~~Section 8.3~~ Graphing Linear Equations

Sometimes we will see equations that have two variables for example, $y = 3x + 5$. The variables are x and y, because we do not know what numbers they stand for. So, it is our job to find out what numbers we can substitute in for x and y to make the equation true. So here is how you do it,

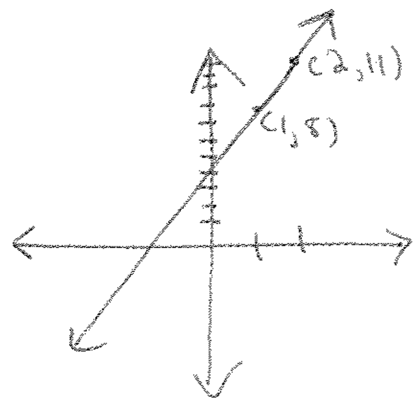
1) Pick any number for x (I would recommend picking a small number that is easy to work with like -1, 0, or 1)
2) Plug your number in for x and solve the equation, so let's say we picked the number 1, now the equation reads $y = 3(1) + 5$; by using the order of operations we see that $y = 8$. In a table, which I have written below record your data.
3) Now repeat this process of picking a number for x and solving the equation three more times.
4) After you have four values for x, and four values for y; graph the ordered pairs and connect the dots with a straight line.

$y = 3x + 5$

X	Y	Graph Point
1	8	(1, 8)
2	11	(2, 11)

$$\boxed{\begin{aligned} y &= 3(1)+5 \\ y &= 3+5 \\ y &= 8 \end{aligned}}$$

$$\boxed{\begin{aligned} y &= 3(2)+5 \\ y &= 6+5 \\ y &= 11 \end{aligned}}$$



Linear equation – an equation for which the graph is a straight line

Sometimes you may be given an equation like $y = -3x + 4$ and they give you the ordered pair (5, 2). They may then ask if (5, 2) is a solution to the equation. It is a solution only if you can plug in the x and y value and the two sides remain equal. Let me show you what I mean. Remember the first number in the parentheses always stands for the x value and the second number is the y value.

$y = -3x + 4$ (5, 2)
(x, y)

$2 = -3(5) + 4$

$2 = -15 + 4$

$2 = -11$ False, the ordered pair is not a solution to the equation.

Slope

~~Section 8.6 Slope~~

There are an infinite amount of lines that you can draw, so we have come up with some ways to classify or describe lines. One of the ways is ***slope*** which we are going to talk about today. Basically, slope describes the steepness of a line. Some lines are very steep and have a large slope while others are not that steep at all and have a small slope.

When determining a line's slope we always look at the line from the left to the right, if the *line rises then it has a positive slope*, if the line falls then it has a negative slope

Slope can be defined as a line's change in x over change in y, rise over run, or a simple equation. I have listed them beneath this for you.

$$m = \frac{\text{rise}}{\text{run}} \qquad m = \frac{y_2 - y_1}{x_2 - x_1}$$

$m = \text{slope}$

If two points are given to you like (4, 6) and (2, 5) you can find the slope of the line that passes through those two points by using the slope formula. It is always important to label your x and y coordinates so as not to mess up the equation.

$$\overset{x_1,\ y_1}{(4, 6)} \qquad \overset{x_2\ \ y_2}{(2, 5)}$$

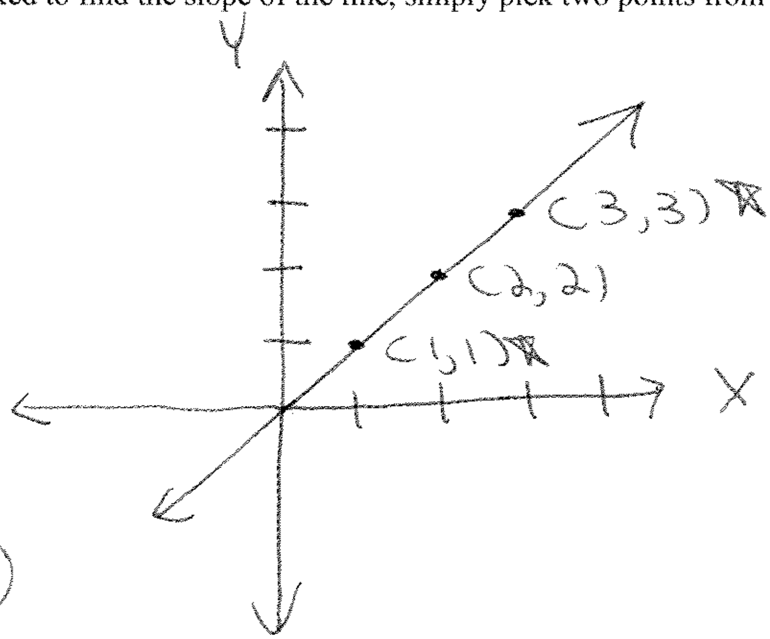
$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{5-6}{2-4} = \frac{-1}{-2} = \frac{1}{2}$$

If you are given a line and asked to find the slope of the line, simply pick two points from the line and put them in the slope formula.

$$\overset{x_2,\ y_2}{(3,3)} \qquad \overset{x_1,\ y_1}{(1,1)}$$

$$\frac{y_2 - y_1}{x_2 - x_1}$$

$$\frac{3-1}{3-1} = \frac{2}{2} = 1$$

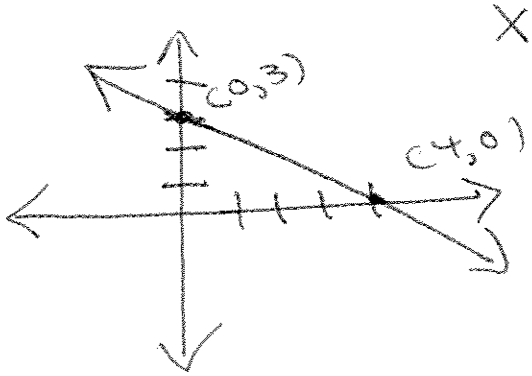


Intercepts

~~Section 8.7 Intercepts~~

There are an infinite amount of lines that you can draw, so we have come up with some ways to classify or describe lines. We have already talked about slope, so now we will talk about intercepts. If a line crosses the x and y axis on a graph, then it has two intercepts the **x-intercept and y-intercept.**

The **x-intercept** is the x-coordinate of where a line crosses the x-axis.
The **y-intercept** is the y-coordinate of where a line crosses the y-axis.
You can locate both of these from a graph.



x-int = 4

y-int = 3

If you are not given a graph and just an equation you can still find out the lines x and y intercepts.
Example: $y = 3x + 9$

<u>For an x-intercept, make the y a zero and solve for x</u>

$$0 = 3x + 9$$
$$-9 = \quad -9$$
$$\frac{-9}{3} = \frac{3x}{3}$$
$$-3 = x$$

<u>For a y-intercept, make the x a zero and solve for y</u>

$$y = 3(0) + 9$$
$$y = 9$$

When an equation is written in the form $y = mx + b$, it is said to written in ***<u>slope-intercept form</u>***, the m stands for slope and the b stands for y-intercept.

$$y = 3x + 5$$

y-int. = 5

Slope = 3

x-int

$$0 = 3x + 5$$
$$-5 = \quad -5$$
$$\frac{-5}{3} = \frac{3x}{3}$$
$$\boxed{-\frac{5}{3} = x}$$