

Obtaining the Equation of a Line: Point and Slope (review)

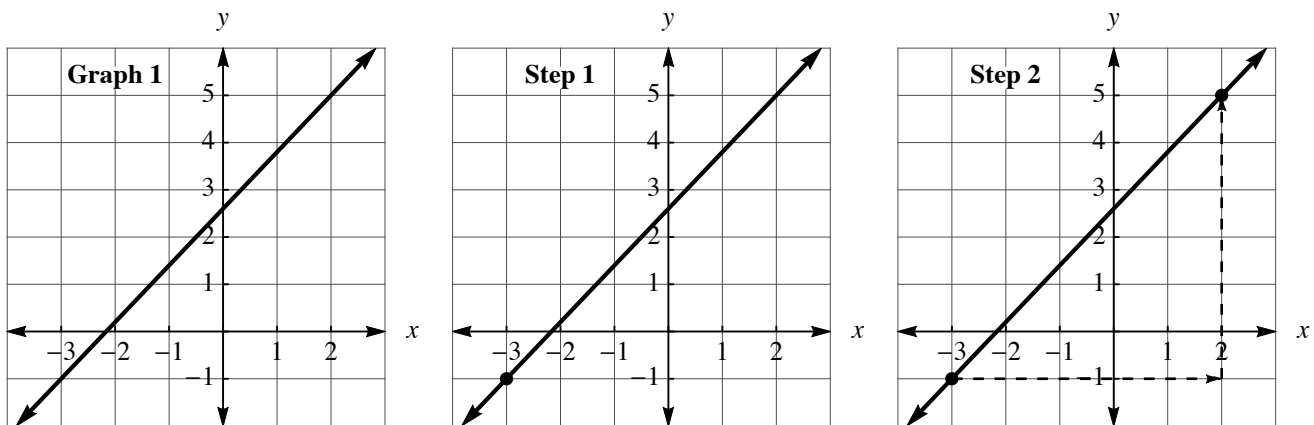
If you are given a graph with a line (or line segment) drawn and you are asked to find the equation of the line, the task can be broken down into three basic steps:

1. Find a point on the line: (x_1, y_1)
2. Find the slope of the line (which has the variable name m).
3. Use the *point-slope* form of the equation of the line, $y - y_1 = m(x - x_1)$, to obtain the equation.

The examples below illustrate.

Example 1

Find the equation of the line shown in Graph 1 below.



Step 1

Find a point on the line. By looking at the graph, we can see that the point $(-3, -1)$ is on the line. So,

$$x_1 = -3 \quad \text{and} \quad y_1 = -1$$

Step 2

Find the slope. To get the slope, we look for another point on the graph that has easy coordinates to identify. In this example, the point $(2, 5)$ is an obvious choice. Now that we have two points on the line, $(-3, -1)$ and $(2, 5)$, we can find the slope using:

$$m = \text{slope} = \frac{\text{rise}}{\text{run}} = \frac{6}{5}$$

Step 3

Now that we have the slope and a point on the line, we can substitute our values into the equations:

$$y - y_1 = m(x - x_1)$$

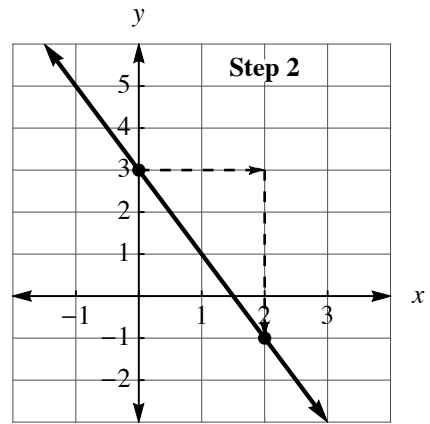
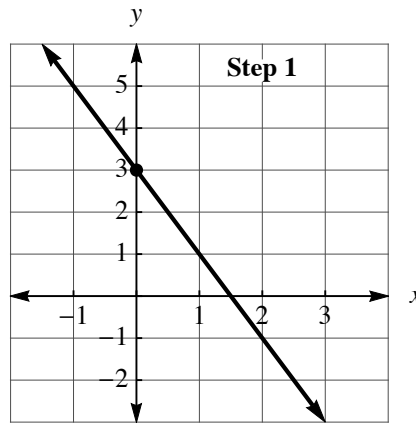
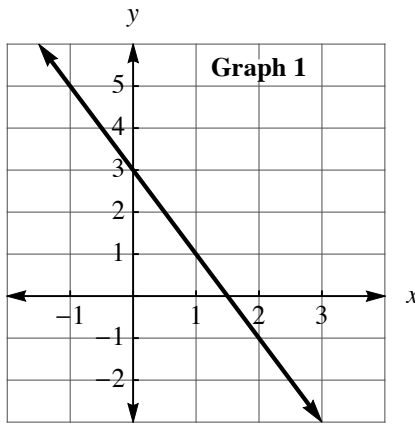
$$y - (-1) = \frac{6}{5}(x - (-3))$$

$$y + 1 = \frac{6}{5}(x + 3)$$

$$y = \frac{6}{5}(x + 3) - 1$$

Example 2

Find the equation of the line shown in Graph 2 below.



Step 1

Find the y -intercept, which is where the line crosses the y -axis. By looking at the graph, we can see the y -intercept is 3, so $b = 3$. This always means the point $(0, 3)$ is on the line.

Step 2

Find the slope. To get the slope, we look for another point on the graph that has easy coordinates to identify. In this example, the point $(2, -1)$ is one obvious choice. Now that we have two points on the line, $(0, 3)$ and $(2, -1)$, we can find the slope using:

$$m = \text{slope} = \frac{\text{rise}}{\text{run}} = \frac{-4}{2} = -2$$

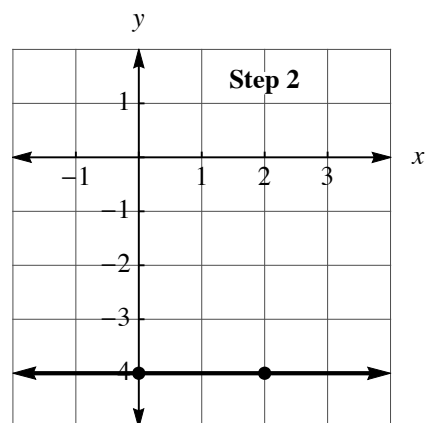
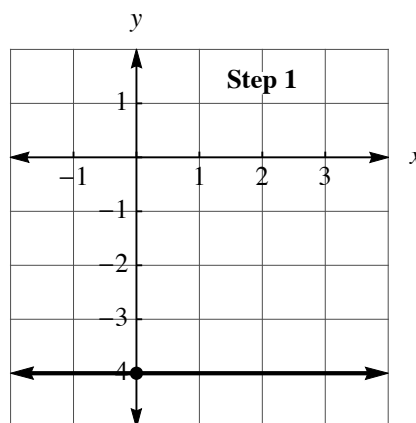
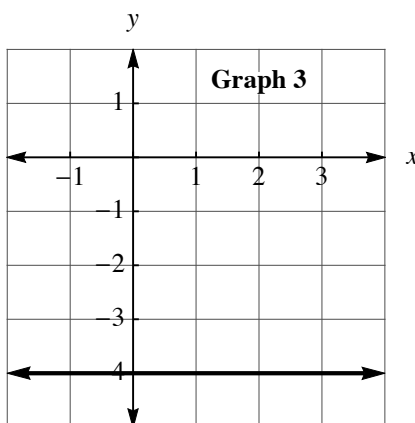
Step 3

Now that we have m and b , we can build the equation by substituting our values for m and b :

$$\begin{aligned} y &= mx + b \\ y &= (-2)x + (3) \\ y &= -2x + 3 \end{aligned}$$

Example 3

Find the equation of the line shown in Graph 3 below.



Step 1

Find the y -intercept, which is where the line crosses the y -axis. By looking at the graph, we can see the y -intercept is -4 , so $b = -4$. This always means the point $(0, -4)$ is on the line.

Step 2

Find the slope. In this case, the slope is clearly zero because it's a horizontal line:

$$m = \text{slope} = \frac{\text{rise}}{\text{run}} = \frac{0}{2} = 0$$

Step 3

Now that we have m and b , we can build the equation by substituting our values for m and b :

$$y = mx + b$$

$$y = (0)x + (-4)$$

$$y = -4$$