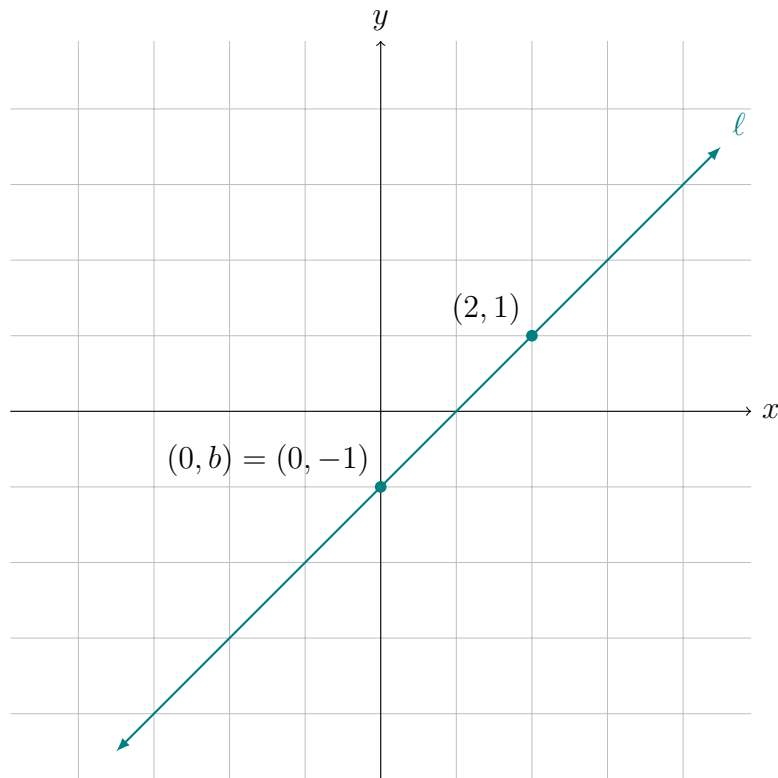


# Cartesian Plane: Slope-Intercept Formula for Lines

Video companion

## 1 Derivation using point-slope form



From last video, the equation of a line in point-slope form that passes through  $(2, 1)$  and has slope  $m = 1$  is

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

The  $y$ -intercept is at point  $(0, b)$ . To find  $b$ , we substitute that point into the definition of the line:

$$(0, b) \in \ell, \text{ so}$$

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

$$b = -1$$

Using the  $y$ -intercept in the equation for the line in point-slope form:

$$y - (-1) = 1(x - 0)$$

$$y + 1 = x$$

$$y = 1x - 1$$

## 2 Slope-intercept form

If  $\ell$  has slope  $m$ , and  $\ell$  hits the  $y$ -axis at  $(0, b)$ , then

$$\boxed{y = mx + b}$$

is an equation for  $\ell$ , where  $m$  is the slope and  $b$  is the  $y$ -intercept.

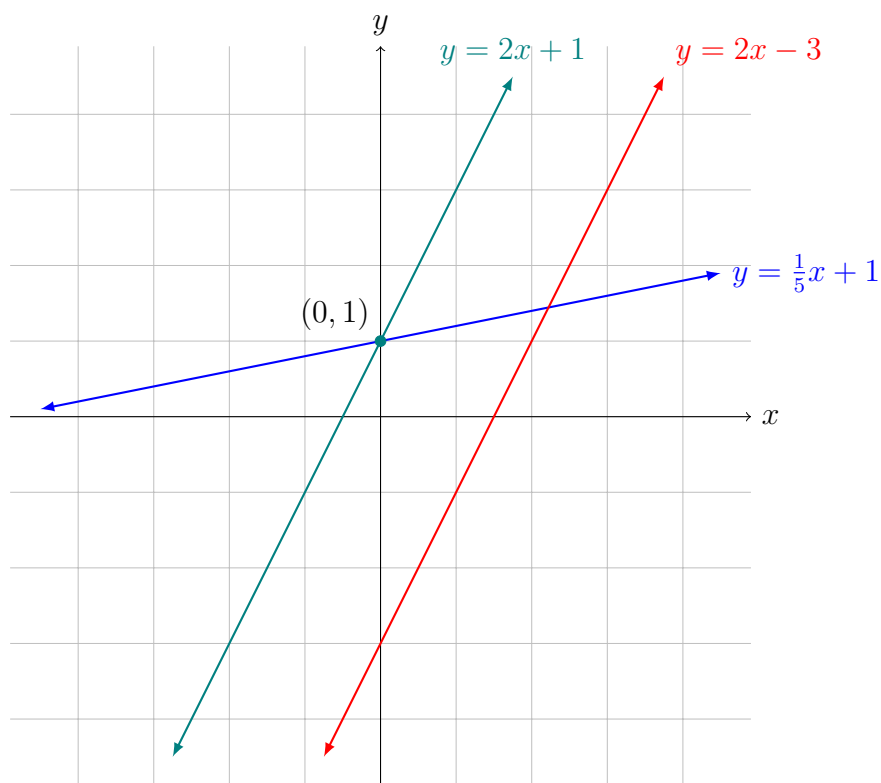
### 3 Drawing lines

Draw line with equation

$$y = 2x + 1$$

$$y = \frac{1}{5}x + 1$$

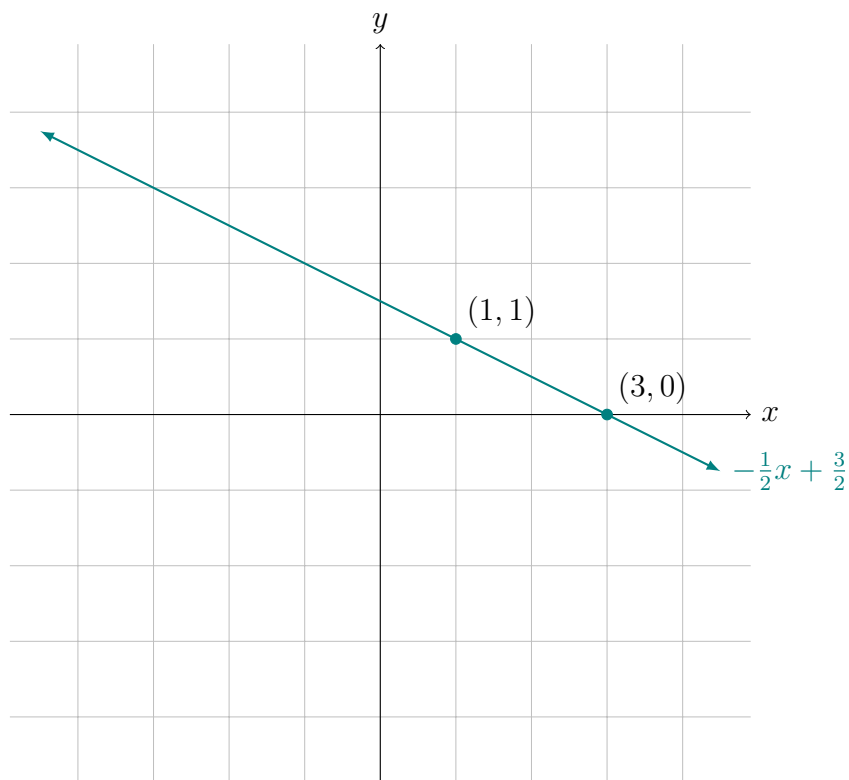
$$y = 2x - 3$$



The slope tells you how to angle the line, and the  $y$ -intercept tells you where to anchor it on the  $y$ -axis.

## 4 Example

**Problem:** Line  $\ell$  has points  $(1, 1)$  and  $(3, 0)$  on it. Find an equation for  $\ell$ .



Find the slope:

$$m = \frac{0 - 1}{3 - 1} = -\frac{1}{2}$$

Some possible equations for the line in point-slope form:

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

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

An equation for the line in slope-intercept form:

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