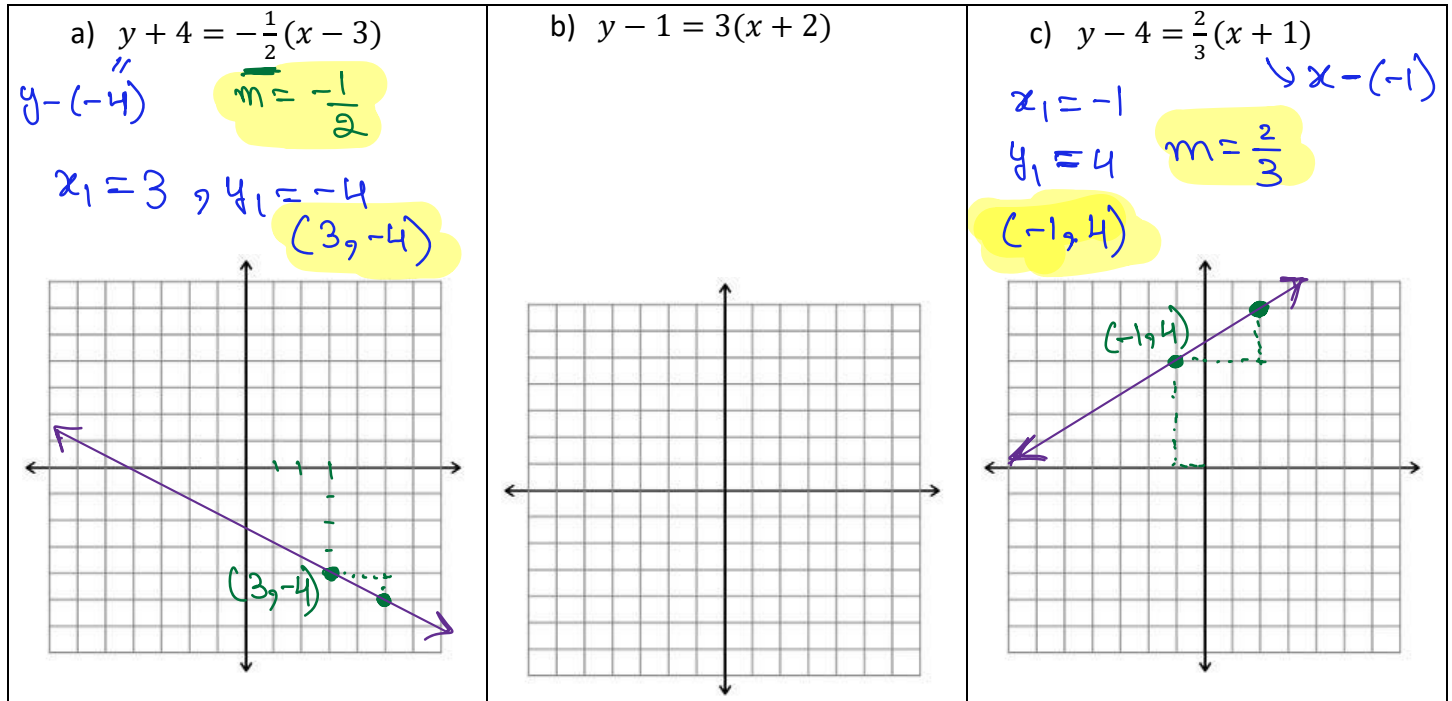


→ slope-intercept form:  $y = mx + b$

## 2.5 Equations of Lines and Modeling

**Point-Slope Form:**  $(x_1, y_1)$  point and  $m$  slope  
 $y - y_1 = m(x - x_1)$

**Example 1: Graphing in Point Slope Form**



**Example 2: Use point slope form to find an equation of a line**

<p>a) <math>(-7, 8) m = 3</math>  <math>x_1 \rightarrow y_1</math>  <math>y - 8 = 3(x - (-7))</math>  <math>y - 8 = 3(x + 7)</math>  <math>y - 8 = 3x + 21</math>  <math>\Rightarrow y = 3x + 29</math></p>	<p>b) <math>(1, -6) m = -5</math></p>	<p>c) <math>(-3, -4) m = -\frac{2}{3}</math>  <math>x_1 = -3, y_1 = -4</math>  <math>y - (-4) = -\frac{2}{3}(x - (-3))</math>  <math>y + 4 = -\frac{2}{3}(x + 3)</math>  <math>3(y + 4) = -2(x + 3)</math> <i>multiply by 3</i>  <math>3y + 12 = -2x - 6</math>  <math>3y + 18 = -2x</math> <i>add 6 on both sides</i>  <math>2x + 3y + 18 = 0</math> <i>add 2x</i></p>
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**Given the slope and the y-intercept**

If we know the slope  $m$  and the y-intercept  $(0,b)$  of a line, we can find an equation of the line by substituting into slope-intercept form,  $y = mx + b$

a) Find an equation for the line parallel to  $8y = 7x - 24$  with y-intercept  $(0, -6)$

$y = mx + b$   
 $\uparrow$   
 need to find.

$m = \text{slope of } (8y = 7x - 24) \rightarrow y = \frac{7}{8}x - 3$   
 $\frac{7}{8}$  slope

$\Rightarrow m = \frac{7}{8}$

$\Rightarrow y = \frac{7}{8}x - 6 \Rightarrow 8y = 7x - 48$

**b) Find an equation for the line parallel to  $3y = 3x + 12$  with y- intercept (0,5)**

$$y = x + 5 \quad (\text{HW})$$

c) Find an equation for the line parallel to  $6y = 2x - 36$  with y-intercept  $(0, -2)$

(divide by 6)  $y = \frac{1}{3}x - 6$   $\downarrow$   
 $b = -2$

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

$$y = \frac{1}{3}x - 2 \quad \text{multiply by 3.}$$
$$\Rightarrow 3y = x - 6$$

Given the slope and a point or given two points

When we know the slope  $m$  of a line and any point on the line, we can find the equation of the line either by using slope-intercept form,  $y = mx + b$ , and solving for  $b$  or by substituting into point-slope form

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

Example 4:

- a) Find an equation for the line perpendicular to  $2x + y = 5$  that passes through  $(1, -3)$ .

$$y = -2x + 5$$

$$x_1 = 1$$

$$y_1 = -3$$

slope of  $2x + y = 5$  is  $-2 = m_1$

$$\text{slope of perpendicular line } m = \frac{-1}{m_1} = \frac{-1}{-2} = \frac{1}{2}$$

$$y - (-3) = \frac{1}{2}(x - 1) \Rightarrow y + 3 = \frac{1}{2}(x - 1) \xrightarrow{\times 2} 2y + 6 = x - 1 \Rightarrow 2y = x - 7$$

- b) Find an equation in point-slope form for the line perpendicular to  $3x - 4y = 7$  that passes through  $(8, 2)$

$$\text{slope} = \frac{3}{4}$$

$$m = \frac{-1}{3/4} = -\frac{4}{3}$$

$$y - 2 = -\frac{4}{3}(x - 8)$$

Example 5:

- a) Use slope intercept form to find an equation of the <sup>line</sup> ~~line~~ with slope 4 that passes through  $(6, -5)$

$$y - (-5) = 4(x - 6)$$

$$y + 5 = 4x - 24 \Rightarrow y = 4x - 29$$

- b) Use slope intercept form to find an equation of the line with slope  $\frac{1}{2}$  that passes through  $(8, -3)$

$$f(x) = \dots$$

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

- c) Find a linear function that has a graph passing through  $(-1, -5)$  and  $(3, -2)$

Need m

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

$$y - (-5) = \frac{3}{4}(x - (-1)) \Rightarrow y + 5 = \frac{3}{4}(x + 1) \Rightarrow 4(y + 5) = 3(x + 1)$$

$$\Rightarrow 4y + 20 = 3x + 3$$

$$\Rightarrow 4y = 3x - 17$$

$$\Rightarrow y = \frac{3}{4}x - \frac{17}{4}$$

$$f(x) = \frac{3}{4}x - \frac{17}{4}$$

- d) Find a Linear function that has a graph passing through  $(6, -1)$  and  $(-2, -3)$

$$m = \frac{-3 - (-1)}{-2 - 6} = \frac{-3 + 1}{-8} = \frac{-2}{-8} = \frac{1}{4}$$

$$y - (-1) = \frac{1}{4}(x - 6)$$

$$y + 1 = \frac{1}{4}(x - 6) \Rightarrow 4y + 4 = x - 6 \Rightarrow 4y = x - 10$$

$$\Rightarrow y = \frac{1}{4}x - \frac{10}{4}$$

$$\Rightarrow f(x) = \frac{1}{4}x - \frac{5}{2}$$

### Horizontal Lines and Vertical Lines

Example 6:

- a) Find the equation of the horizontal line that passes through  $(1, -4)$

$$y = -4$$

- b) Find the equation of the vertical line that passes through  $(1, -4)$

$$x = 1$$

- c) Find the equation of the vertical line that passes through  $(2, 8)$

$$x = 2$$

- d) Find the equation of the horizontal line that passes through  $(2, 8)$

$$y = 8$$