Direct Variation

What is it? *a linear equation whose graph goes through (0,0)*

a relationship that can be represented by a function in the form $y = kx$, where $k \neq 0$

Constant:

$$k = \frac{y}{x}$$ is constant for all ordered pairs

Equation:

y-int is 0

$$y = mx \quad (y = kx \text{ or } y = ax)$$

constant

Table: $y = \frac{1}{2}x$ Graph

x	y
-4	-2
-2	-1
* 0	0
2	1
4	2

D.V.
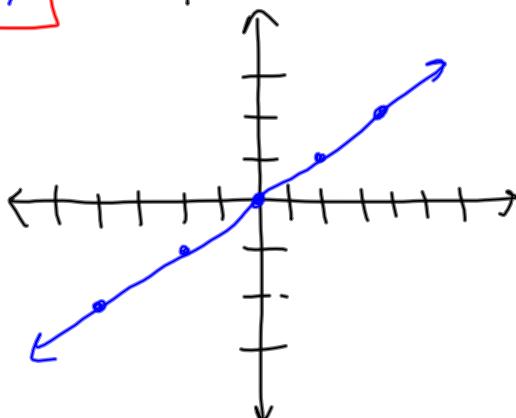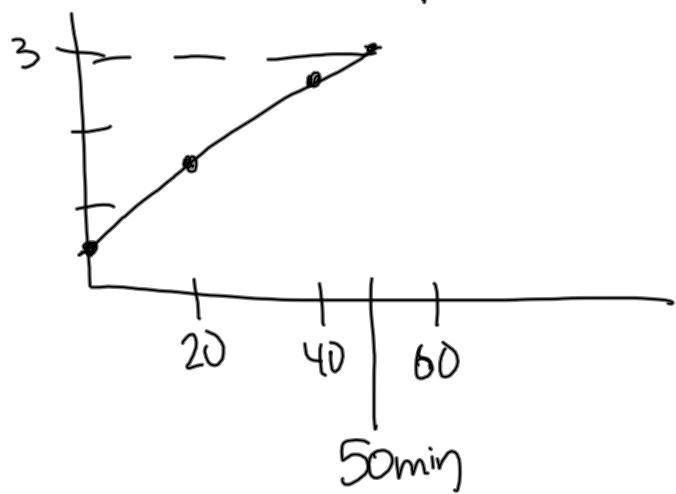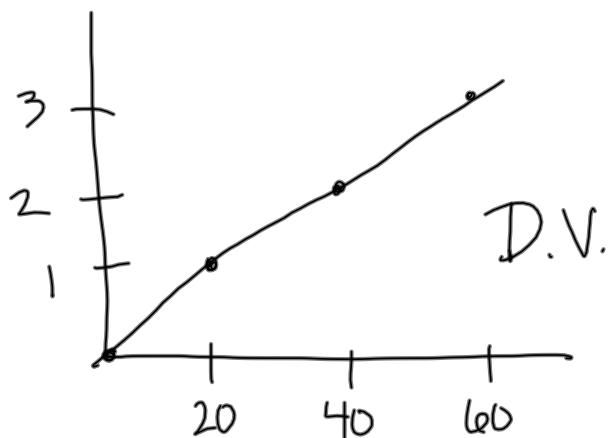
Direct Variation

Not a Direct Variation

$y = mx$

$y = mx + b$

$5x - 2y = 0$

$y = \frac{3}{4}x - 7$

$y = -5x$

$x - 3y = 7$

$-3x + 2y = 0$

$8x + 4y = 12$

$3x = 2y$

x	y
3	2
3	2
9	6

x	y
4	8
7	14
10	20

x	y
2	4
3	8
4	16

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Problems 5.2

① $\dfrac{2y}{2} = \dfrac{3x}{2} + \dfrac{1}{2}$ Is. this D.V.?

$y = \dfrac{3}{2}x + \dfrac{1}{2}$ NO, $b = \dfrac{1}{2}$, not 0

② Y varies directly with x
Write a direct variation equation.
Find the value of y when x = 10.
$y = 9$ when $x = 5$ $m = \dfrac{y}{x} = \dfrac{9}{5}$

$y = mx$

$\dfrac{9}{5} = \dfrac{m5}{5}$

$\boxed{y = \dfrac{9}{5}x}$

$\dfrac{9}{5} = m$

$x = 10,\quad y = \dfrac{9}{5} \cdot \dfrac{10^2}{1} = 18$

$\boxed{18}$

Notes

Problem 3:

Graph $y = \boxed{-\frac{1}{2}}^{m} x$

x	y
-2	$-\frac{1}{2}(-2)$

+1
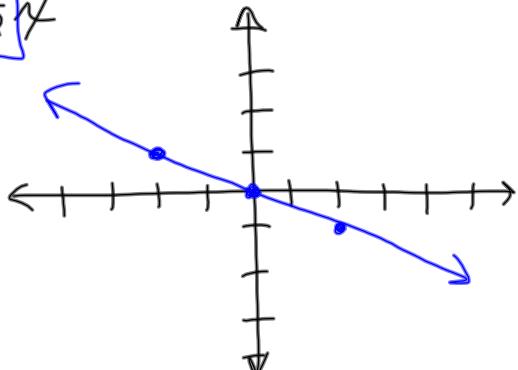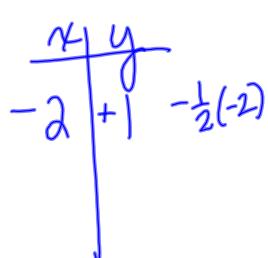
Problem 4:

Suppose $15 (US) is worth about $150 Mexican Pesos.

a. What is an equation that relates US dollars x to Mexican pesos y?

$$y = mx$$

$$\frac{150}{15} = \frac{m \cdot 15}{15}$$

$$10 = m$$

$$m = \frac{y}{x} = \frac{150}{15}$$

$$m = 10$$

$$\boxed{y = 10x} \quad m = \frac{10}{1}$$

b. What is the graph of this equation?

x	y = 10x
5	50 10·5

Mexican Pesos

US dollars
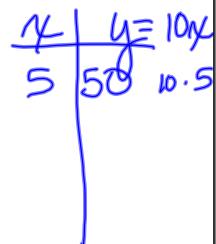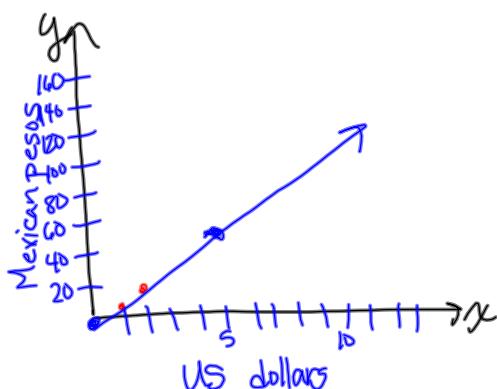
Problem 5
 Do these quantities vary directly?

a. the number of ounces of cereal and the number of Calories the cereal contains
 Yes, as the number of ounces increases, the number of Calories increases. When one is 0, the other is 0.

b. the amount of money you have left and the number of items you purchase

 As the number of items you purchase increases, the amount of money you have decreases
 No   (inverse variation)

Sec. 5.3 Slope-Intercept Form

Slope - Intercept Form

$$y = mx + b$$

↓ slope　　↓ y-intercept

Problem 1:
What are the slope and y-intercept of the graph of

$$y = 3x - 6$$

slope : 3

y-intercept : -6

Problem 2:
What is an <u>equation</u> of the <u>line</u> with slope 5 and y-intercept 8?

↓ m　　↓　　↓ b

$$y = mx + b$$

$$y = 5x + 8$$

Problem 3:
What is the equation of the line?
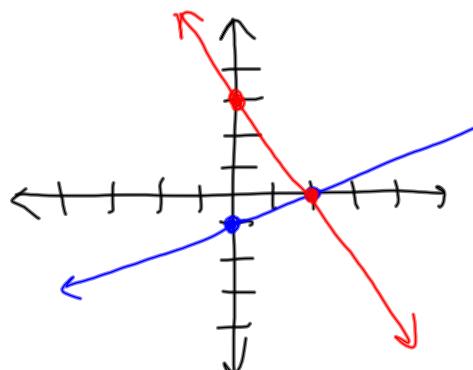
$$y = mx + b$$

$$y = \frac{1}{2}x - 1$$

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

Problem 4:

What is an equation in <u>slope-intercept</u> <u>form</u> of the line that passes through the points that follow?

a. $(1, -6)$ and $(-3, 10)$

$$y = mx + b \rightarrow y = -4x + b$$

① Find slope $m = \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{10 - -6}{-3 - 1} = \dfrac{10 + 6}{-4} = \dfrac{16}{-4}$

$$m = -4$$

② Find b.
— Pick ONE point
— Plug it in for x and y
— Plug in m.
— Solve for b.

$$\overset{x}{(}1, \overset{y}{-6})$$

$$y = -4x + b$$
$$-6 = -4(1) + b$$
$$-6 = -4 + b$$
$$\underline{+4 \quad +4}$$
$$-2 = b$$

③ Write the equation, plugging in m + b.

$$m = -4 \qquad b = -2$$

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

b. $\boxed{(3, -2)}$ and $(1, -3)$

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

$$m = \frac{1}{2} \rightarrow y = \frac{1}{2}x + b$$

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

$$-2 = 1\frac{1}{2} + b$$

$$\underline{-1\frac{1}{2} \qquad -1\frac{1}{2}}$$

$$-\frac{7}{2} \text{ or } -3\frac{1}{2} = b$$

$$b = -3\frac{1}{2}, \quad m = \frac{1}{2}$$

$$\boxed{y = \frac{1}{2}x - 3\frac{1}{2}}$$

c. $(2, 1)$ and $(5, -8)$

$$m = \frac{-8-1}{5-2} = \frac{-9}{3} = -3$$

$$y = -3x + b \rightarrow \boxed{y = -3x + 7}$$

$$\overset{x\ y}{(2, 1)} \quad 1 = -3(2) + b$$

$$1 = -6 + b$$

$$\underline{+6 \quad +6}$$

$$7 = b$$

d. $(-2, 4)$ and $(3, -1)$

$$m = \frac{-1-4}{3++2} = \frac{-5}{5} = -1$$

$$y = -x + b$$

$$(-2, 4) \quad 4 = -(-2) + b \quad \boxed{y = -1x + 2}$$

$$4 = 2 + b$$

$$\underline{-2 \quad -2}$$

$$2 = b$$

Problem 5:

Graph $y = \frac{1}{2}x - 1$

$$m = \frac{1}{2}$$

$$b = -1$$

$$(0, -1)$$
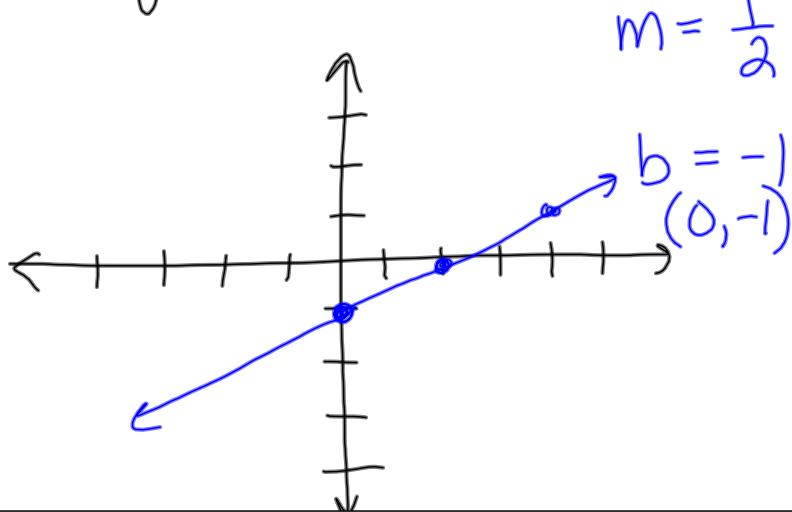
# Sec. 5.4 Point - Slope Form

$$y - y_1 = m(x - x_1)$$

$$(x_2 - x_1)m = \frac{y_2 - y_1}{(x_2 - x_1)} \cdot (x_2 - x_1)$$

$$y_2 - y_1 = m(x_2 - x_1)$$

(x, y)

(x_1, y_1)

$$m = \frac{y - y_1}{x - x_1}$$

$$y - y_1 = m(x - x_1)$$

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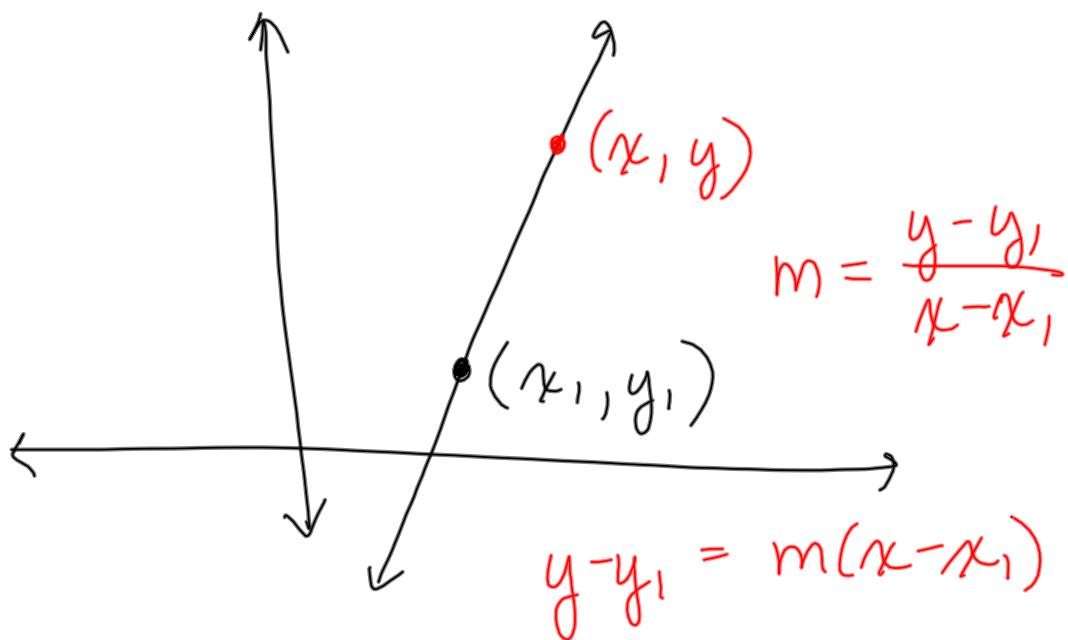
Problem 1:

A line passes through $\overset{x_1 \quad y_1}{(1, -4)}$
and has slope $\overset{m}{3}$. What is an
equation of the line in point-slope
form. $y - \boxed{y_1} = \boxed{m}(x - \boxed{x_1})$

$$y - (-4) = 3(x - 1)$$

$$\boxed{y + 4 = 3(x - 1)}$$

Problem 2:

a. Graph $y + 3 = -2(x-2) \rightarrow x_1 = 2$

where $y_1 = -3$

$y - (-3)$

$y - y_1 = m(x - x_1)$

(x_1, y_1)

$(2, -3)$

$m = -\dfrac{2}{1}$
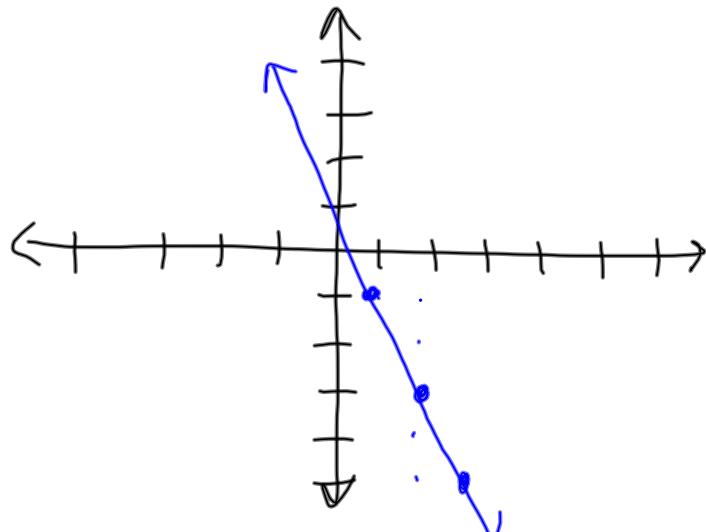
b. Graph $y - y_1 = \boxed{m}(x - x_1)$

$y + 7 = \boxed{-\dfrac{4}{5}}(x - 4)$

point: $(4, -7)$

slope: $-\dfrac{4}{5} \qquad \dfrac{-4}{5} \text{ or } \dfrac{4}{-5}$

$(4, -7)$
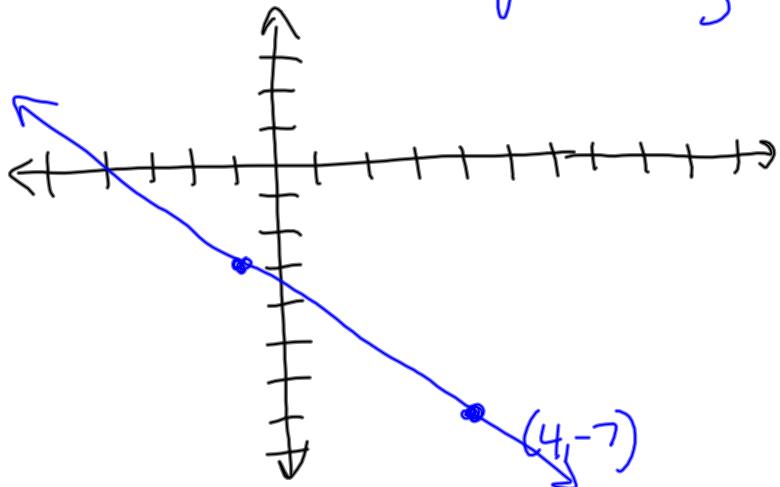
C. Graph $y + 3 = 2(x - 1)$

$y - y_1 = m(x - x_1)$

$(x_1, y_1) = (1, -3)$

$m = \dfrac{2}{1}$

Problem 3

$m = \dfrac{1}{2}$

$m = \dfrac{3}{6}$

$(4,4)$

$(-2,1)$
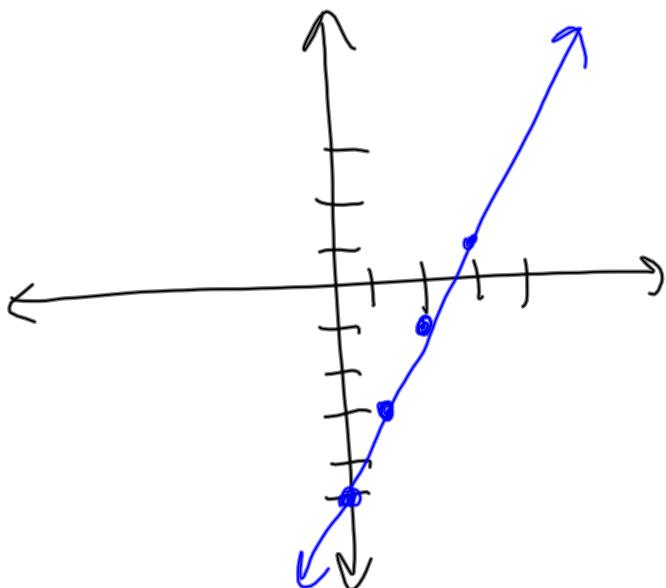
$y - 4 = \dfrac{1}{2}(x - 4)$
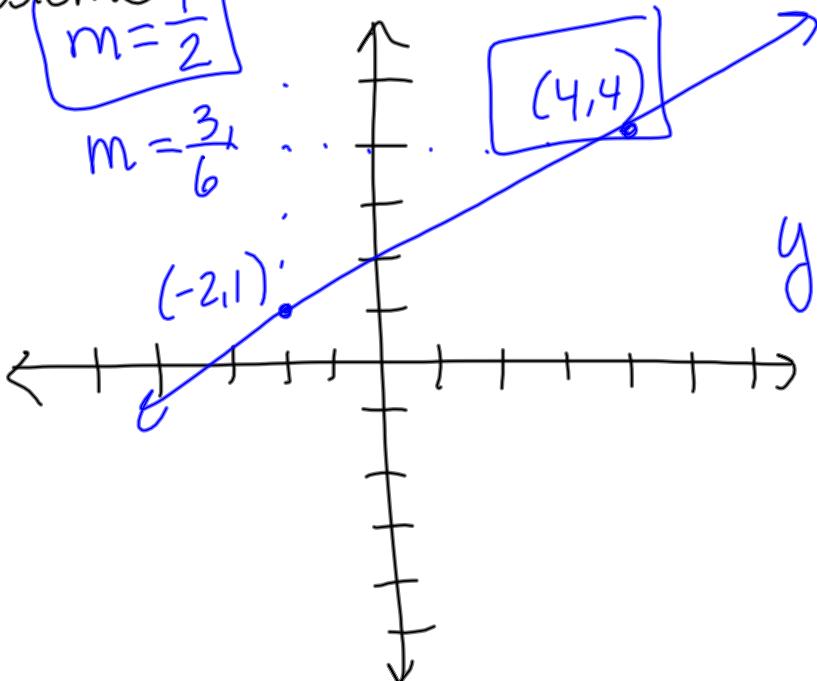
Problem 3:
Write an equation in point-slope form of the line shown below.

$m = \dfrac{-3}{+4} = -\dfrac{3}{4}$

$(-3,4)$

$(1,1)$

$y - y_1 = m(x - x_1)$

$(1,1) \quad y - 1 = -\dfrac{3}{4}(x - 1)$

OR

$(-3,4) \quad y - 4 = -\dfrac{3}{4}(x + 3)$

$m = \dfrac{2}{5}$

$(3,1)$

$(-2,-1)$

$y - y_1 = m(x - x_1)$

$(3,1) \quad y - 1 = \dfrac{2}{5}(x - 3)$

$(-2,-1) \quad y - (-1) = \dfrac{2}{5}(x - (-2))$

$y + 1 = \dfrac{2}{5}(x + 2)$

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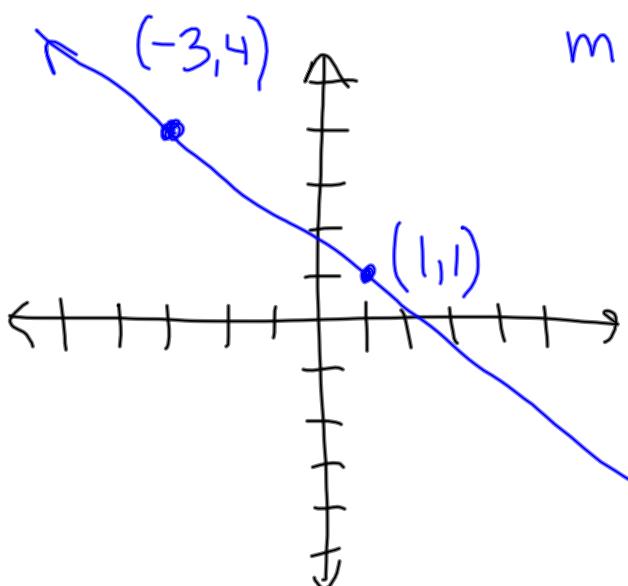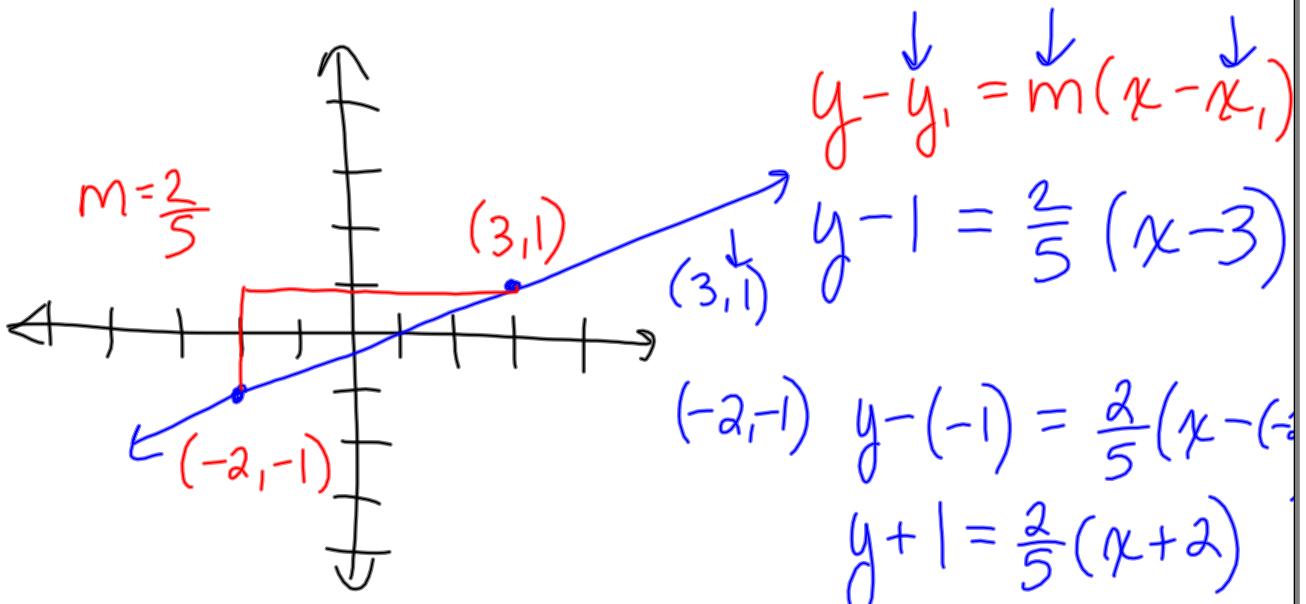
Problem 4

Julio's Earnings

Hr Worked	Wages
5 x_1	$130 y_1
10	$210
15	$290
20	$370

$\Delta x = 5$

$\Delta y = \$80$

a. Equation:

$$m = \frac{\Delta y}{\Delta x} = \frac{80}{5} = \$16/hr$$

$$y - y_1 = m(x - x_1)$$

$$y - 130 = 16(x - 5)$$

slope-intercept

$$y - 130 = 16x - 80$$
$$+130 \qquad +130$$

$$\boxed{y = 16x + 50}$$

b. What do the slope and y-intercept represent?

The slope is hourly pay rate.

The y-intercept is a fixed amount of income per pay period.

Point – Slope Form

slope

$$y - y_1 = m(x - x_1)$$

y-coordinate of point

x-coordinate of point

Write Equation (Given slope & point)

Write Equation (Given two points)

Graph Equation (Given point-slope form)

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