

# 4.2

## Graph Linear Equations

**Goal** • Graph linear equations in a coordinate plane.

### Your Notes

#### VOCABULARY

**Solution of an equation in two variables** An ordered pair  $(x, y)$  that produces a true statement when the values of  $x$  and  $y$  are substituted into the equation

**Graph of an equation in two variables** The set of points in a coordinate plane that represents all solutions of the equation

**Linear equation** An equation whose graph is a line

**Standard form of a linear equation**  $Ax + By = C$ , where  $A$ ,  $B$ , and  $C$  are real numbers and  $A$  and  $B$  are not both zero

**Linear function** The equation  $Ax + By = C$  represents a linear function provided  $B \neq 0$  (that is, provided the graph of the equation is not a vertical line).

#### Example 1 Graph an equation

Graph the equation  $x + y = 4$ .

#### Solution

**Step 1** Solve the equation for  $y$ .

$$x + y = 4$$

$$y = 4 - x$$

**Step 2** Make a table.

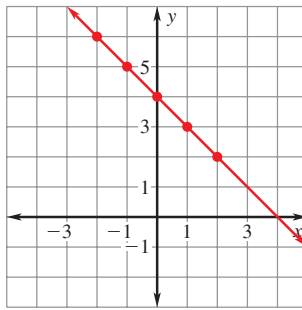
Choose a few values for  $x$  and find the values for  $y$ .

$x$	-2	-1	0	1	2
$y$	6	5	4	3	2

Use convenient values for  $x$  when making a table. These should include a combination of negative values, zero, and positive values.

## Your Notes

**Step 3** Plot the points.



**Step 4** Connect the points by drawing a line through them. Use arrows to indicate that the graph goes on without end.

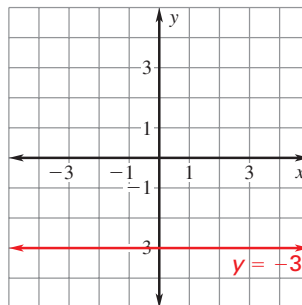
The equations  $y = -3$  and  $0x + 1y = -3$  are equivalent. For any value of  $x$ , the ordered pair  $(x, -3)$  is a solution of  $y = -3$ .

**Example 2** Graph  $y = b$  and  $x = a$

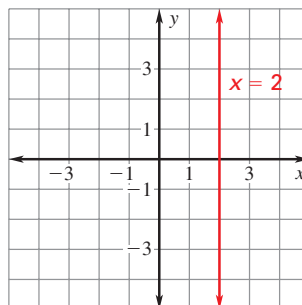
Graph (a)  $y = -3$  and (b)  $x = 2$ .

**Solution**

a. Regardless of the value of  $x$ , the value of  $y$  is always  $-3$ . The graph of  $y = -3$  is a horizontal line 3 units below the  $x$ -axis.



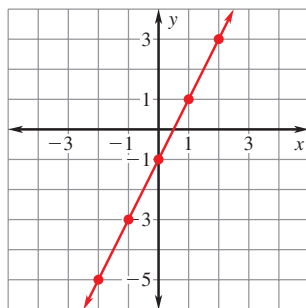
b. Regardless of the value of  $y$ , the value of  $x$  is always  $2$ . The graph of  $x = 2$  is a vertical line 2 units to the right of the  $y$ -axis.



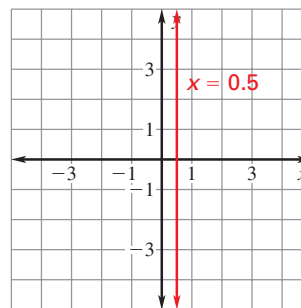
## Your Notes

### ✓ Checkpoint Graph the equation.

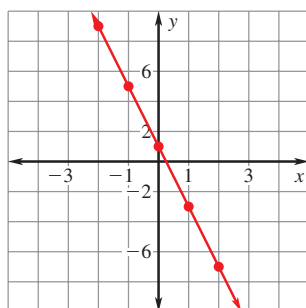
1.  $y = 2x - 1$



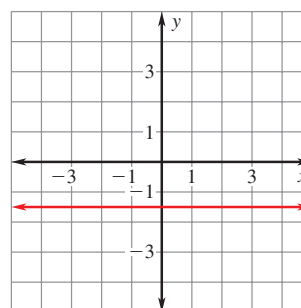
2.  $x = 0.5$



3.  $y = -4x + 1$



4.  $y = -1.5$



### EQUATIONS OF HORIZONTAL AND VERTICAL LINES

1. The graph of  $y = b$  is a horizontal line.
2. The line of graph  $y = b$  passes through the point  $(0, b)$ .
3. The graph of  $x = a$  is a vertical line.
4. The line of graph  $x = a$  passes through the point  $(a, 0)$ .

## Your Notes

### Example 3 Graph a linear function

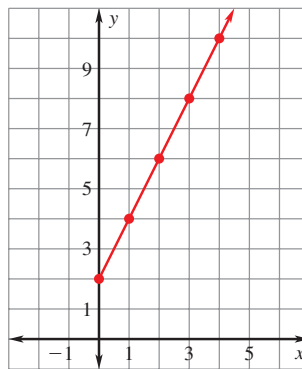
Graph the function  $y = 2x + 2$  with domain  $x \geq 0$ . Then identify the range of the function.

#### Solution

Step 1 Make a table.

$x$	0	1	2	3	4
$y$	2	4	6	8	10

Step 2 Plot the points.

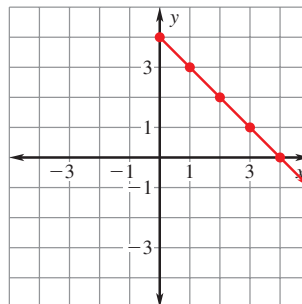


Step 3 Connect the points with a ray because the domain is restricted.

Step 4 Identify the range. From the graph, you can see that all points have a  $y$ -coordinate of 2 or more, so the range of the function is  $y \geq 2$ .

✓ **Checkpoint** Complete the following exercise.

5. Graph the function  $y = -x + 4$  with domain  $x \geq 0$ . Then identify the range of the function.



range:  $y \leq 4$

## Homework