# 6.6 Equation of a Line Given Two Points

**Remember:** You can write the equation of a line once you know the slope and y-intercept.

$$y = mx + b$$

**Slope** **y-intercept**

# DO IT NOW!

**Instructions:** Write the equation of the following lines:

**a)** Line with a slope of $\frac{3}{5}$ ($m$) that passes through the point B(-5, 4) ($x$, $y$).

$y = mx + b$

$4 = \left(\frac{3}{5}\right)(-5) + b$

$4 = \frac{-15}{5} + b$

$4 = -3 + b$

$4 + 3 = b$

$b = 7$

$y = \frac{3}{5}x + 7$

**b)** Line that is parallel to the line $y = 2x - 7$ and passes through the point (1, -3).

$m = 2$

($x$, $y$)

$y = mx + b$

$-3 = 2(1) + b$

$-3 = 2 + b$

$-3 - 2 = b$

$b = -5$

$y = 2x - 5$

**c)** Line that is perpendicular to the line $2x - 2y + 4 = 0$ and passes through the point $(-2, 5)$.

$\perp m = -1$

Point: $(-2, 5)$

$y = mx + b$

$5 = (-1)(-2) + b$

$5 = 2 + b$

$5 - 2 = b$

$b = 3$

$y = -1x + 3$

$-2y = -2x - 4$

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

$y = 1x + 2$

$m = 1$

**Today's Lesson:** Find the equation of a line given two points on the line.

What do you need to write the equation of a line?

slope (m) and y-intercept (b)

If you are not given the slope of a line, how can you find it?

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

How can you find the $y$-intercept?

use the slope (m) and the coordinates (x,y) of any point on the line to solve for the y-intercept (b).

**Example 1:** Determine the equation of a line that passes through the points M(4, -3) and N(2, 5).

$x_1$ $y_1$ $x_2$ $y_2$

**Step 1: Calculate the slope**

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{5-(-3)}{2-4} = \frac{8}{-2} = -4$$

**Step 2: Find the y-intercept**

**Note:** to find the y-intercept you can use any point that is on the line for your x and y values.

$y = mx + b$

$5 = (-4)(2) + b$

$5 = -8 + b$

$5 + 8 = b$

$b = 13$

**Step 3: Write the equation of the line**

$$y = -4x + 13$$

**Example 2:** Determine the equation of a line that passes through the points P(0, 4) and Q(7, 0).

$x_1$ $y_1$ $x_2$ $y_2$

**Step 1: Calculate the slope**

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

$$= \frac{0-4}{7-0}$$

$$= \frac{-4}{7}$$

**Step 2: Find the y-intercept**

$y = mx + b$

$4 = \left(\frac{-4}{7}\right)(0) + b$

$4 = b$

**Step 3: Write the equation of the line**

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

**Example 3:** Determine the equation of a line that passes through the points A(-4, 2) and B(8, 11).

$x_1$ $y_1$ $x_2$ $y_2$

**Step 1: Calculate the slope**

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

$$= \frac{11 - 2}{8 - (-4)}$$

$$= \frac{9}{12}$$

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

**Step 2: Find the y-intercept**

$$y = mx + b$$

$$2 = \left(\frac{3}{4}\right)(-4) + b$$

$$2 = -\frac{12}{4} + b$$

$$2 = -3 + b$$

$$2 + 3 = b$$

$$b = 5$$

**Step 3: Write the equation of the line**

$$y = \frac{3}{4}x + 5$$

**Example 4:** On your own determine the equation of the line that passes through the points A(2,-4) and B(5,5)

$x_1$ $y_1$ $x_2$ $y_2$

SLOPE

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

$$= \frac{5 - (-4)}{5 - 2}$$

$$= \frac{9}{3}$$

$$= 3$$

Y-int

$$y = mx + b$$

$$5 = 3(5) + b$$

$$5 = 15 + b$$

$$5 - 15 = b$$

$$b = -10$$

$$y = 3x - 10$$

**Example 5:**

**a)** An appliance repair company charges $205 for a repair that takes 3 hours. The same company charges $505 for a repair that takes 8 hours. Determine an equation that represents the cost of a repair based on the number of hours that the repair takes. y x

***Hint:*** *you can write two coordinate points with the information given. (ind. variable, dep. variable)*

Point 1: $(3, 205)$ ($x_1$, $y_1$)

Point 2: $(8, 505)$ ($x_2$, $y_2$)

Slope

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

$= \frac{505 - 205}{8 - 3}$

$= \frac{300}{5}$

$= 60$

y-int

$y = mx + b$

$205 = 60(3) + b$

$205 = 180 + b$

$205 - 180 = b$

$b = 25$

$y = 60x + 25$ OR COST $= 60$(hours) $+ 25$

**b)** What is the cost of a repair that takes 7 hours? y x

$y = 60x + 25$

$y = 60(7) + 25$

$y = 420 + 25$

$y = 445$

$445

**c)** If a repair costs $385, how many hours does it take? y x

$y = 60x + 25$

$385 = 60x + 25$

$385 - 25 = 60x$

$\frac{360}{60} = \frac{60x}{60}$

$\frac{360}{60} = x$

$x = 6$

6 hours

**Consolidate:**

To write the equation of a line you need the slope and y-intercept.

If you are not given the slope you can find it if you have 2 points on the line by using the

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