

How Do We Write An Equation For A Line?

To write an equation for a line, determine its ^mslope and ^by-intercept. Then, use the slope-intercept formula: $y = mx + b$.

To write an equation for a line with a given slope and passing through a given point we:

Method:

- 1) Use the slope-intercept form of an equation, $y = mx + b$, and substitute the given value of the slope for "m"
- 2) Use the x and y values of the given point for the x and y in the equation.
- 3) Solve for "b" (the y-intercept.)
- 4) In the equation $y = mx + b$, replace "m" with the given slope and "b" with the value you found in step 3.

Example:

Write the equation of the line through (2, 16) that has a slope of -5

$y = mx + b$
 $m = -5$
 $b = 26$

$y = -5x + 26$

Work for b:

$y = mx + b$	$(2, 16)$
$16 = (-5)(2) + b$	x y
$16 = -10 + b$	$m = -5$
$+10 \quad +10$	$m = 4$
<u>$26 = b$</u>	$(2, 6)$

$y = mx + b$
 $m = 4$
 $b = -2$
 $y = 4x - 2$

Examples:

1) Write the equation of the line through (3, 5) that has a slope of 4

$y = mx + b$
 $m = 4$
 $b = -7$

$y = 4x - 7$

Work for b:

$y = mx + b$	$(3, 5)$
$5 = (4)(3) + b$	x y
$5 = 12 + b$	$m = 4$
$-12 \quad -12$	
<u>$-7 = b$</u>	

2) Write an equation of the line whose slope is 2, and that passes through the point (-3, 4).

$y = mx + b$
 $m = 2$
 $b = 10$

$y = 2x + 10$

Work for b:

$y = mx + b$	$(-3, 4)$
$4 = (2)(-3) + b$	x y
$4 = -6 + b$	$m = 2$
$+6 \quad +6$	
<u>$10 = b$</u>	

To write an equation for a line passing through two given points we:

Method:

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

- 1) Use the **slope formula** to find the slope of the line passing through the given points
- 2) In $y = mx + b$, replace m by the slope
- 3) Select one of the given points that is on the line and replace the x and y with those coordinate values.
- 4) Solve the resulting equation to find the value of b , the y -intercept.
- 5) Now replace b with its correct value and check to make sure that the coordinates of the second point satisfy the equation.

Example:

Write an equation of the line that passes through the points $(3, 7)$ and $(5, 15)$.

$$y = mx + b$$

$$m = 4$$

$$b = -5$$

$$y = 4x - 5$$

work for m :

$$\begin{matrix} (3, 7) & (5, 15) \\ x_1 & x_2 \\ y_1 & y_2 \end{matrix}$$

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

$$m = \frac{15 - 7}{5 - 3}$$

work for b :

$$y = mx + b \quad m = 4$$

$$7 = (4)(3) + b$$

$$7 = 12 + b$$

$$-12 \quad -12$$

$$-5 = b$$

$$m = \frac{15 - 7}{5 - 3}$$

$$m = \frac{8}{2}$$

$$m = 4$$

Extra:

$$\begin{matrix} (6, 5) & (8, 9) \\ x_1 & x_2 \\ y_1 & y_2 \end{matrix}$$

$$m = 2$$

$$b = -7$$

$$y = mx + b \quad m = 2$$

$$5 = (2)(6) + b$$

$$5 = 12 + b$$

$$-12 \quad -12$$

$$-7 = b$$

Examples:

- 1) Write an equation of the line that passes through the points $(2, 5)$ and $(4, 11)$.

$$y = mx + b$$

$$m = 3$$

$$b = -1$$

$$y = 3x - 1$$

$$\begin{matrix} (2, 5) & (4, 11) \\ x_1 & x_2 \\ y_1 & y_2 \end{matrix}$$

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

$$m = \frac{11 - 5}{4 - 2}$$

$$m = \frac{6}{2} \quad m = 3$$

$$y = mx + b \quad m = 3$$

$$(2, 5)$$

$$5 = (3)(2) + b$$

$$5 = 6 + b$$

$$-6 \quad -6$$

$$-1 = b$$

- 2) Write an equation of the line that passes through the points $(0, -2)$ and $(-3, -5)$

$$y = mx + b$$

$$m = 1$$

$$b = -2$$

$$y = 2x - 7$$

$$y = x - 2$$

$$y = 1x - 2$$

$$\begin{matrix} (0, -2) & (-3, -5) \\ x_1 & x_2 \\ y_1 & y_2 \end{matrix}$$

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

$$m = \frac{-5 - (-2)}{-3 - 0}$$

$$m = \frac{-3}{-3}$$

$$m = 1$$

$$y = mx + b \quad m = 1$$

$$(0, -2)$$

$$-2 = (1)(0) + b$$

$$-2 = 0 + b$$

$$-0 \quad -0$$

$$b = -2$$