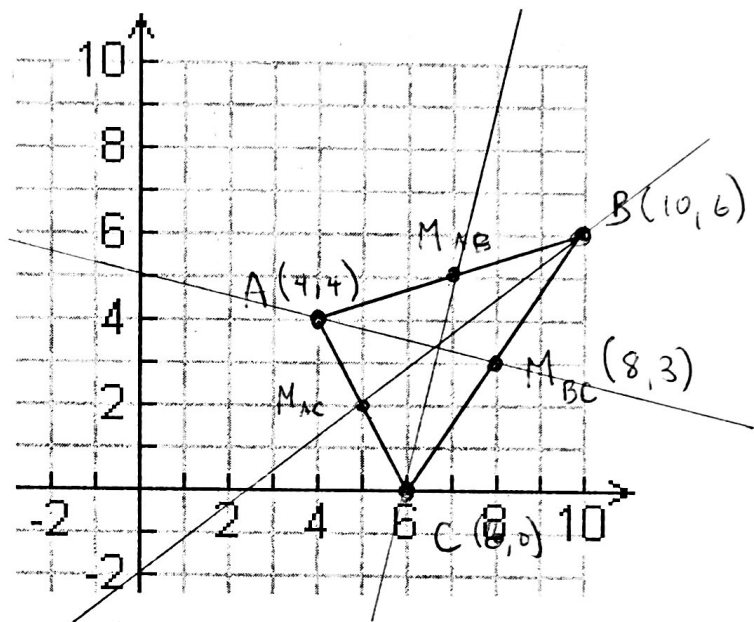$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{3-4}{8-4} = \frac{-1}{4}$$

$$y = \frac{-1}{4}x + b$$

$$4 = \frac{-1}{4}(4) + b$$

$$4 = -1 + b$$

$$b = 5$$

$$\boxed{y = \frac{-1}{4}x + 5}$$

You try the following two...

Median from B:

$$M_{AC} = \left(\frac{4+6}{2}, \frac{4+0}{2}\right) = (5,2)$$

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{6-2}{10-5} = \frac{4}{5}$$

$$y = \frac{4}{5}x + b$$

$$2 = \frac{4}{5}(5) + b$$

$$2 = 4 + b$$

$$b = -2$$

$$\boxed{y = \frac{4}{5}x - 2}$$

Median from C:

$$(6,0) \text{ to } (7,5)$$
$$\rightarrow C \text{ to } M_{AB}$$

$$M_{AB} = \left(\frac{4+10}{2}, \frac{4+6}{2}\right) = (7,5)$$

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{5-0}{7-6} = \frac{5}{1} = 5$$

$$y = 5x + b$$

$$0 = 5(6) + b$$

$$0 = 30 + b$$

$$b = -30$$

$$\boxed{y = 5x - 30}$$