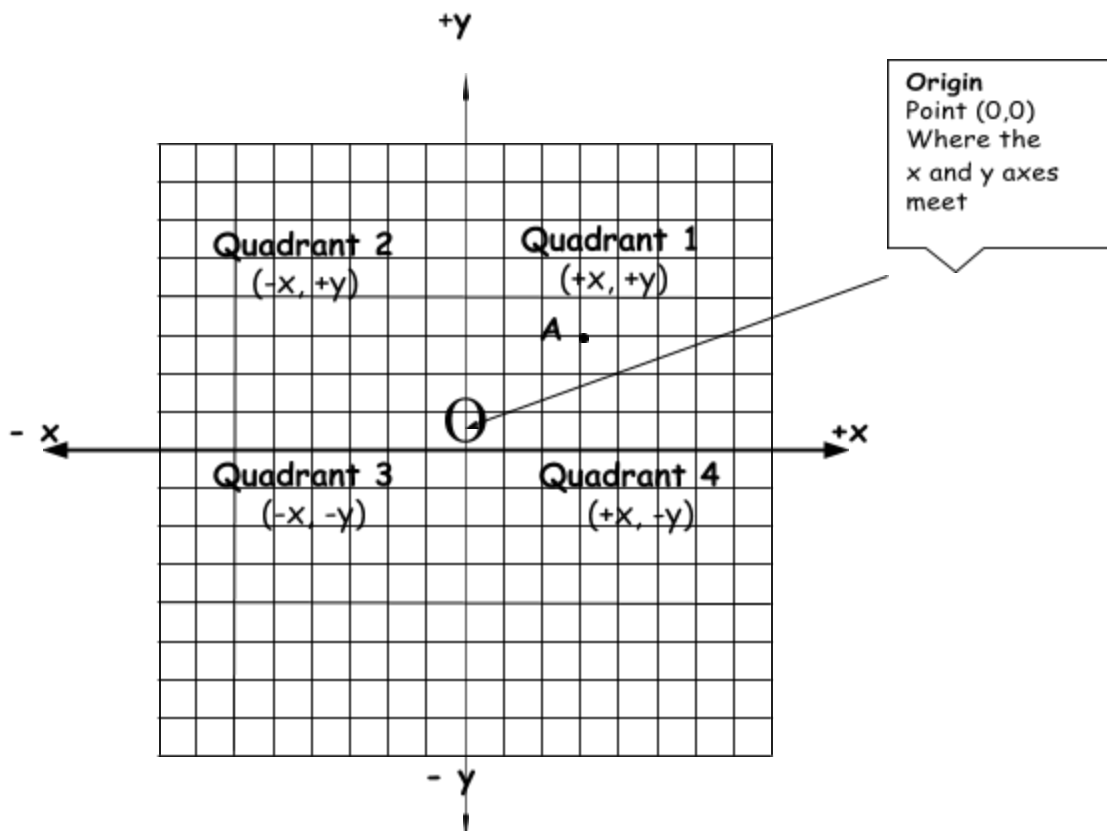


## Various Modes of Representation

**Cartesian Plane** -- any plane represented by a system of two intersecting number lines. These two lines must meet at a perpendicular ( $90^\circ$  angle). A plane is a flat (2D) surface that extends forever or an infinite set of points that can be shown on a sheet of paper.

When two planes meet at  $90^\circ$  angles they create four equal parts called Quadrants. They are numbered starting with quadrant 1 in the top right corner and going in a counter clockwise (CCW) direction.

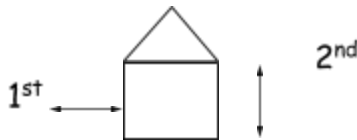


**Coordinate** -- One of a pair of numbers that tells you where a point on a graph is located, relative to its horizontal (x) axis and vertical (y) axis. For example, the point A (3, 2) is a point that is three units along the x-axis and 2 units along the y-axis.

**Cartesian Reference System** -- To find points with a Cartesian reference system coordinates are used. Each specific point on a Cartesian plane has an (x) coordinate and a (y) coordinate. The specific location of a point is usually written as an ordered pair (x, y) of the two coordinates. It is important that the x coordinate (horizontal) always be written first, followed by the y coordinate (the vertical). This allows the system to be used universally.



To remember the order of the coordinates think about entering a typical house. You must go in the house (horizontal --x) before you can go up or down the stairs (vertical --y).



The x value or coordinate is called the abscissa and the y value or coordinate is called the ordinate. To remember this (a)bscissa is before (o)rdinate and (x) is before (y) in the alphabet.

When the Cartesian Reference System is used to represent data we call this graphic representation. You have had many experiences with graphing before; however, most graphs that you have drawn have been in Quadrant 1 only. **\*\*Remember, when drawing a graph scale is very important.**

### Situations can be represented in Various Ways:

#### 1- A graph

2- Table of Values -- A chart in columns or rows that shows pairs of numbers that are related to each other. Each pair of coordinates represent one point (vertex) on the graph.

x	y
0	0
1	5
2	10

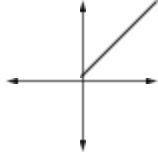
Each ordered pair in the table of values is plotted onto the graph. **\*\*Note that the (x) coordinate always comes first in the table of values and you always graph the (x) value first.**

The (x) value is also known as the independent variable and the (y) value is known as the dependent variable. Any change in the independent variable causes a corresponding change in the dependent variable. For example  $Y=5x$ , where  $Y$ =cost, \$5 is the constant cost of one movie, and  $x$ = # of movies rented. Therefore the total cost of movies is equal to \$5 multiplied by the number of movies rented. (See above tables).

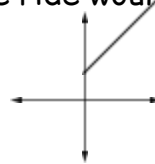
3- Rule (Equation) -- A sentence or formula that represents a relation. It can be used to find ordered pairs of a relation. The rule is always written as  $Y$ =something. For our purposes, linear relations will either be  $Y= mx$  (**direct variation**) OR  $Y=mx +b$  (**partial variation**) . The (m) is the constant rate of change.

## Types of Linear Relations:

1- A **direct variation** ( $Y = mx$ ) occurs when the values are proportional. The graph will appear as a straight line with a constant rate of change and will always pass through the origin (0,0). Again, take the movie example where the rule would be  $Y = 5x$ . In this rule 5 is the rate of change. If you rent no movies, you will pay nothing. If you rent 1 movie you will pay \$5, 2 movies you will pay 10, etc.



2- A **partial variation** ( $Y = mx + b$ ) occurs when the values are not proportional. The graph will not go through the origin but does grow at a constant rate after the initial value. An example could be  $Y = 2x + 10$  where \$10 is the cost to enter an amusement park.  $Y =$  your total cost, \$2 is the cost per ride, and  $x =$  the number of rides you go on. You pay \$10 to enter the amusement park regardless of the number of rides you choose to purchase afterwards. In such cases the \$10 is called an initial value because your costs for the day will begin at \$10. Even if you go in and decide not to ride, it will cost \$10. One ride would be \$12, two rides, \$14, etc.



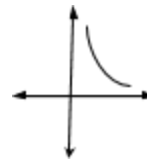
## Type of Non-Linear Relations:

1- **Inverse Relations** ( $Y = k/x$ ) In these relations, as the value of  $x$  increases, the value of  $y$  decreases as different rates.

### The Rule:

$$Y = \frac{k}{x}$$

Where  $Y =$  the dependent variable  
 $k =$  the constant  
 $x =$  the independent variable.



### How to:

#### 1- Determine a rule from a table of values:

x	y
0	1
1	3
2	5
3	7

The Y value always grows by 2 everytime the x value grows by 1

Whatever the y grows by is the rate of change or slope. So  $Y=2x+ \underline{\hspace{1cm}}$ .

To figure out the initial value take the x coordinate, multiply by two and see what you need to do to the number to make it equal the corresponding y value. For example take the ordered pair (1, 3) from above. Take 1 and multiply it by the rate of change of 2. 1 multiplied by 2 is 2 but the y coordinate is 3 so you must add 1. Therefore my rule is  $Y= 2x+1$ . Once you find that the rule works, check it again because a correct rule will work with any set of ordered pairs.

## 2- Determine the Rate of change using a formula:

$$\begin{aligned} \text{Rate of Change } m &= \frac{y_2 - y_1}{x_2 - x_1} \\ &= \frac{7 - 3}{3 - 1} \\ &= \frac{4}{2} \\ m &= 2 \end{aligned}$$

Use any two sets of coordinates to complete the formula. For example (1,3) and (3,7) from above. Decide which point will be point 1 and point 2 and keep it that way. Here point 1 is (1,3) and point 2 is (3,7)

\*\* The higher the rate of change, the steeper the graph will be.

## 3- Create a table of values from a rule:

Given a rule you can create a table of values and then graph the equation on the Cartesian Plane. For example if given the rule  $Y=3x -1$

Choose any value for x and substitute into the equation. Example  $x=0$

$$Y=3x -1$$

$$Y= 3(0) - 1$$

$$Y= 0 -1$$

$$Y= -1$$

So your ordered pair would be (0, -1) Continue in the same way until you have at least three or four ordered pairs. Then graph them and join the points with a ruler. Label your line  $Y= 3x -1$ .

x	y
0	-1
1	2
2	5