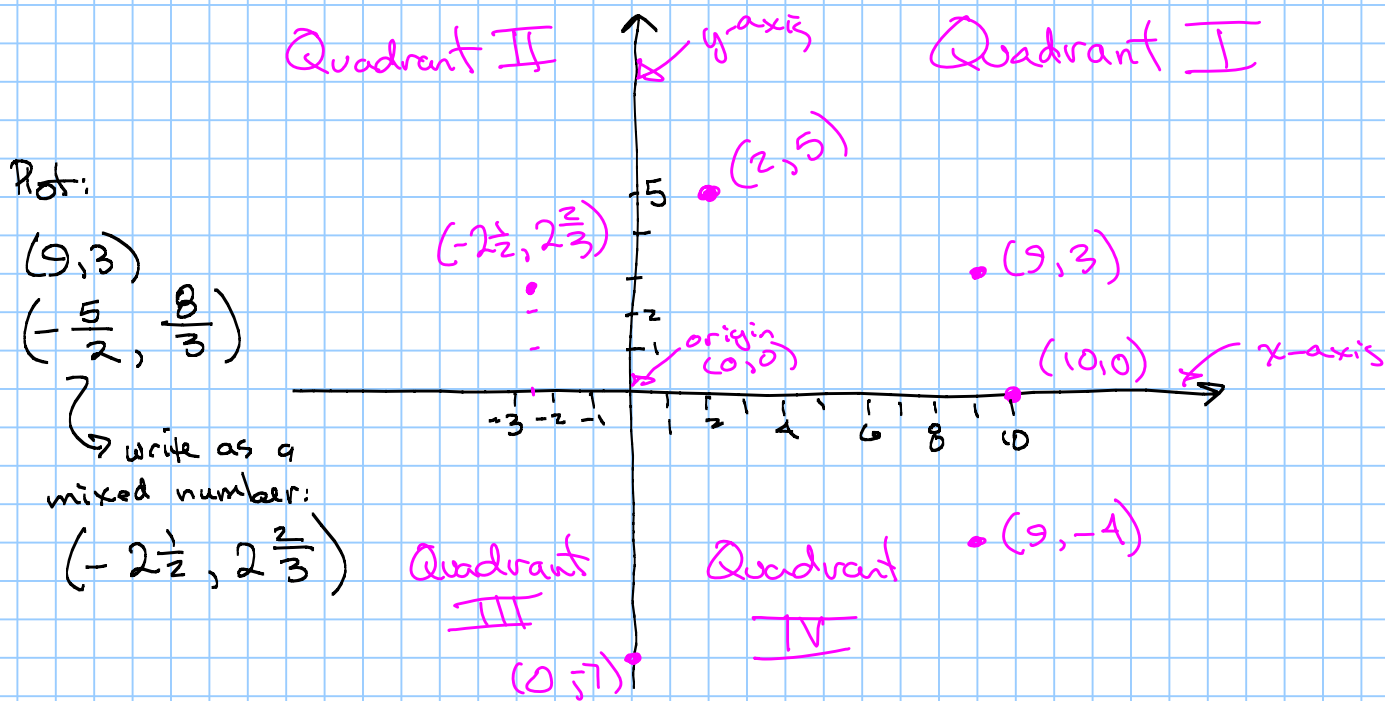


3.1: The Rectangular Coordinate System

Note Title

2/5/2015



Important Notes:

- * You must label at least 1 tick mark on each axis. This tells the reader your scale.
- * It is standard in mathematics to put an arrow on only the positive end of each axis.

3.2 Solutions and Graphs of Linear Equations (in 2 variables)

Linear Equation in 1 variable:

Example:

$$5x - 3 = 8$$

$$5x = 11$$

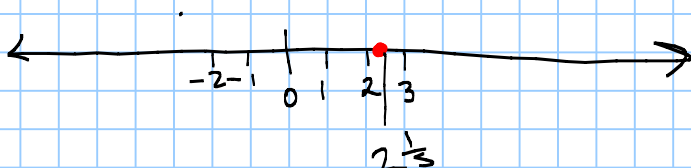
$$\frac{5x}{5} = \frac{11}{5}$$

$$x = \frac{11}{5}$$

has 1 solution. The solution is a number.

Solution Set: $\{\frac{11}{5}\}$

Mixed number: $\frac{11}{5} = 2\frac{1}{5}$



This is a 1-dimensional graph

Linear Equations in 2 variables

- can be written in the form $Ax + By = C$, where A, B, C are real numbers, and x and y are variables.
- solutions take the form of ordered pairs
- solutions are graphed in 2 dimensions

A solution to a linear equation (in 2 variables) is an ordered pair that makes the equation true, (when the x -coordinate and y -coordinate in the ordered pair are substituted into the equation for x and y)

The graph of an equation (in 2 variables) is the set of all ordered pairs that make the equation true.

Example: Is $(4, 6)$ a solution to $3x - 2y = 1$?

$$\begin{array}{l} x=4, y=6 \\ 3(4) - 2(6) = 1 \\ 12 - 12 = 1 \\ 0 = 1 \quad \text{False!} \end{array}$$

No, $(4, 6)$ is not a solution.

Is $(5, 7)$ a solution to $3x - 2y = 1$?

$$\begin{array}{l} x=5, y=7 \\ 3(5) - 2(7) = 1 \\ 15 - 14 = 1 \\ 1 = 1 \quad \text{True!} \end{array}$$

Yes, $(5, 7)$ is a solution.

Can we find other solutions?

$$\begin{array}{l} x=3, y=2 \\ 3(3) - 2(2) = 1 \\ 9 - 4 = 1 \\ 5 = 1 \quad \text{False. No!} \end{array}$$

$$\begin{array}{l} x=3, y=4 \\ 3(3) - 2(4) = 1 \\ 9 - 8 = 1 \\ 1 = 1 \quad \text{True. Yes, this is a solution} \end{array}$$

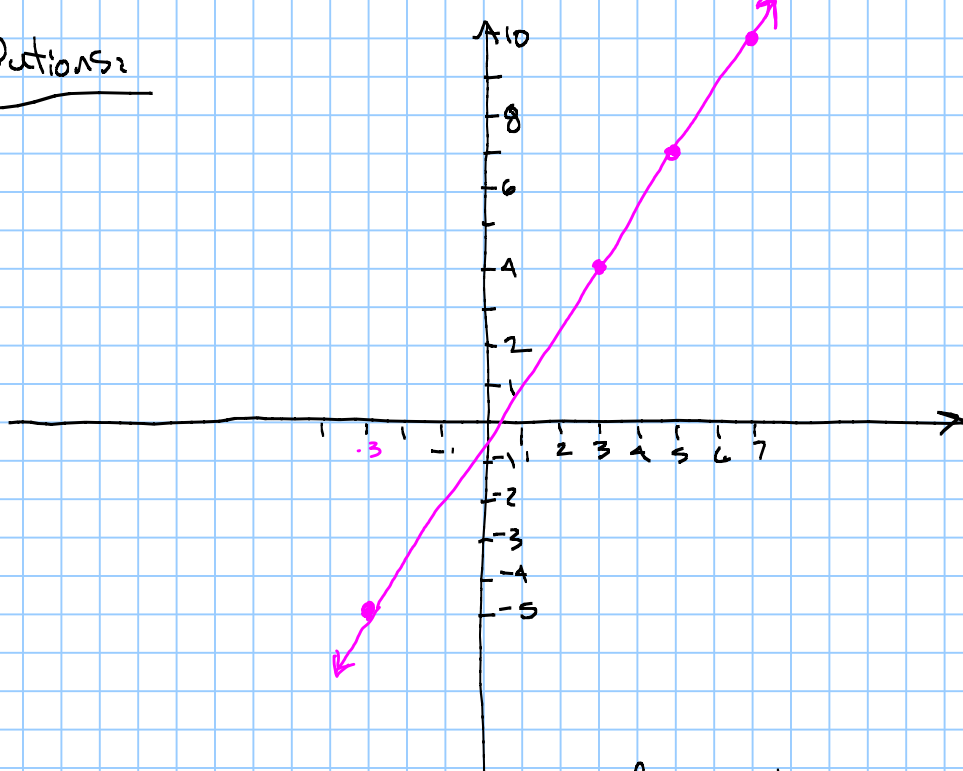
$$\begin{array}{l} x=7, y=10 \\ 3(7) - 2(10) = 1 \\ 21 - 20 = 1 \\ 1 = 1 \quad \text{True Yes!} \end{array}$$

$$\begin{array}{l} x=-3, y=-5 \\ 3(-3) - 2(-5) = 1 \\ -9 + 10 = 1 \\ 1 = 1 \quad \text{Yes} \end{array}$$

See next page
for graph.

We found solutions:

$(5, 7)$
 $(3, 4)$
 $(7, 10)$
 $(-3, -5)$



Note: 2 points are needed to uniquely determine a line.

Ex: Graph the equation $-3x + 2y = -4$.

$$\begin{aligned} \underline{x=2} \quad & -3(2) + 2y = -4 \\ & -6 + 2y = -4 \\ & \quad +6 \quad \quad +6 \\ & 2y = 2 \\ & y = \frac{2}{2} = 1 \quad (2, 1) \end{aligned}$$

$$\begin{aligned} \underline{x=5} \quad & -3(5) + 2y = -4 \\ & -15 + 2y = -4 \\ & \quad +15 \quad \quad +15 \\ & 2y = 11 \\ & y = \frac{11}{2} = 5\frac{1}{2} \\ & \quad (5, 5\frac{1}{2}) \end{aligned}$$

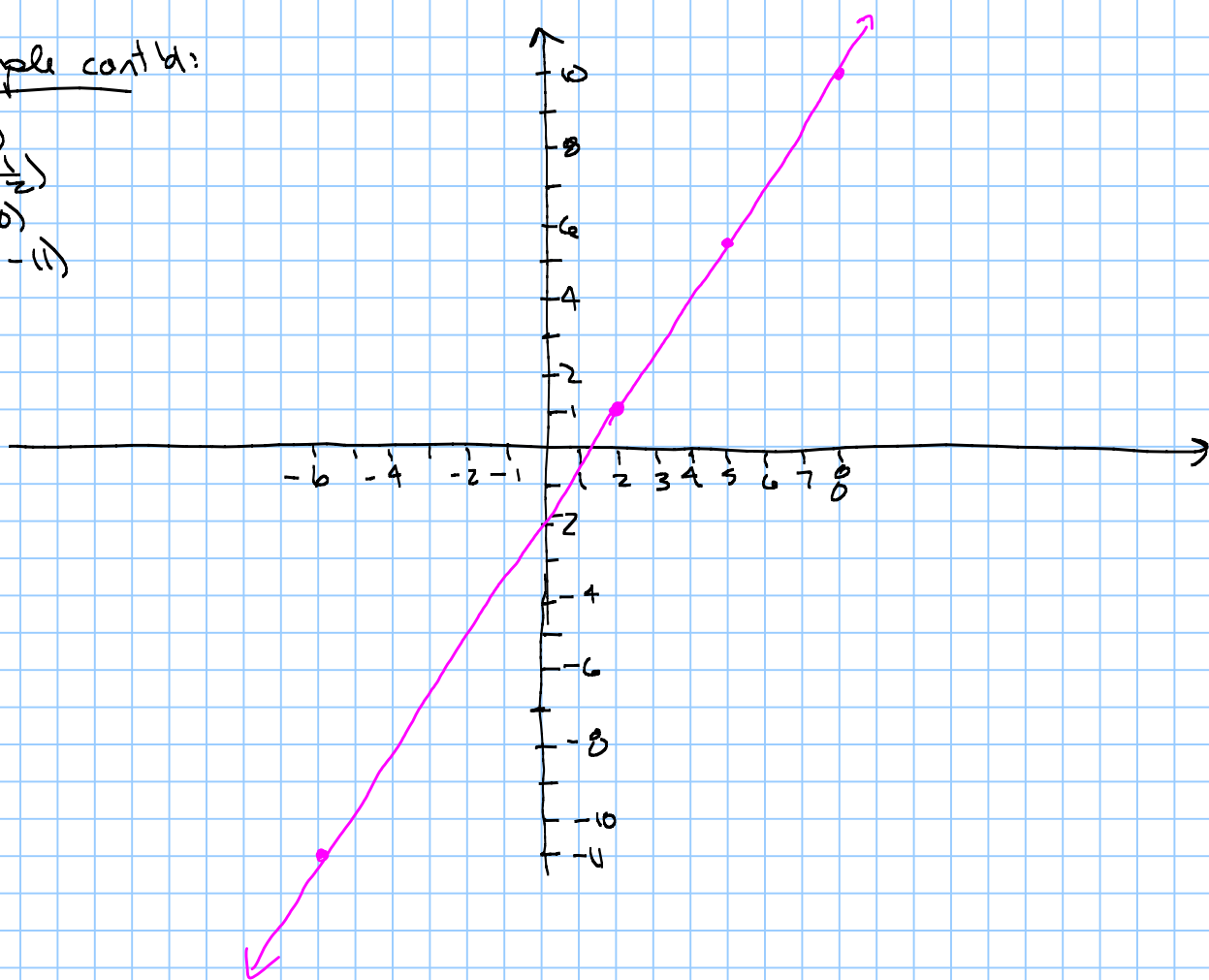
$$\begin{aligned} \underline{x=-6} \quad & -3(-6) + 2y = -4 \\ & 18 + 2y = -4 \\ & \quad -18 \quad \quad -18 \\ & 2y = -22 \\ & y = \frac{-22}{2} = -11 \quad (-6, -11) \end{aligned}$$

$$\begin{aligned} \underline{y=10} \quad & -3x + 2(10) = -4 \\ & -3x + 20 = -4 \\ & \quad -20 \quad \quad -20 \\ & -3x = -24 \\ & x = \frac{-24}{-3} = 8 \quad (8, 10) \end{aligned}$$

Graph on next page

Previous Example cont'd:

Solutions: $(2, 1)$
 $(5, 5\frac{1}{2})$
 $(8, 10)$
 $(-6, -11)$



Example: Graph the line $2x + y = -1$ by solving for y first, then choosing x -values to get ordered pairs.

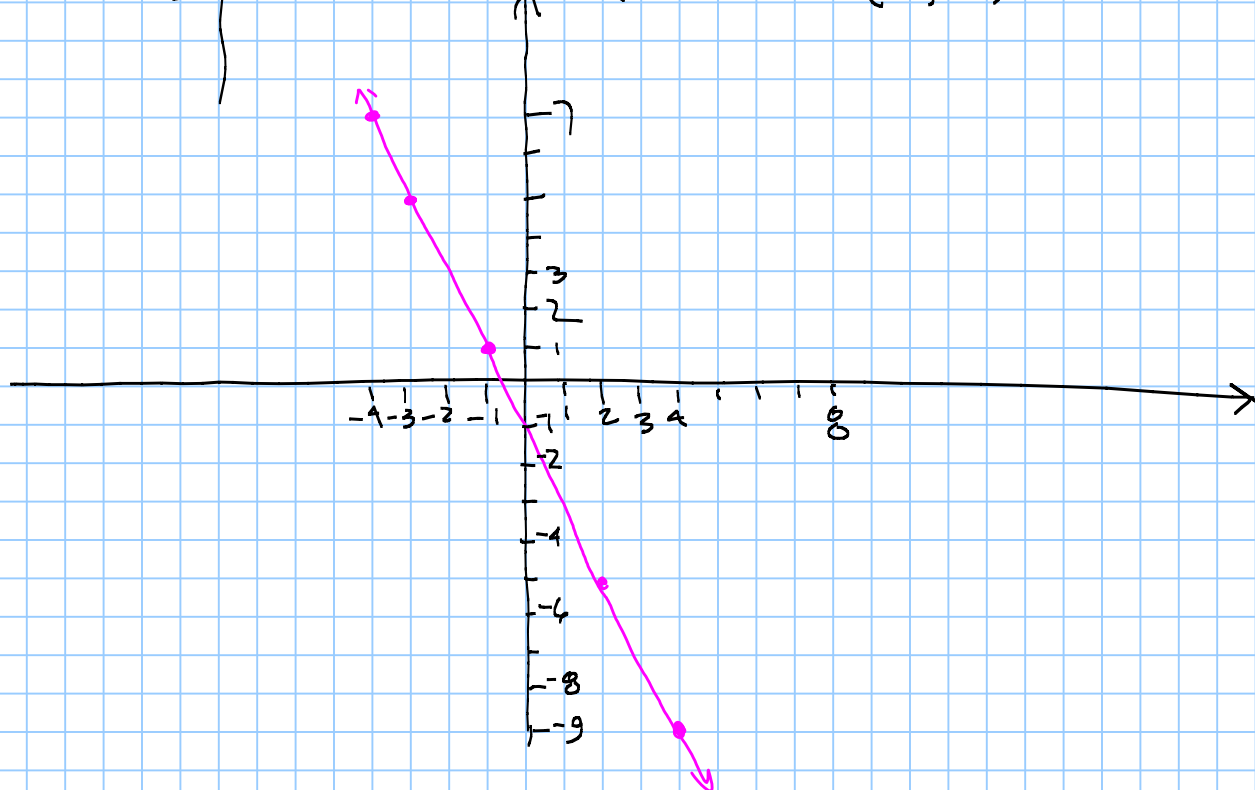
$$2x + y = -1$$

$$\quad \quad \quad -2x \quad \quad \quad -2x$$

Solve for y :

$$y = -1 - 2x$$

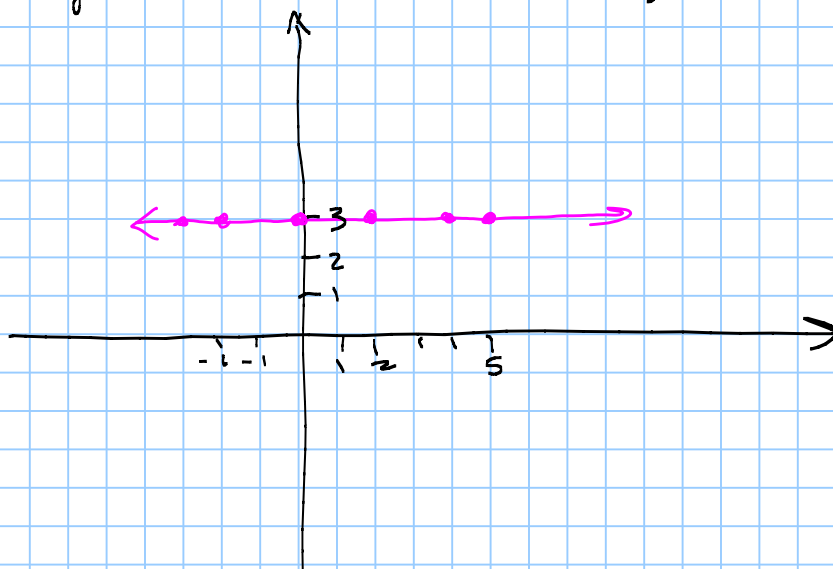
x	$y = -1 - 2x$	
4	$y = -1 - 2(4) = -1 - 8 = -9$	$(4, -9)$
8	$y = -1 - 2(8) = -1 - 16 = -17$	$(8, -17)$
-1	$y = -1 - 2(-1) = -1 + 2 = 1$	$(-1, 1)$
-3	$y = -1 - 2(-3) = -1 + 6 = 5$	$(-3, 5)$
-1	$y = -1 - 2(-4) = -1 + 8 = 7$	$(-1, 7)$
2	$y = -1 - 2(2) = -1 - 4 = -5$	$(2, -5)$



Ex: Graph the equation $y = 3$ (in 2 dimensions).

Find some solutions:

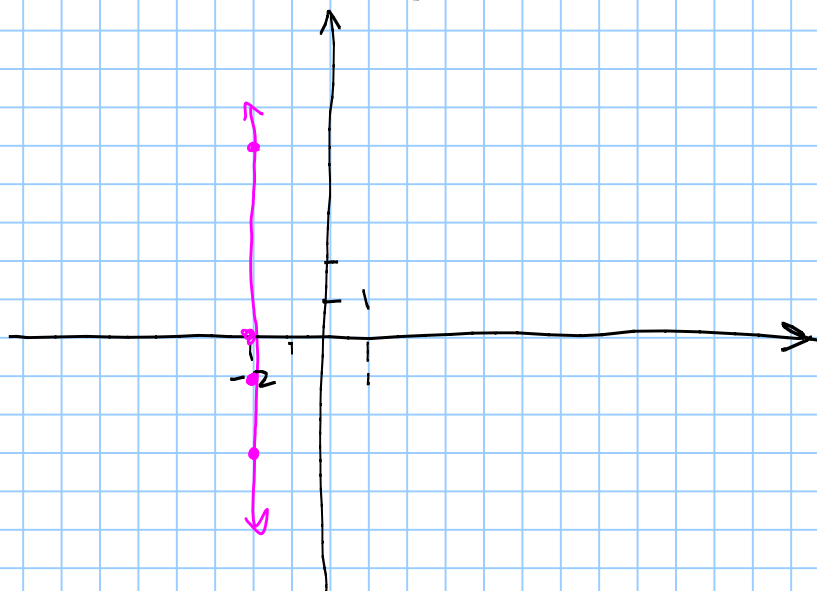
- $(5, 3)$
- $(0, 3)$
- $(2, 3)$
- $(4, 3)$
- $(-3, 3)$
- $(-2, 3)$
- $(-23, 3)$
- $(427.5, 3)$



Ex: Graph the equation $x = -2$. (in 2 dimensions)

Write some solutions:

$(-2, 5)$
 $(-2, -1)$
 $(-2, -3)$
 $(-2, 0)$
 ~~$(5, -2)$~~



Prereading Assignment

Read Section 3.3 (pp 256 - 259)

Rework Example 2 (p. 258)

Work Similar Example: Matched Problem #2 (Graph $3x - y = 6$)