Name____________________________

Algebra2
Lesson 2-2 part 1
Linear Equations

When driving, we consider several things. What is our speed? miles per hour (MPH). How many miles do we get per gallon of gas? miles per gallon (MPG). These are a special kind of ratio, a **rate.** The idea of a rate can be expanded to functions and their graphs. Because rate is constant, we can use to graph linear equations. Functions with a constant rate of change are called **linear functions** and have the form of **y=mx+b**, where m and be are constants.

The constant **m** is called the rate of change. The rate of change is the ratio between any two f(x) values and their corresponding x-values. In other words:

$$rate\ of\ change = \frac{change\ in\ f(x)}{change\ in\ x} = \frac{f(x_2) - f(x_1)}{x_2 - x_1}$$

Example: Does the xy table have a constant rate of change?

x	0	2	4	6	8
f(x)	1	-2	4	7	10

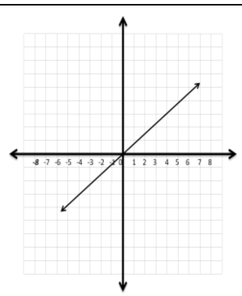
Pick any two (x,f(x)) pairs and you will find that the rate of change is the same.

$$rate\ of\ change = \frac{change\ in\ f(x)}{change\ in\ x} = \frac{f(x_2) - f(x_1)}{x_2 - x_1} = \frac{7-1}{6-4} = \frac{6}{2} = \frac{3}{1}$$

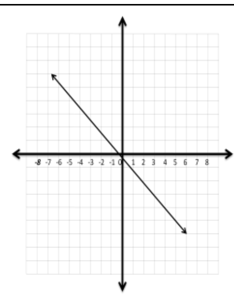
A constant rate of change has another name – **slope**. We are used to calling it "rise over run" or $\frac{rise}{run}$. Formally,

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

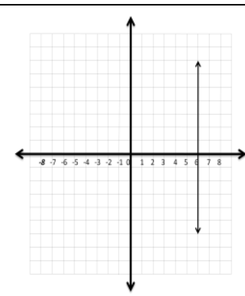
If we were to translate slope into a graph, we would get four (4) possible types of slope. The slope of a line refers to its steepness. The larger the slope value, the steeper the line gets.



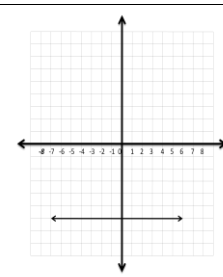
(__________slope)



(__________slope)



(__________slope)

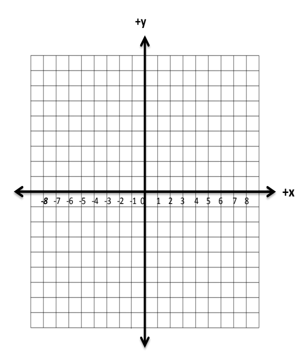


(__________slope)

A slope makes graphing a line from a given point very easy.

Example: Graph a line through (-1,-2) with a slope of $\frac{2}{3}$.

Plot (-1,-2), then rise 2 and run right 3. Plot a second point. Rise 2 more then run right 3 more. Plot a third point, and so on.



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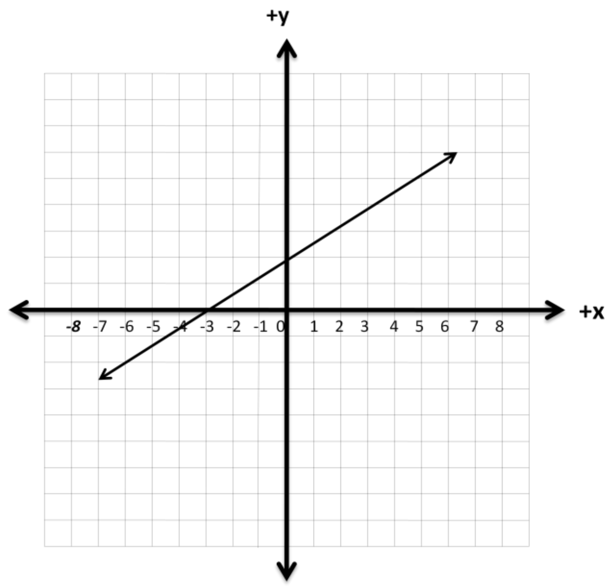
Notice that lines tend to cross the x-axis or y-axis or both. The location where a line crosses the x-axis is called the x-intercept, while the location where a line crosses the y-axis is called the y-intercept. In general,

y-intercept has the form (0,y) x-intercept has the form (x,0)

Example:

state the x and y intercepts for the graph at the right. The line crosses the y-axis at 2, so the y-intercept = (0,2) The line crosses the x-axis at -3, so the x-intercept = (-3,0)	

Putting the ideas about slope, intercepts lead to a general equation form for a line called the slope-intercept form: y=mx+b, where m is the slope and b is the y-intercept. The slope-intercept form allows one to graph almost any linear equation in just a few seconds WITHOUT the use of a graphing calculator. Recall that the slope-intercept form of a line, y=mx+b is very useful.

y-intercept

y=mx+b

slope

Though graphing calculators can make quick work of graphing any equation, it is best to balance technology with algebraic knowledge. Choose the “standard” square window when using a graphing calculator.
[ZOOM>ZSTANDARD, ENTER].