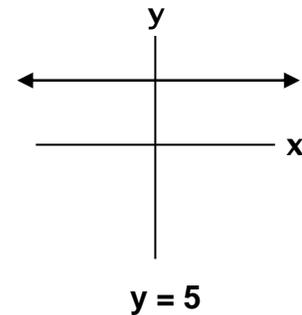
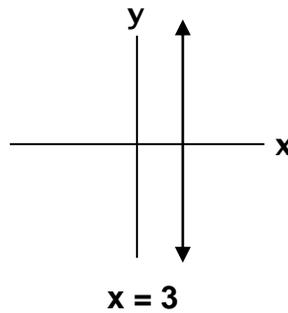
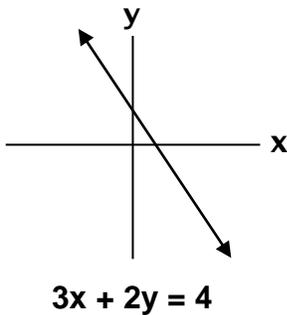


# Graphing Linear Equations

A linear equation has variables  $x$  and  $y$  with exponents of 1. The standard form of a linear equation is  $Ax + By = C$ , where  $A$  and  $B$  cannot both be zero. (Example:  $2x + y = 5$ .) Linear equations are among the easiest equations to graph with a pencil and paper.

## Examples of linear equations and their graphs:



There are several ways to graph the solutions of a linear equation. One of the most common methods involves using a t-chart, which lists pairs of  $x$  and  $y$  values that satisfy (solve) the equation. We start by choosing a number for  $x$ , substituting it into the equation and then solving for  $y$ . We'll use our example,  $2x + y = 5$ .

Choose 1 for  $x$  and solve for  $y$ .

$$\begin{aligned} 2x + y &= 5 \\ 2(1) + y &= 5 \\ 2 + y &= 5 \\ y &= 5 - 2 \\ y &= 3 \end{aligned}$$

So, when  $x = 1$ ,  $y = 3$ .

Choose 0 for  $x$  and solve for  $y$ .

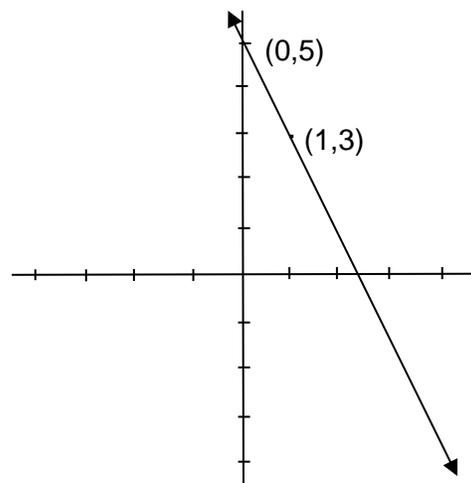
$$\begin{aligned} 2x + y &= 5 \\ 2(0) + y &= 5 \\ 0 + y &= 5 \\ y &= 5 - 0 \\ y &= 5 \end{aligned}$$

So, when  $x = 0$ ,  $y = 5$ .

Put the values in the t-chart. Find and list more values, if needed, for the graph.

X	Y
1	3
0	5
4	-3

Plot the points from the t-chart as ordered pairs  $(1, 3)$  and  $(0, 5)$  on the graph. After that, draw a line through the points. The arrow heads on the line show that solutions to the equation extend past the ends of the line graphed.



# Graphing Linear Equations

Another way to graph a linear equation involves changing the form of the equation to the slope-intercept form of the equation. This form ( $y = mx + b$ ) allows us to easily identify the slope ( $m$ ) and the y-intercept ( $b$ ). Let's use an example that is different from the earlier one.

$$x - 3y = 3$$

If we take the original equation  $x - 3y = 3$  and solve for  $y$ , it should look like  $y = mx + b$

Start with the original equation.

$$x - 3y = 3$$

Add  $-x$  to both sides.

$$-3y = -x + 3$$

Divide both sides by  $-3$ .

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

Simplify to put in slope-intercept form.

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

So, the slope ( $m$ ) is  $\frac{1}{3}$  and the y-intercept ( $b$ ) is  $-1$ .

## Graphing the line $y = \frac{1}{3}x - 1$

First, we plot the y-intercept  $(0, -1)$ . Then we use the slope to determine the location of the next point to plot. The slope of a line is a ratio of the change in the y values to the change in the x values of two points (also called rise over run). A slope of  $\frac{1}{3}$  tells us that the change in y (or rise) is 1 and the change in x (or run) is 3. This means that from  $(0, -1)$  we would go up 1 and to the right 3 to find our next point  $(0 + 3, -1 + 1)$ , which will be  $(3, 0)$ . Connect the two points to graph the line.

