6.5 - Equation of a Line Given Slope and a Point

DO IT NOW!

Instructions: Determine the equation of the line, in slope y-intercept form, that has a slope of 3 and goes through the point (2, -5)

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

$$y = mx + b$$

Slope   **y-intercept**

Step 1: State what you know about the line

Slope = m = 3

Point on line: $(\overset{x}{2}, \overset{y}{-5})$

Step 2: Determine the y-intercept of the line

To do this we can use the equation $y = mx + b$, substitute in values for m, x and y and then solve for the b value. Use the point on the line that is given for the x and y values.

y = mx + b
-5 = 3(2) + b
-5 = 6 + b
-5 - 6 = b
b = -11

STEP 3: Write the equation of the line in slope y-intercept form.

Note: When writing the final equation of the line, plug in values for m and b, not for x and y.

y = 3x - 11

Example 1: Find the equation of the line with a slope of $\frac{1}{2}$ that passes through $(1, 5)$.

Step 1: State what you know about the line

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

$\overset{x\ \ y}{\text{Point}: (1, 5)}$

Step 2: Determine the y-intercept of the line

$y = mx + b$

$5 = \frac{1}{2}(1) + b$

$5 = \frac{1}{2} + b$

$\frac{5}{1} - \frac{1}{2} = b$

$\frac{10}{2} - \frac{1}{2} = b$

$b = \frac{9}{2}$

STEP 3: Write the equation of the line in slope y-intercept form.

$y = \frac{1}{2}x + \frac{9}{2}$

Example 2: Find the equation of the line with a slope of 3 and that passes through $(0, 2)$. Then graph the line.

Step 1: State what you know about the line

$\text{Slope}: m = 3$

$\overset{x\ \ y}{\text{Point}: (0, 2)}$

↑
This point is the y-intercept. If you notice this, you don't have to calculate it.

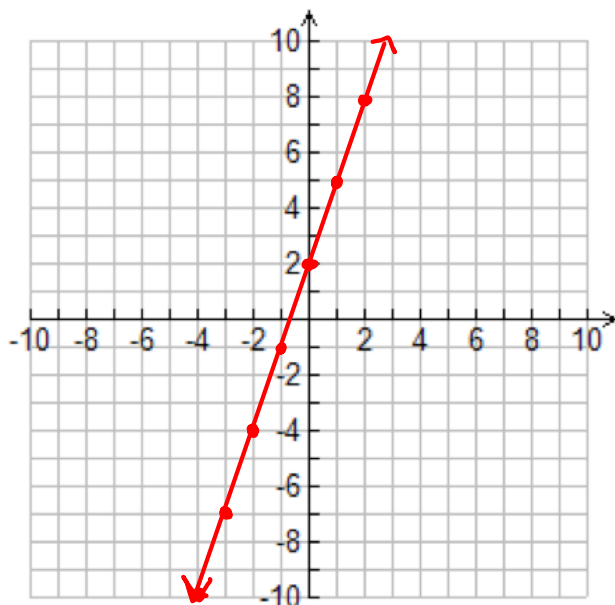**Step 2: Determine the y-intercept of the line**

$y = mx + b$

$2 = 3(0) + b$

$2 = b$

STEP 3: Write the equation of the line in slope y-intercept form.

$y = 3x + 2$

Step 4: Graph the line using the slope and y-intercept

Example 3: Determine the equation of a line that is parallel to the line $y = -2x - 7$ and passes through the point $(1, -3)$.

Step 1: State what you know about the line

> **Remember:** lines that are parallel have the same slope. They do not have the same y-intercept. You will still have to solve for that.

Slope: $m = -2$

Point: $(\overset{x}{1}, \overset{y}{-3})$

Step 2: Determine the y-intercept of the line

$y = mx + b$

$-3 = -2(1) + b$

$-3 = -2 + b$

$-3 + 2 = b$

$-1 = b$

STEP 3: Write the equation of the line in slope y-intercept form.

$y = -2x - 1$

Example 4: Determine the equation of a line that is perpendicular to the line $2x - y + 4 = 0$ and passes through the point (-2, 5).

Hint: to determine the slope you will need to put the equation into $y = mx + b$ form so that you can see the slope and then take the negative reciprocal.

$$2x - y + 4 = 0$$
$$2x + 4 = y$$
$$y = 2x + 4$$

STEP 1: state what you know about the line

Slope of given line: $M = 2$

Slope of perpendicular line (find negative reciprocal):

$$\underline{\text{—}} m = -\frac{1}{2}$$

Point on the perpendicular line: $(-\overset{x}{2}, \overset{y}{5})$

Step 2: Determine the y-intercept of the line (make sure to use the slope of the perpendicular line)

$$y = mx + b$$
$$5 = -\frac{1}{2}(-2) + b$$
$$5 = \frac{2}{2} + b$$
$$5 = 1 + b$$
$$5 - 1 = b$$
$$4 = b$$

STEP 3: Write the equation of the line in slope y-intercept form (make sure to use the slope of the perpendicular line).

$$y = -\frac{1}{2}x + 4$$

Consolidation:

To write the equation of a line you need to know the _Slope (m)_ and _y-intercept (b)_ .

You can use the slope of a line and a point on the line to calculate the _y-intercept_ .

To find the slope of a perpendicular line, find the _negative reciprocal._