# Writing Linear Equations $y = mx + b$

To write the equation of a line, we need two pieces of information, the slope and the y-intercept. Whether we are given a graph or numeric data, we will follow the same process. Find the slope and express it as a ratio comparing the change in y to the change in x and find the y-intercept. Once those two numbers are known, we can write the equation of the line that satisfies the given conditions.

## Three Scenarios

1. Given two points.
2. Given slope and one point.
3. Given slope and y-intercept.

## Formulas

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

$$y = mx + b$$

### Example: Given two points

Find the equation of the line that connects the given points $(-4, -6)$ *and* $(-2, 10)$.

**1. Substitute into the slope formula.**

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

$$\overbrace{(-4, -6)}^{(x_1,\ y_1)} \text{ and } \overbrace{(-2, 10)}^{(x_2,\ y_2)}$$

$$m = \frac{10-(-6)}{(-2)-(-4)} = \frac{16}{2} = 8$$

$m = 8$

**2. Substitute the slope and one of the given points into the slope-intercept form of the equation of a line.**

$$y = mx + b$$

$$-6 = (8)(-4) + b$$

$$-6 = -32 + b$$

$26 = b$

$y = 8x + 26$

### Example: Given slope and one point

Find the equation of the line that passes through the given point $(2, 3)$ and has the slop $m = -\frac{3}{2}$.

**1. Because you know the slope, you do not need to use the slope formula.**

$m = -\frac{3}{2}$

**2. Substitute the slope and the given point into the slope-intercept form.**

$$y = mx + b$$

$$3 = (-\tfrac{3}{2})(2) + b$$

$6 = b$

$y = -\frac{3}{2}x + 6$

## Example: Given slope and y-intercept

Find the equation of the line that has the given slope $m = \frac{2}{5}$ and y-intercept $b = 3$.

**Substitute the slope and y-intercept into the slope-intercept form of the equation of the line.**

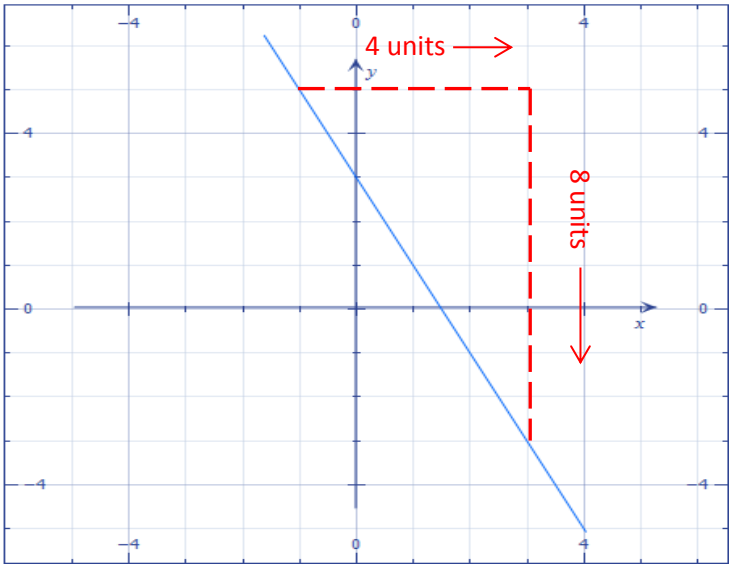
$m = \frac{2}{5}$

$b = 3$

$y = \frac{2}{5}x + 3$

## Example: Given a graph

Write the equation of the line graphed below.




The y-intercept is the point at which the line crosses the y-axis. The slope can be calculated using any two points on the line. Count the number of units to move from the leftmost point to a point on its right. Next count the number of units up or down to move from the leftmost point to the point on its right.

$m = \frac{\Delta y}{\Delta x} = \frac{-8}{4} = -2$

$m = -2$

$b = 3$

$y = -2x + 3$