**I.** Points and Ordered pairs:

Points are plotted on a coordinate system (graph grid) called a Cartesian Plane.
Points are called Ordered Pairs because they have a specific order and they contain two coordinates:

x-coordinate and y-coordinate   (x , y)

The Cartesian Plane or graph grid has two lines that divide it into four quadrants, the x-axis and the y-axis, and a beginning point called the origin.
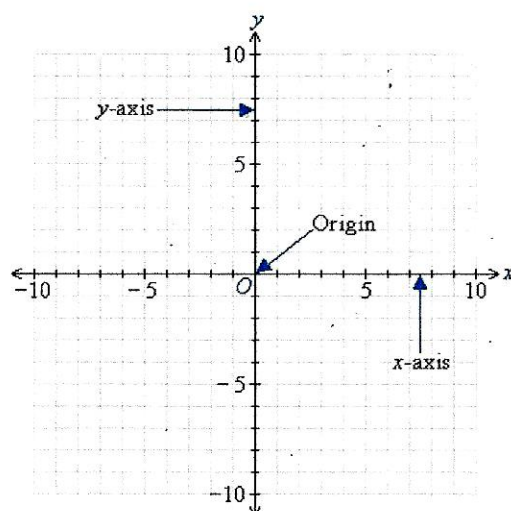
When plotting points (x , y), it's the same as giving someone directions and your map is the graph grid.
The x-coordinate tells you where to move in the left-right direction from the origin.
The y-coordinate tells you where to move in the up-down direction from the origin.

EXAMPLE:
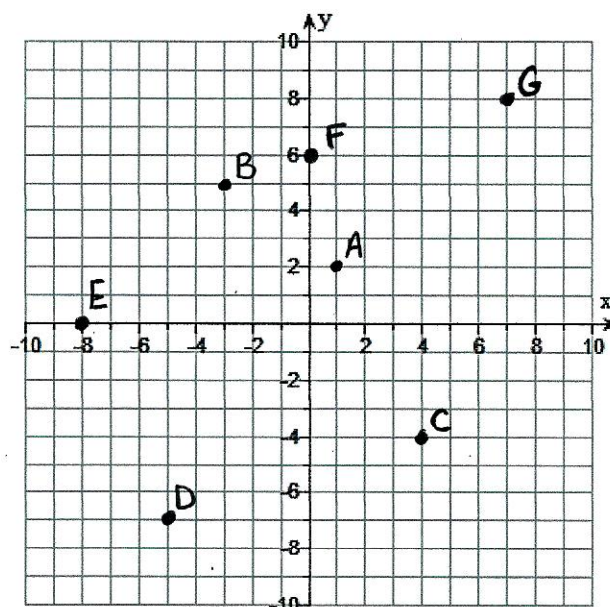Plot the following points on the graph grid:

A (1 , 2)

B (-3, 5)

C (4 , -4)

D (-5 , -7)

E (-8 , 0)

F (0 , 6)

G (7 , 8)

II. Linear equations are equations of lines. We see graphs of lines in business, sciences, math, computers, statistics, economics, and more.

The standard form of a linear equation is $Ax + By = C$ A, B, C are numbers

In general, we graph lines by plotting points then connecting those dots to form a line. Sometimes points are lie on an axis. When points are on the x-axis or y-axis, then we call them ___intercepts___. These are the points where a line crosses each axis.

A point on the x-axis is called the ___x-intercept (x, o)___

A point on the y-axis is called the ___y-intercept (y, o)___

To find the x-intercept, ___replace y with zero and solve for x___

To find the y-intercept, ___replace x with zero and solve for y___

EXAMPLES: Find the x-intercept and y-intercept for each linear equation. Plot the intercepts on the grid and connect the dots to form the line.

$2x + 5y = 10$ x-intercept: $(5, 0)$
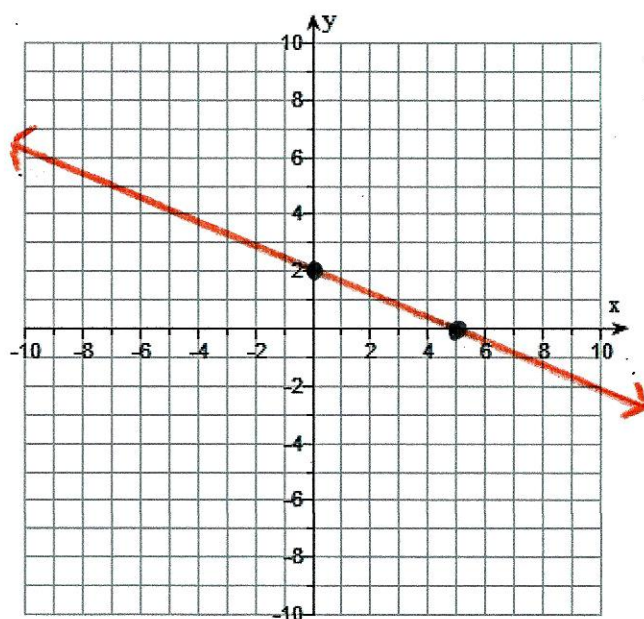
y-intercept: $(0, 2)$

$2x + 5(0) = 10$

$\dfrac{2x}{2} = \dfrac{10}{2}$

$x = 5$

$2(0) + 5y = 10$

$\dfrac{5y}{5} = \dfrac{10}{5}$

$y = 2$

2

$x - 3y = 6$ x-intercept: $(6, 0)$

y-intercept: $(0, -2)$
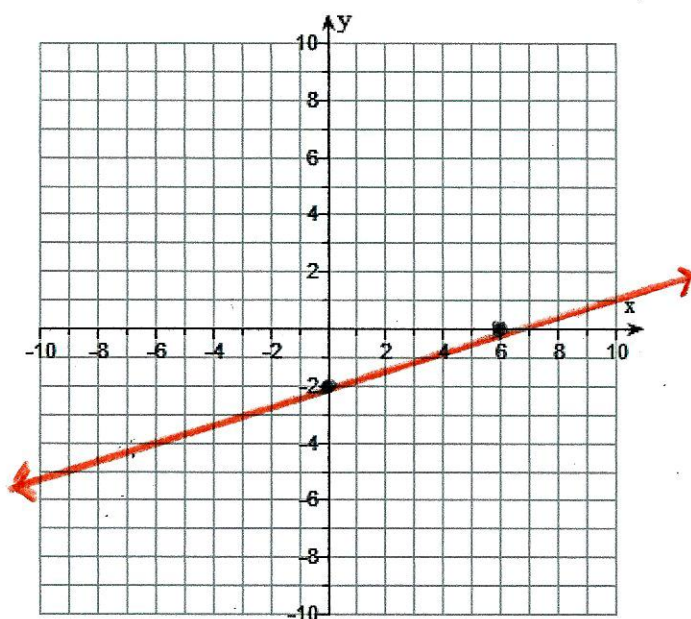
$$x - 3(0) = 6$$
$$x = 6$$

$$(0) - 3y = 6$$
$$\frac{-3y}{-3} = \frac{6}{-3}$$
$$y = -2$$

$x + y = 0$ x-intercept: $(0, 0)$

y-intercept: $(0, 0)$

$$x + 0 = 0 \qquad 0 + y = 0$$
$$x = 0 \qquad\quad y = 0$$

must have two different
points. choos another
x-value and solve for y

$$x = 2$$

$$2 + y = 0$$
$$\frac{-2 \qquad -2}{y = -2} \qquad (2, -2)$$

3
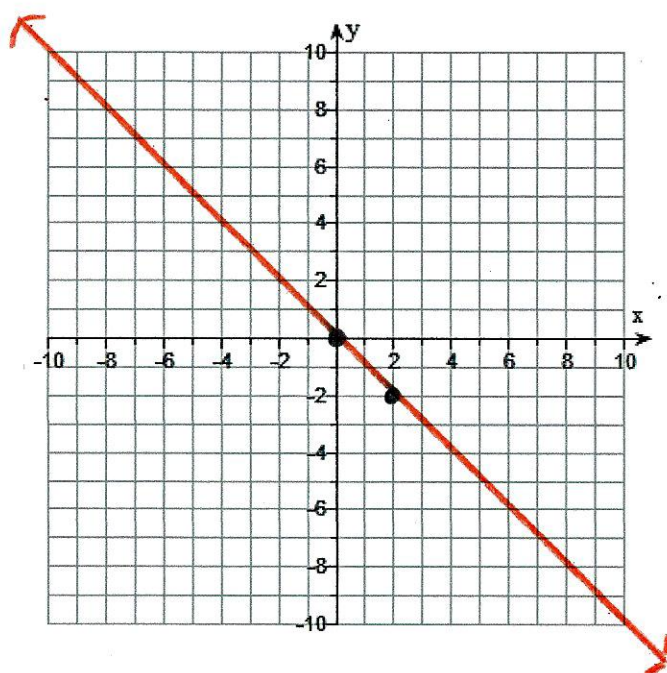
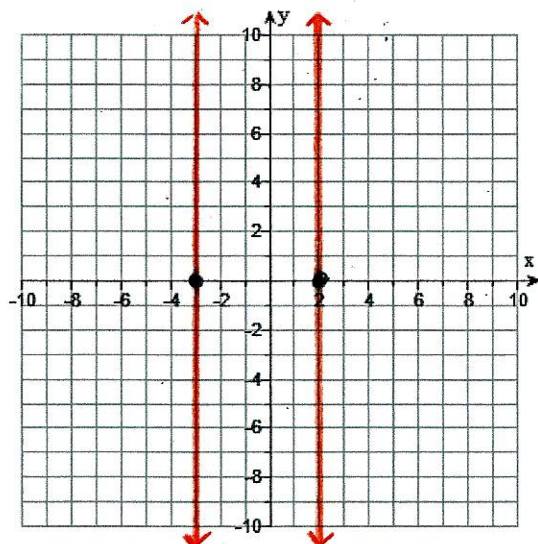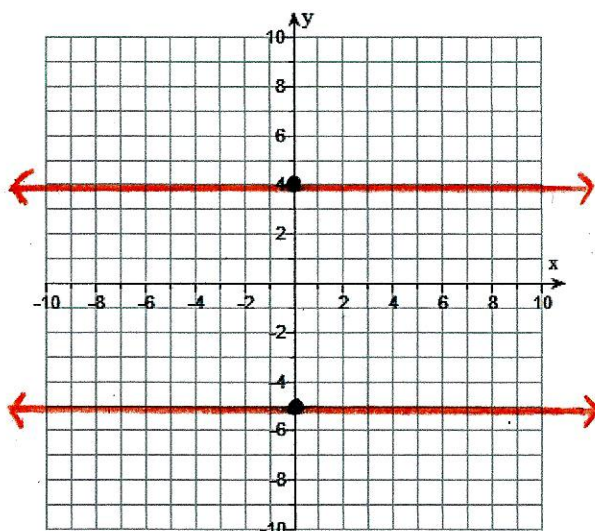## III. Vertical and Horizontal lines:

Vertical lines: <u>only cross the x-axis. only have an x-intercept. Equation is $x = K$ where K is the x-intercept $(K, 0)$</u>

EXAMPLES: graph the vertical lines $x = 2$ and $x = -3$

Horizontal lines: <u>only cross the y-axis. Only have a y-intercept. Equation is $y = b$ where b is the y-intercept $(0, b)$</u>

EXAMPLES: graph the horizontal lines $y = -5$ and $y = 4$

4

IV. Lines have slope. Slope measures the ___slant or tilt of a line___

Examples of things with slope: ___ramp, roof, slide, stairs, mountain, hill___

Slope is a fraction that measures: $\dfrac{rise}{run}$

Slope between two points on a line: (slope) m = $\dfrac{y_2 - y_1}{x_2 - x_1}$

EXAMPLES: Find the slope of the line between each pair of points

(8, 1) (2, 6)
$x_1\ y_1,\ x_2\ y_2$

$m = \dfrac{6-1}{2-8} = \dfrac{5}{-6}$

$m = \dfrac{-5}{6}$

(-2, -3) (-1, 5)
$x_1\ y_1,\ x_2\ y_2$

$m = \dfrac{5 - -3}{-1 - -2} = \dfrac{5+3}{-1+2} = \dfrac{8}{1}$

$m = 8$

(3, 5) (-4, 5)
$x_1\ y_1,\ x_2\ y_2$

$m = \dfrac{5-5}{-4-3} = \dfrac{0}{-7}$

$m = 0$

horizontal line

(-3, 2) (-3, -4)
$x_1\ y_1,\ x_2\ y_2$

$m = \dfrac{-4-2}{-3 - -3} = \dfrac{-4-2}{-3+3} = \dfrac{-6}{0}$
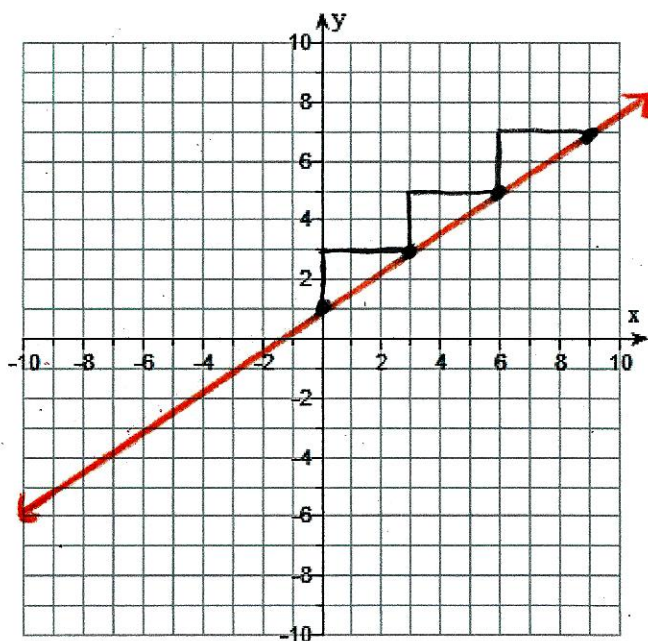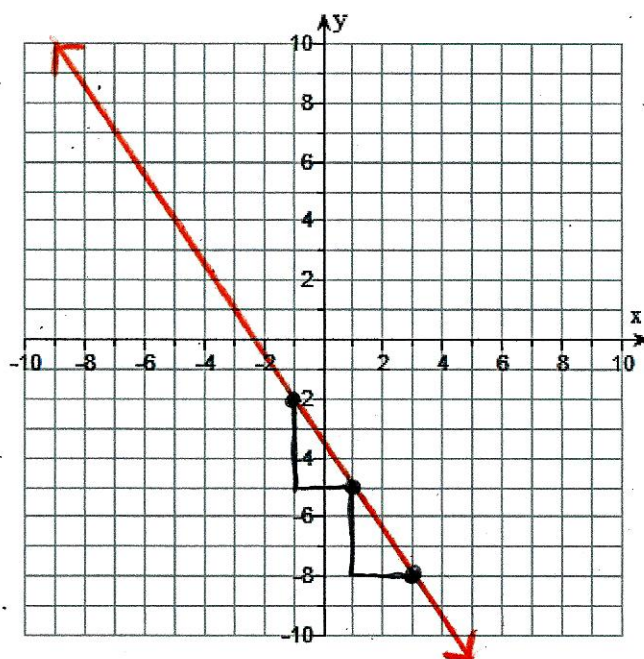
$m = undefined$

vertical line

V. Use the slope to help graph a line. All lines have a starting point. First, plot the starting point, then use the slope to find and make additions points. Remember slope is "rise over run". Once you have two or more points, connect the dots to form the line.

EXAMPLES: graph the following lines using the given point and slope of the line
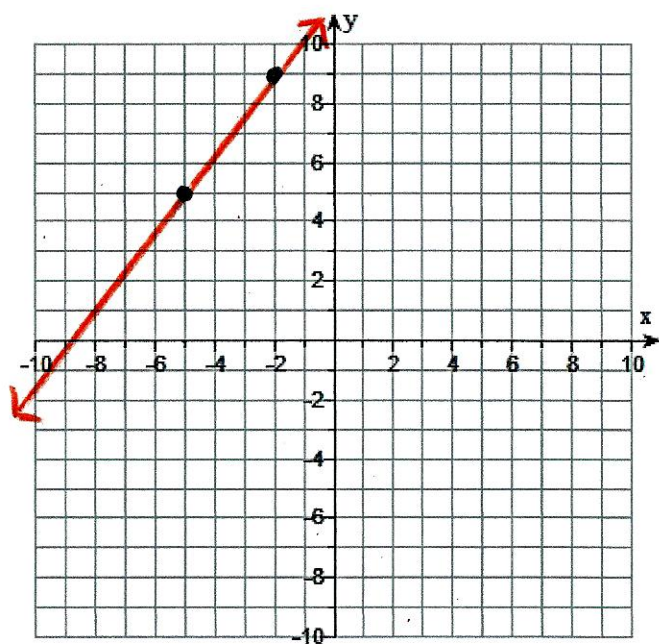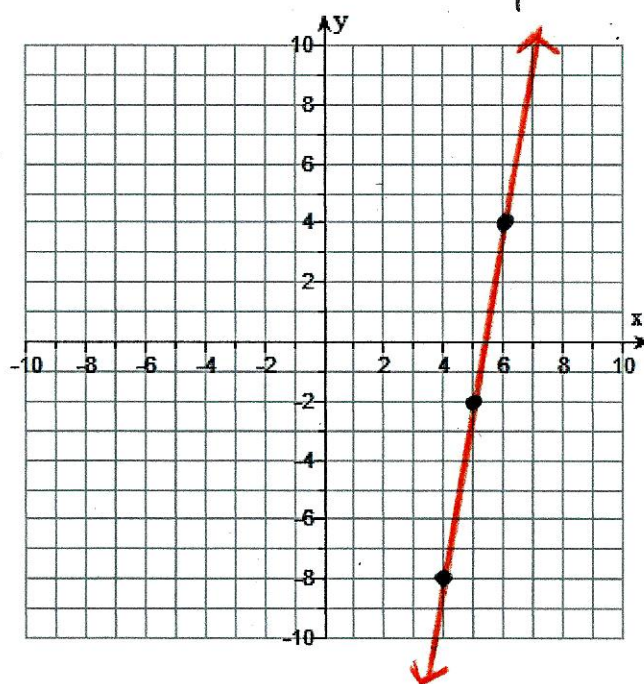
Point = (0, 1)   Slope = $\dfrac{2}{3}$

Point = (-1, -2)   Slope = $\dfrac{-3}{2}$
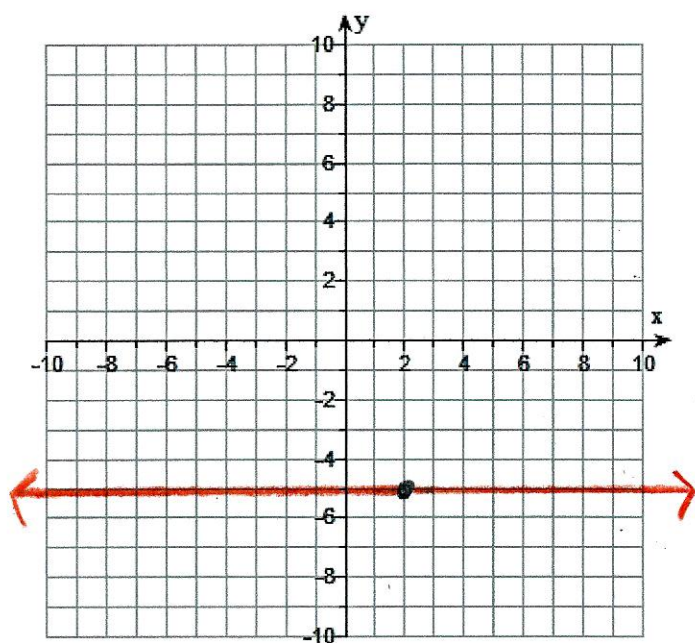
Point = (-5, 5)   Slope = $\dfrac{4}{3}$

Point = (4, -8)   Slope = $6 = \dfrac{6}{1}$

6

Point = (2, -5)   Slope = 0

Point = (-7, -6)   Slope = undefined