

Key Concepts

Lesson
12

Graphing Linear Equations

Objective Teach students to graph linear equations.

Note to the Teacher *The main idea of this lesson is that you can draw the graph of a linear equation once you know two points on the graph, by simply placing a ruler along the two points. It is typically easy to find two points on a graph when it is in one of the standard forms.*

First, introduce the following key idea.

Key Idea

If two points on a line are known, then the line can be drawn using a ruler.

Illustrate this idea on the chalkboard by using a straightedge to draw the line going through the two points at $(1, 2)$ and $(4, -2)$. Ask students, “How do we graph a line that is given to us in the form of an equation?” **Find two points on the line.**

Graphing Lines in Slope-Intercept Form

Example 1 Graph $y = 2x + 3$.

Solution Two points are needed to graph this equation, which is given in slope-intercept form. Since the y -intercept is 3, one point is $(0, 3)$. To find a second point, choose any other x value and compute the corresponding y value. For instance, choose $x = 1$.

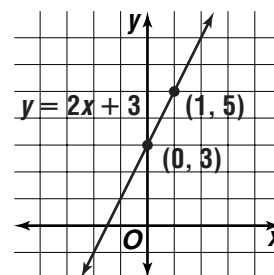
$$y = 2x + 3$$

$$y = 2(1) + 3 \quad \text{Replace } x \text{ with } 1.$$

$$y = 5$$

So the point at $(1, 5)$ is also on the line. Now graph the line as shown at the right.

This works for all lines in slope-intercept form. The y -intercept is always given and another point can be generated by substituting any other value for x .



Graphing Lines in Point-Slope Form

Example 2 Graph $y - 4 = 3(x - 2)$.

Solution One point on the line is easily found when an equation is in point-slope form. In this case, it is the point at $(2, 4)$. To find a second point, choose an x value different from 2, say 4, and substitute it into the equation.

$$y - 4 = 3(x - 2)$$

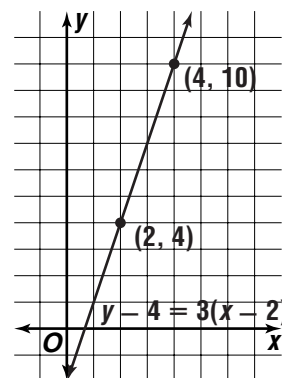
$$y - 4 = 3(4 - 2) \quad \text{Replace } x \text{ with } 4.$$

$$y - 4 = 3(2)$$

$$y - 4 = 6$$

$$y = 10 \quad \text{Add } 4 \text{ to each side.}$$

So the point at $(4, 10)$ is also on the line. Draw a line going through $(2, 4)$ and $(4, 10)$.



Equations in point-slope form can be graphed by first choosing the given point. Then generate a second point by substituting a different x value, and solving for y .

Graphing Other Linear Equations

Often equations are neither in slope-intercept form nor point-slope form. In this case, we can substitute any two different x values, and solve to find the corresponding y values.

Example 3 Graph $4x + 3y = 24$.

Solution Choose two x values, say $x = 0$ and $x = 2$. (We could have chosen any two different x values.) Use substitution to find the corresponding y values.

$$4x + 3y = 24$$

$$4(0) + 3y = 24 \quad \text{Replace } x \text{ with } 0.$$

$$3y = 24$$

$$y = 8 \quad \text{Divide each side by } 3.$$

The point at $(0, 8)$ is on the line.

$$4x + 3y = 24$$

$$4(2) + 3y = 24 \quad \text{Replace } x \text{ with } 2.$$

$$8 + 3y = 24$$

$$3y = 16 \quad \text{Subtract } 8 \text{ from each side.}$$

$$y = \frac{16}{3} \quad \text{Divide each side by } 3.$$

The point at $(2, \frac{16}{3})$ is also on the line.

Graph the line as shown.

