

# 1 Graphing Linear Equations in Two Variables 3.2

By the end of this section, you should be able to solve the following problems:

1. Find the missing values in each coordinate pair and graph the equation.

$$\{(? , 2), (4, ?), (? , 0)\}$$

$$2x + 3y = 2$$

2. Find the intercepts of the given equation.

$$-4x + 3y = 12$$

3. Graph the linear equation. Use intercepts where convenient.

$$2x - 3y = 1$$

4. Graph the linear equation. Use intercepts where convenient.

$$-x + 2y = 4$$

## 2 Concepts

When we graph a linear equation we always get a line. That means that it certainly should not be curved in any way, nor should it have any “elbow” joints in it. In our first example, we find three points and graph the line.

### 2.1 Example

Graph:

$$4x - 2y = 8.$$

for the values:

$$\{(1, ?), (?, 2), (2, ?)\}$$

In this example, we are given 2 values for  $x$  and one value for  $y$ , and our job is to find the missing values.

We substitute into the equation to find the missing value. We begin with  $x = 1$ .

$$4(1) - 2y = 8$$

$$4 - 2y = 8$$

$$-4 \quad -4$$

$$\overline{-2y = 4}$$

$$\frac{-2y}{-2} = \frac{4}{-2}$$

$$y = -2$$

For  $y = 2$  we have

$$4x - 2(2) = 8$$

$$4x - 4 = 8$$

$$4 \quad 4$$

$$\overline{4x = 12}$$

$$\frac{4x}{4} = \frac{12}{4}$$

$$x = 3$$

For  $x = 2$  we have

$$4(2) - 2y = 8$$

$$8 - 2y = 8$$

$$-8 \quad -8$$

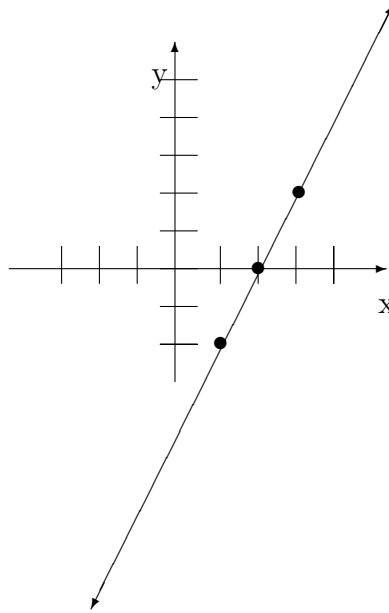
$$-2y = 0$$

$$\frac{-2y}{-2} = \frac{0}{-2}$$

$$y = 0$$

So the set of points we have to graph are:  $\{(1, -2), (3, 2), (2, 0)\}$

Below we have plotted the points and drawn the graph:



### 3 Concepts

In our next example, we use what are called the  $x$ -intercept and  $y$ -intercept to graph the equation. To find the  $x$ -intercept for any equation, simply replace the  $y$  variable with zero. Similarly, to find the  $y$ -intercept, simply replace the  $x$ -variable with zero. An example will illustrate.

### 3.1 Example

Use intercepts to graph the following equation.

$$2x - 3y = -6$$

To get one  $x$ -intercept we replace  $y$  with 0.

$$2x - 3(0) = -6$$

$$2x = -6$$

$$\frac{2x}{2} = \frac{-6}{2}$$

$$x = -3$$

So the  $x$ -intercept is  $(-3,0)$ . To find the  $y$ -intercept we replace  $x$  with 0 in the equation.

$$2x - 3y = -6$$

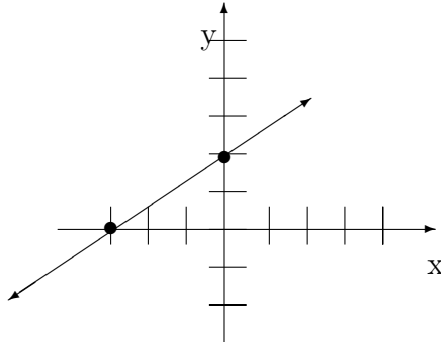
$$2(0) - 3y = -6$$

$$-3y = -6$$

$$\frac{-3y}{-3} = \frac{-6}{-3}$$

$$y = 2$$

So the  $y$ -intercept is  $(0,2)$ . The graph is below



## 4 Facts

1. The equation of the  $y$ -axis is  $x = 0$ .
2. The equation of the  $x$ -axis is  $y = 0$ .
3. To find the  $x$ -intercept replace  $y$  with 0 in the equation and solve for  $x$ .
4. To find the  $y$ -intercept, replace  $x$  with zero in the equation and solve

for  $y$ .

## 5 Exercises

1. Find the missing value in each coordinate pair and graph the equation.

$$\{( , 2), (4, ), ( , 0)\}$$

$$2x + 3y = 2$$

2. Find the intercepts for the given equation.

$$-4x + 3y = 12$$

3. Graph the linear equation. Use intercepts where convenient.

$$2x - 3y = 1$$

4. Graph the linear equation. Use intercepts where convenient.

$$-x + 2y = 4$$

## 6 Solutions

1. Find the missing value in each coordinate pair and graph the equation.

$$\{( , 2), (4, ), ( , 0)\}$$

$$2x + 3y = 2$$

For  $y = 2$  we have

$$2x + 3(2) = 2$$

$$2x + 6 = 2$$

$$-6 \quad -6$$

$$\overline{2x = -4}$$

$$\frac{2x}{2} = \frac{-4}{2}$$

$$x = -2$$

For  $x = 4$

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

$$8 + 3y = 2$$

$$-8 \quad -8$$

$$\overline{3y = -6}$$

$$\frac{3y}{3} = \frac{-6}{3}$$

$$y = -2$$

For  $y = 0$

$$2x + 3(0) = 2$$

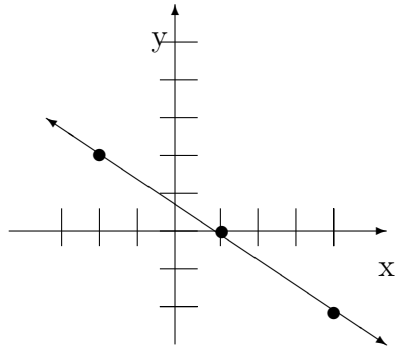
$$2x = 2$$

$$\frac{2x}{2} = \frac{2}{2}$$

$$x = 1$$

Therefore, we have:

$$\{(-2, 2), (4, -2), (1, 0)\}$$



2. Find the intercepts for the given equation.

$$-4x + 3y = 12$$

For  $x = 0$

$$-4(0) + 3y = 12$$

$$3y = 12$$

$$\frac{3y}{3} = \frac{12}{3}$$

$$y = 4$$

For  $y = 0$

$$-4x + 3(0) = 12$$

$$-4x = 12$$

$$\frac{-4x}{-4} = \frac{12}{-4}$$

$$x = -3$$

The intercepts are:

$$\{(0, 4), (-3, 0)\}$$

3. Graph the linear equation. Use intercepts where convenient.

$$2x - 3y = 1$$

We substitute in  $x = 2$  so we get a number evenly divisible by 3 on the other side of the equation.

For  $x = 2$

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

$$4 - 3y = 1$$

$$-4 \quad -4$$

$$\hline -3y = -3$$

$$\frac{-3y}{-3} = \frac{-3}{-3}$$

$$y = 1$$

We substitute in  $y = 3$  so we get a number evenly divisible by 2 on the other side of the equation. For  $y = 3$

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

$$2x - 9 = 1$$

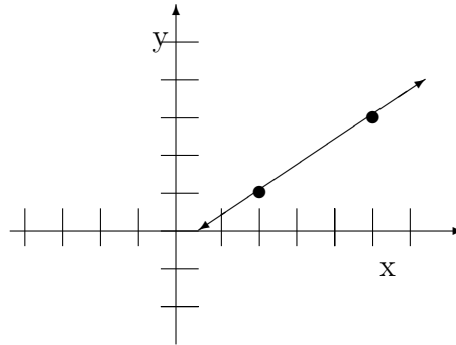
$$9 \quad 9$$

$$\overline{2x = 10}$$

$$\frac{2x}{2} = \frac{10}{2}$$

$$x = 5$$

Using (2,1) and (5,3) we graph the equation.



4. Graph the linear equation. Use intercepts where convenient.

$$-x + 2y = 4$$

For  $x = 0$

$$-(0) + 2y = 4$$

$$2y = 4$$

$$\frac{2y}{2} = \frac{4}{2}$$

$$y = 2$$

For  $y = 0$

$$-x + 2(0) = 4$$

$$-x = 4$$

$$x = -4$$

Using  $(0,2)$  and  $(-4,0)$  we graph the equation

