Linear Equations & Graphs

There are four expressions of linear equations that you will have to know.

Horizontal Lines $y = b$

Vertical Lines $x = a$

Slope-Intercept Form $y = mx + b$

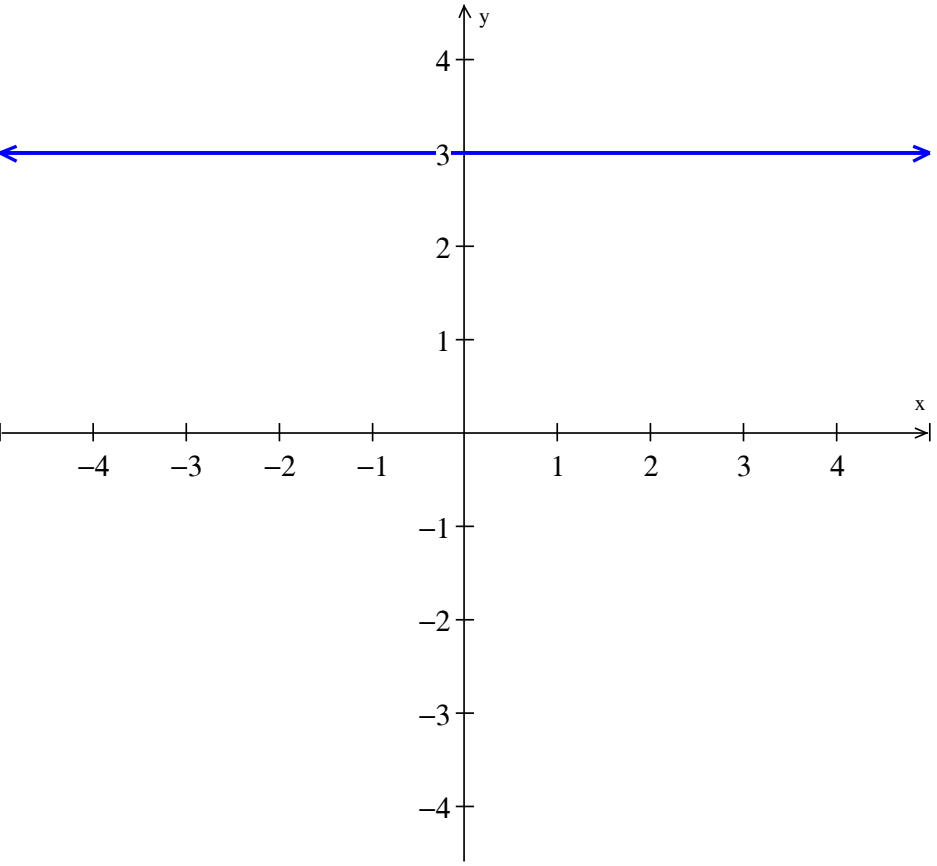
Point-Slope Form $y - y_0 = m(x - x_0)$

We'll talk about slope

There are four expressions of linear equations that you will have to know.

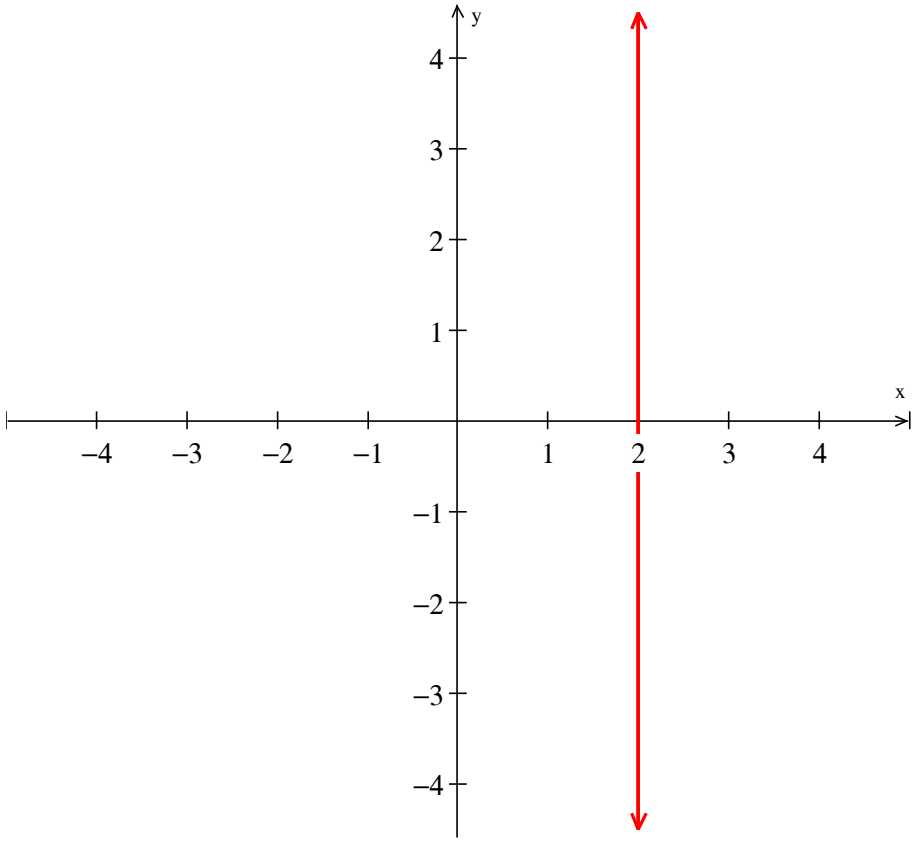
Horizontal Lines

$$y = 3$$



Vertical Lines

$$x = 2$$



There are four expressions of linear equations that you will have to know.

Slope Intercept Form $y = x + 1$

How do we know the graph looks like this?

Find the intercepts on each axis

$x = 0$

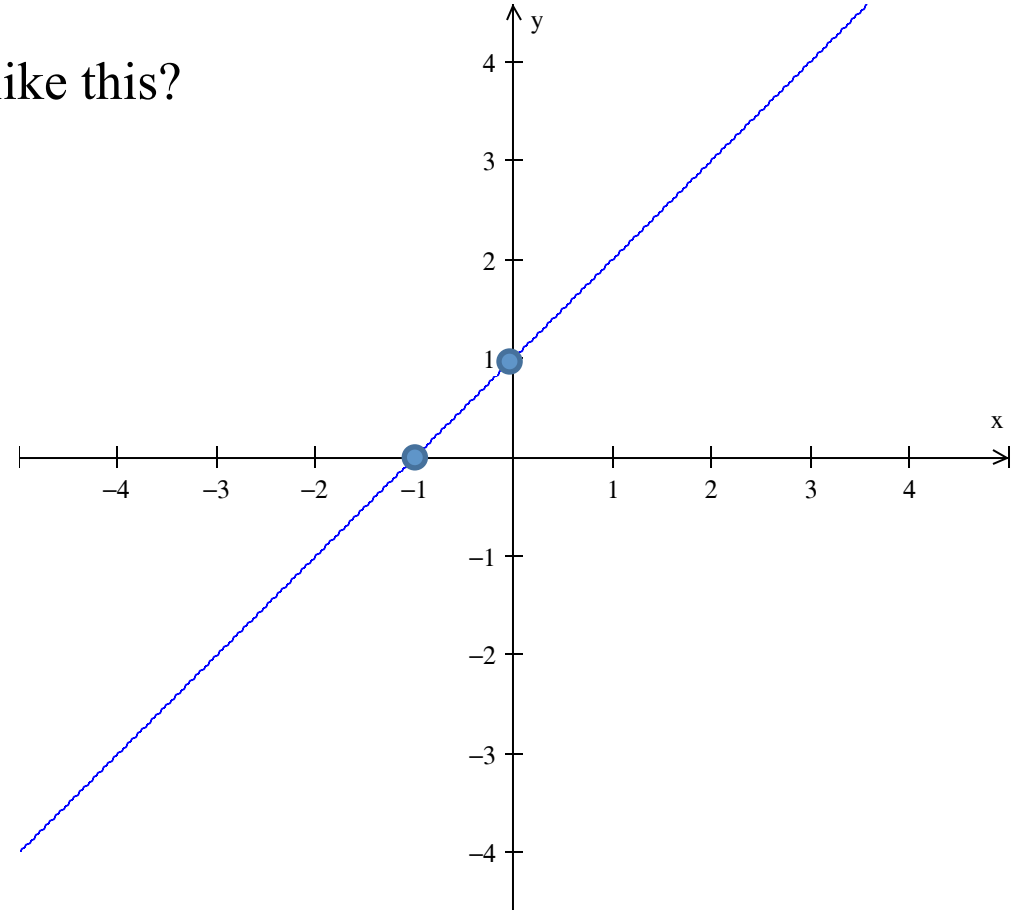
$y = 0 + 1$

$y = 1$

$y = 0$

$0 = x + 1$

$x = -1$



There are four expressions of linear equations that you will have to know.

Through two points you can only draw one line (That's from Chapter 1)

So here are two points: $(-1,0)$ $(0,1)$

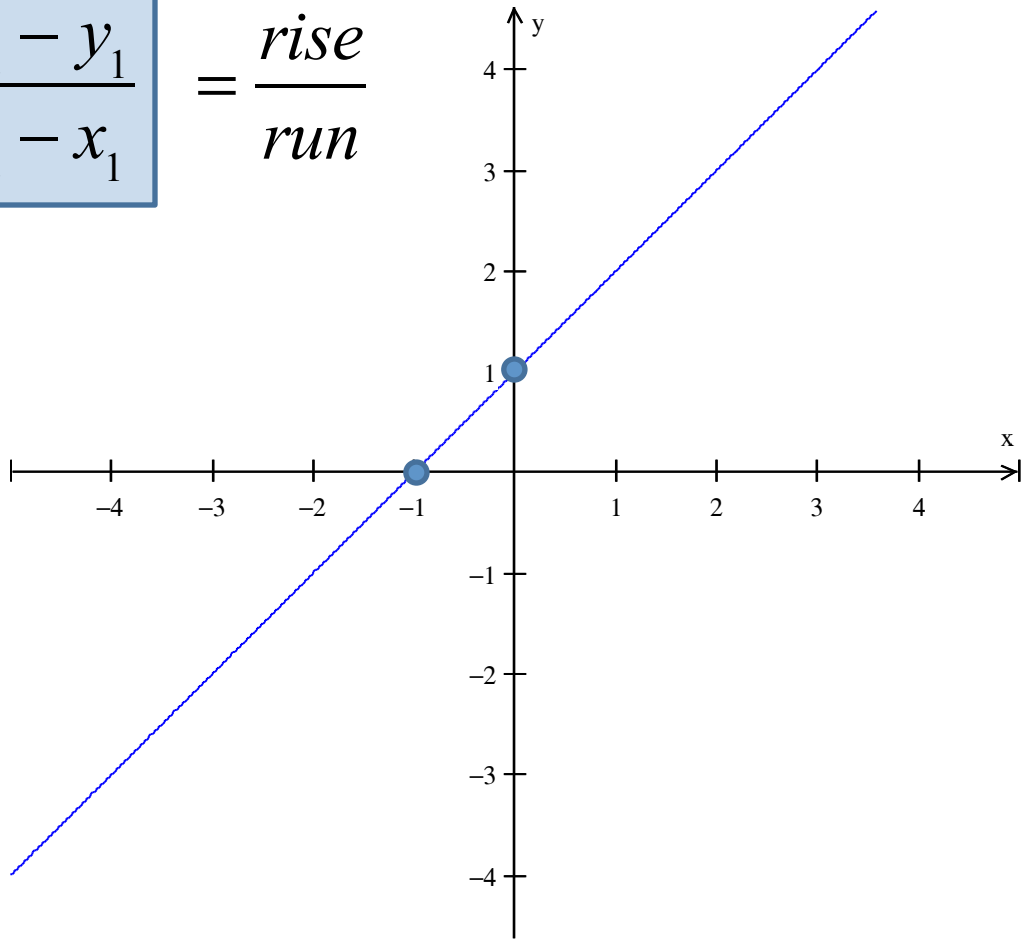
The slope m is defined as $\boxed{m = \dfrac{y_2 - y_1}{x_2 - x_1}} = \dfrac{rise}{run}$

(x_1, y_1) and (x_2, y_2)

can be *any* two points on the line

$$m = \frac{1-0}{0-(-1)} = 1$$

So the slope of this line is 1



There are four expressions of linear equations that you will have to know.

Slope-Intercept Form $y = mx + b$

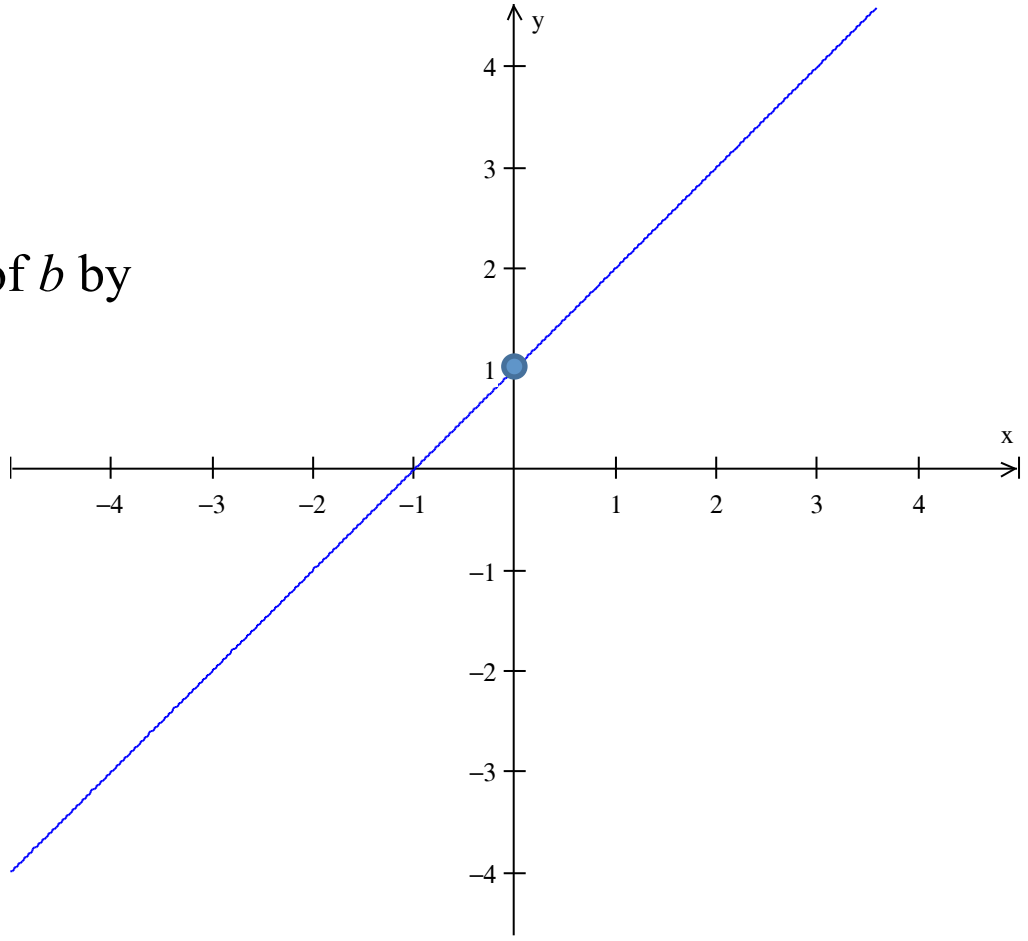
Since the slope is 1 we just need to find b

$$y = x + b$$

Notice that we can find the value of b by plugging in 0 for x

And we know that when $x = 0$, $y = 1$

$$y = x + 1$$



There are four expressions of linear equations that you will have to know.

Point-Slope Form

We can see that the point (2, 3) is also on this line

Point-slope says that we can do this:

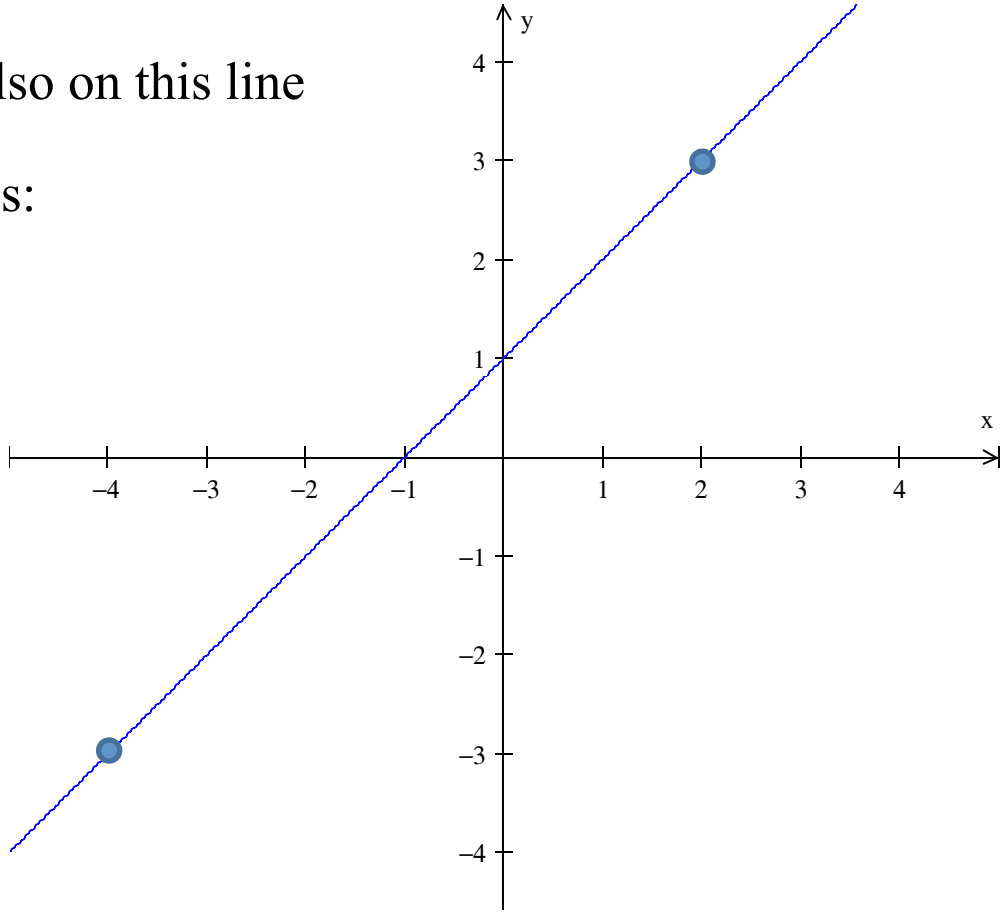
$$y - y_0 = m(x - x_0)$$

$$y - 3 = 1(x - 2)$$

Try it to see for sure that it works.

Now try (–4, –3)

$$y + 3 = 1(x + 4)$$



Write an equation (any form) of a line that passes through the points (1, 2) and (5, – 4).

First find the slope

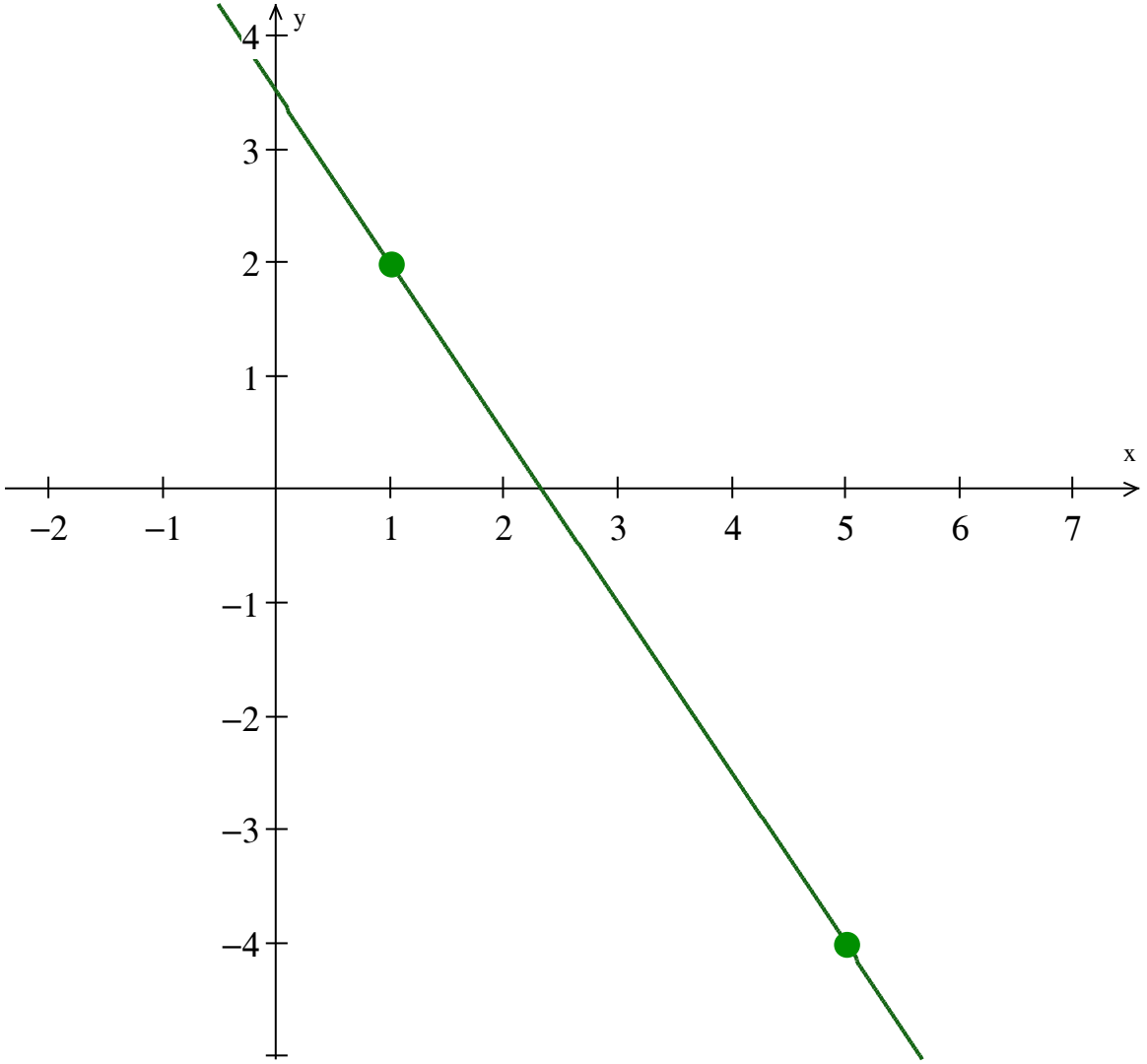
$$m = \frac{2+4}{1-5} = -\frac{3}{2}$$

$$y - y_0 = m(x - x_0)$$

$$y - 2 = -\frac{3}{2}(x - 1)$$

or

$$y + 4 = -\frac{3}{2}(x - 5)$$



Write an equation (any form) of a line that passes through the points (1, 2) and (5, – 4).

$$y-2=-\frac{3}{2}(x-1)$$

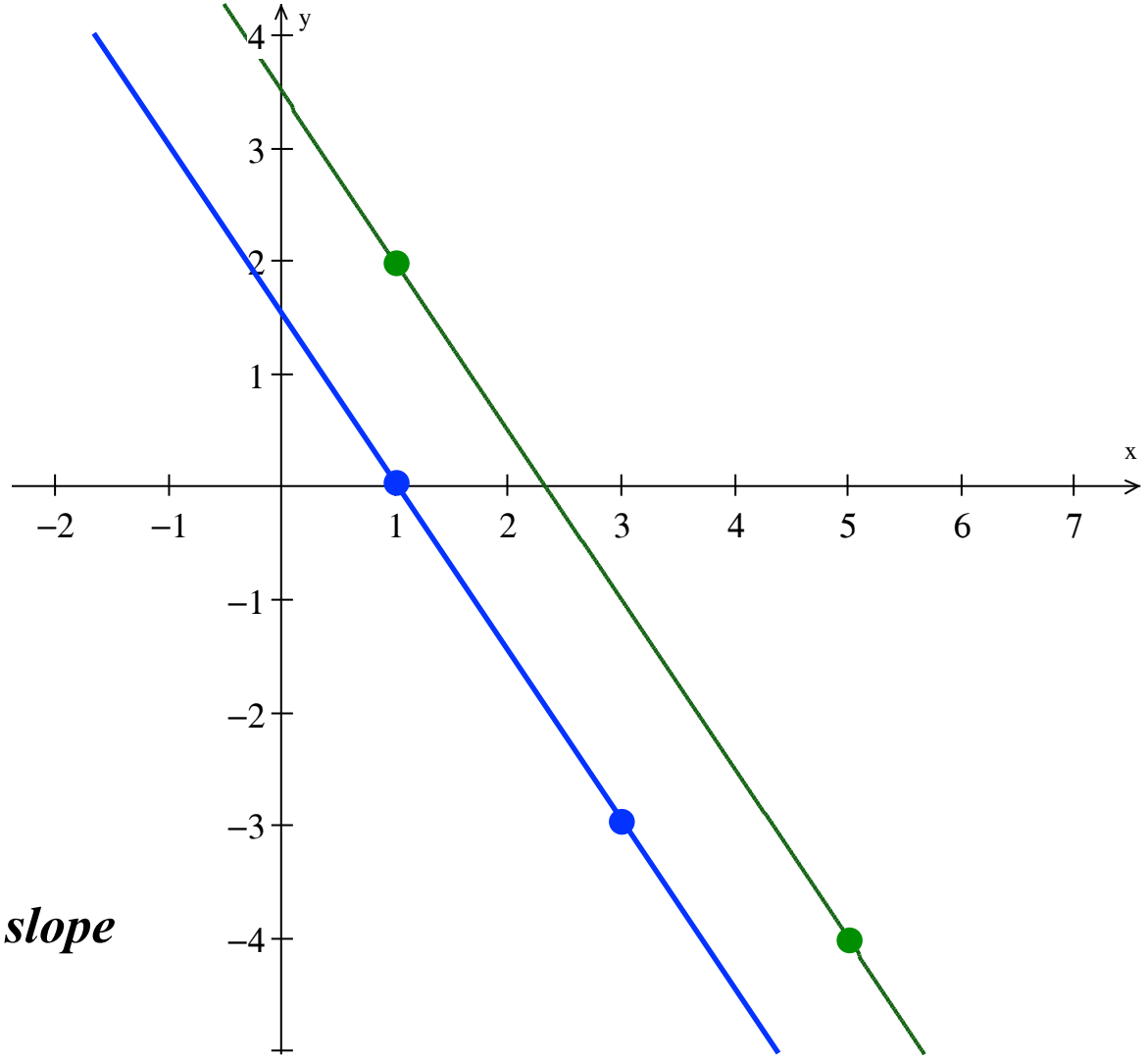
Here's another line through the points (1, 0) and (3, –3)

Find an equation for this line

$$y-0=-\frac{3}{2}(x-1)$$

Notice anything about these two lines and their equations?

Parallel Lines have the same slope



Write an equation (any form) of a line that passes through the points (1, 2) and (5, – 4).

$$y-2=-\frac{3}{2}(x-1)$$

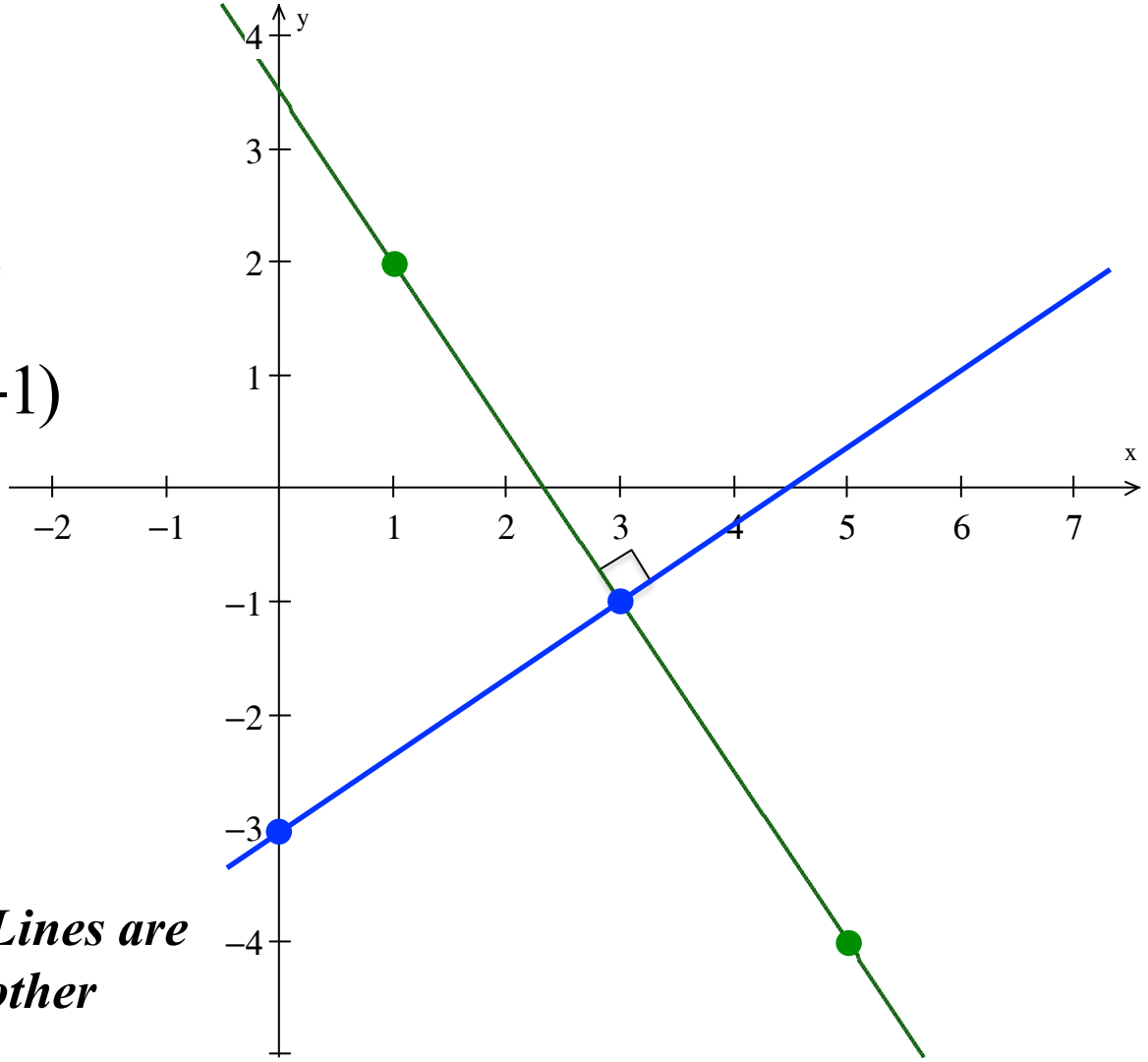
Here's another line through the point (0, –3) and intersecting the other line at the point $(3,-1)$

Find an equation for this line

$$y+1=\frac{2}{3}(x-3)$$

Notice anything about these two lines and their equations?

The slopes of Perpendicular Lines are negative reciprocals of each other



Parallel Lines Theorem

In a coordinate plane, two non-vertical lines are parallel *iff* they have the same slope

Perpendicular Lines Theorem

In a coordinate plane, two non-vertical lines are perpendicular *iff* the product of their slopes is –1

Vertical and horizontal lines are perpendicular

Pg 184

Wait. What does *iff* mean?

If and only if

So this also means that

In a coordinate plane, if two non-vertical lines are parallel then they have the same slope

In a coordinate plane, if two non-vertical lines have the same slope then they are parallel

In a coordinate plane, if two non-vertical lines are perpendicular then the product of their slopes is –1

In a coordinate plane, if the product of the slopes of two non-vertical lines is –1 then the lines are perpendicular