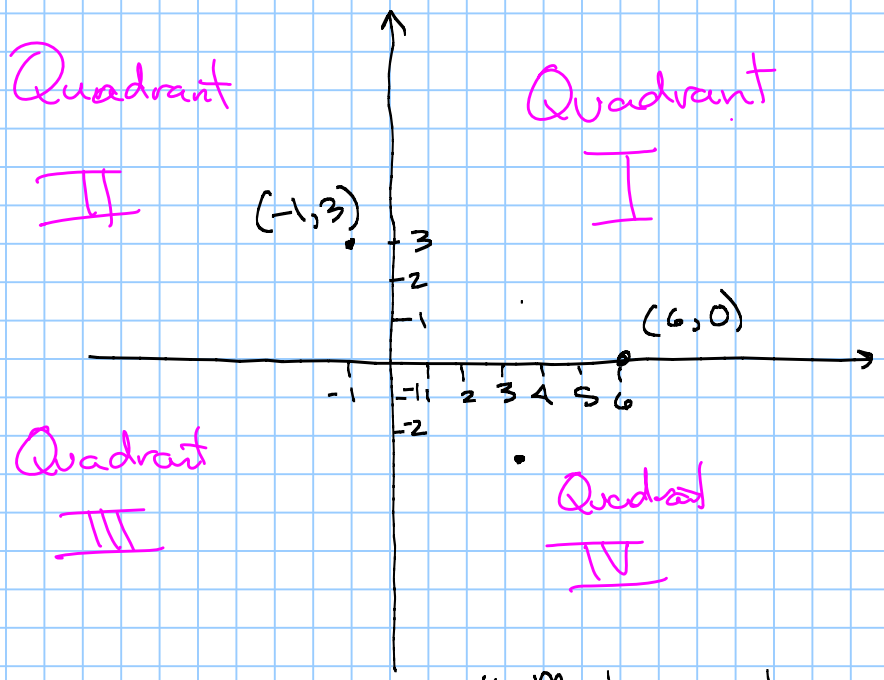
3.1: The Cartesian Coordinate System

Note Title 2/5/2015



* Must mark at least 1 tick mark on each axis. This gives the reader the scale.
* You should only put arrows on the positive end of each axis.

Plot:

$\left(\frac{17}{5}, -\frac{8}{3}\right)$

Write as mixed numbers:

$\left(3\frac{2}{5}, -2\frac{2}{3}\right)$

3.2: Solutions and graphs of linear equations (in 2 variables)

Linear equation in 1 variable:

Ex: $2x + 5 = 8$

$2x = 3$

$x = \frac{3}{2}$ Solution set: $\left\{\frac{3}{2}\right\}$

There is generally 1 solution. It takes the form of a number.
(exceptions: all real numbers, no solution cases)

Linear Equations in 2 variables:

Can be written as $Ax + By = C$,

where A, B, C are real numbers and x and y are the variables.

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

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

$x = 4, y = 6$

$3(4) - 2(6) = 1$

$12 - 12 = 1$

$0 = 1$ False!

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

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

$x = 5, y = 7$

$3(5) - 2(7) = 1$

$15 - 14 = 1$

$1 = 1$ True

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

Are there other solutions?

Try $(1,1)$: $3(1) - 2(1) = 1$

$1 = 1$ Yes

Try $(3,5)$: $3(3) - 2(5) = 1$

$9 - 10 = 1$

$-1 = 1$ No

Try $(-1,-1)$: $3(-1) - 2(-1) = 1$

$-3 + 2 = 1$

$-1 = 1$ No

Try $(7,10)$: $3(7) - 2(10) = 1$

$21 - 20 = 1$

$1 = 1$ Yes

$3x - 2y = 1$

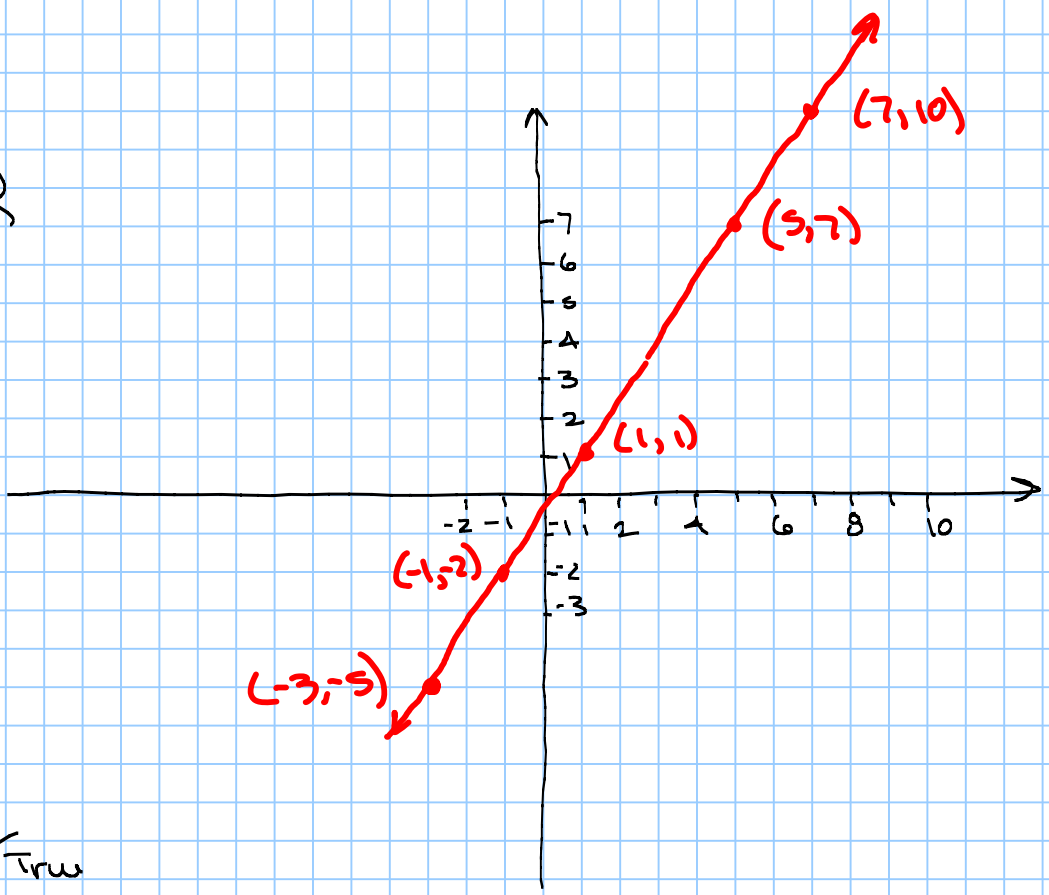
Try $(5,-7)$: $3(5) - 2(-7) = 1$

$15 + 14 = 1$

$29 = 1$ No

See graph on Next page

Solutions: (5, 7)
(1, 1)
(7, 10)
(9, 13)



Try (-1, -2)

$3(-1)-2(-2)=1$
$-3+4=1$
$1=1$ ✓ True

Try (-3, -5):

$3(-3)-2(-5)=1$
$-9+10=1$
$1=1$

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

Linear equations: The graph is a line

How many points are needed to uniquely determine a line?
2

It's a good idea to plot 3 or more points.

Example: Graph the line $-3x+5y=-4$.

$x=1$: $-3(1)+5y=-4$
$-3+5y=-4$
$+3 \quad +3$
$5y=-1$
$y=-\frac{1}{5}$
$(1, -\frac{1}{5})$

$x=3$: $-3(3)+5y=-4$
$-9+5y=-4$
$+9 \quad +9$
$5y=5$
$\frac{5y}{5}=\frac{5}{5}$
$y=1$
$(3, 1)$

See next page

Previous example cont'd

$y = 5$

$-3x + 5y = -4$

$-3x + 5(5) = -4$

$-3x + 25 = -4$

$-25 \quad -25$

$-3x = -29$

$x = \frac{-29}{-3} = \frac{29}{3} = 9\frac{2}{3}$

$(9\frac{2}{3}, 5)$

$y = -1$

$-3x + 5(-1) = -4$

$-3x - 5 = -4$

$+5 \quad +5$

$-3x = 1$

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

$(-\frac{1}{3}, -1)$

$y = -2$

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

$-3x - 10 = -4$

$+10 \quad +10$

$-3x = 6$

$x = \frac{6}{-3} = -2$

$(-2, -2)$

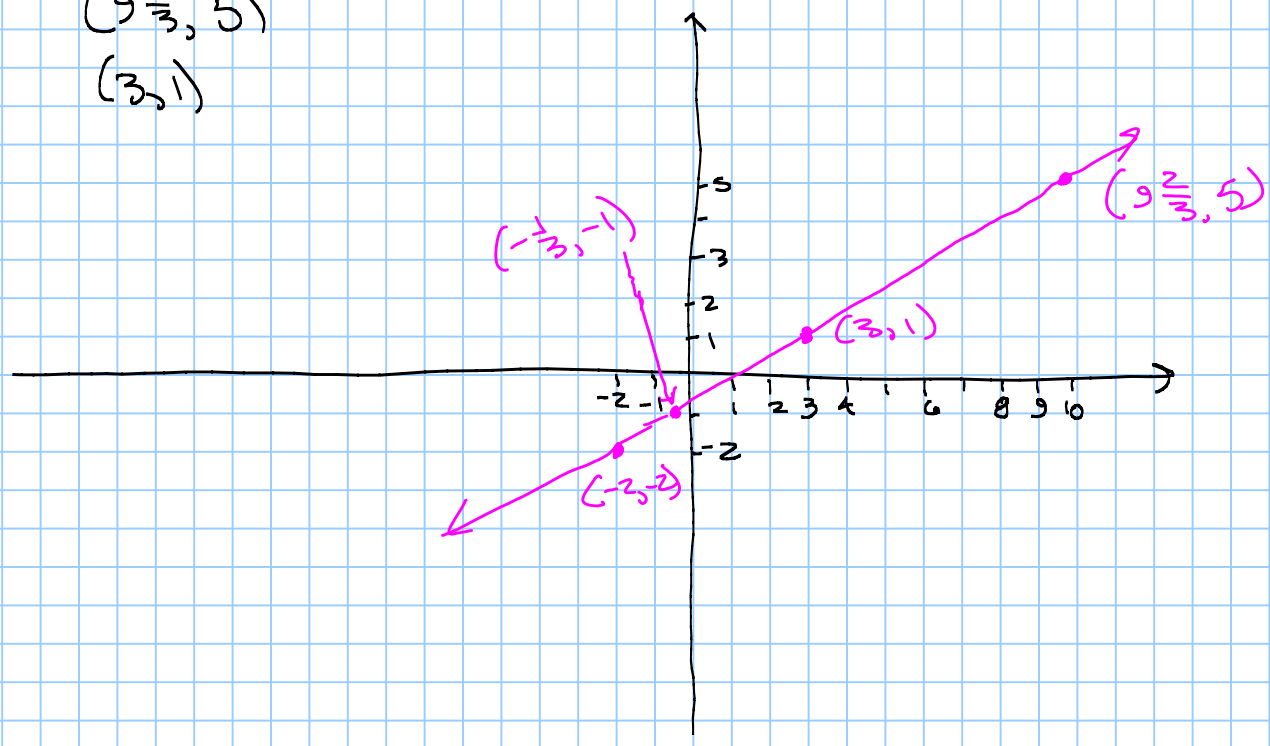
Graph it:

$(-2, -2)$

$(-\frac{1}{3}, -1)$

$(9\frac{2}{3}, 5)$

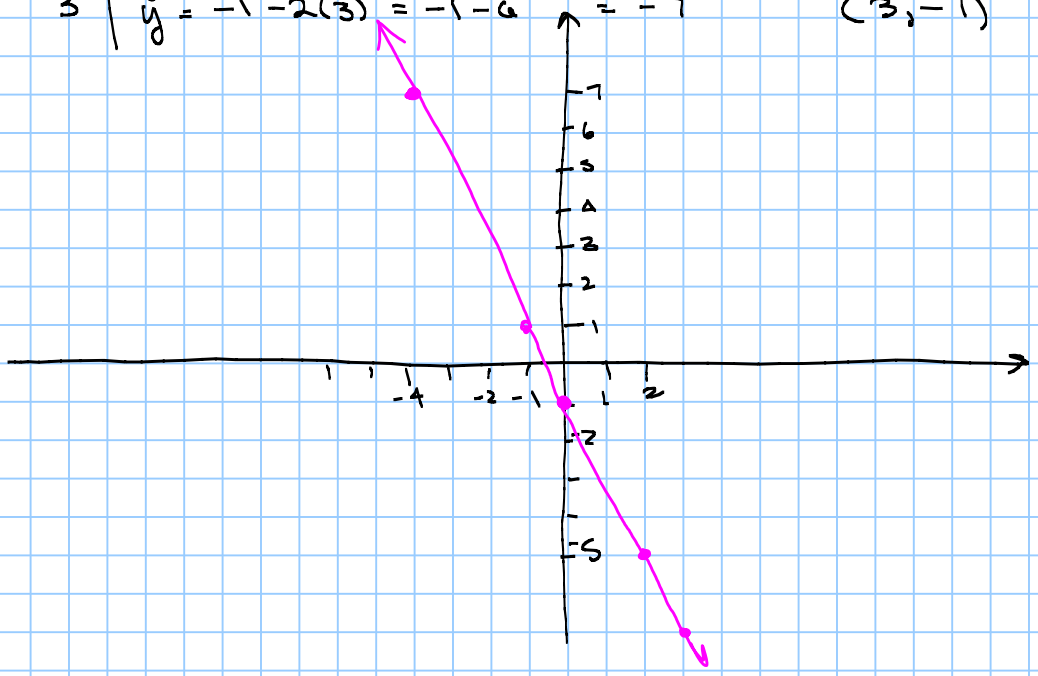
$(3, 1)$



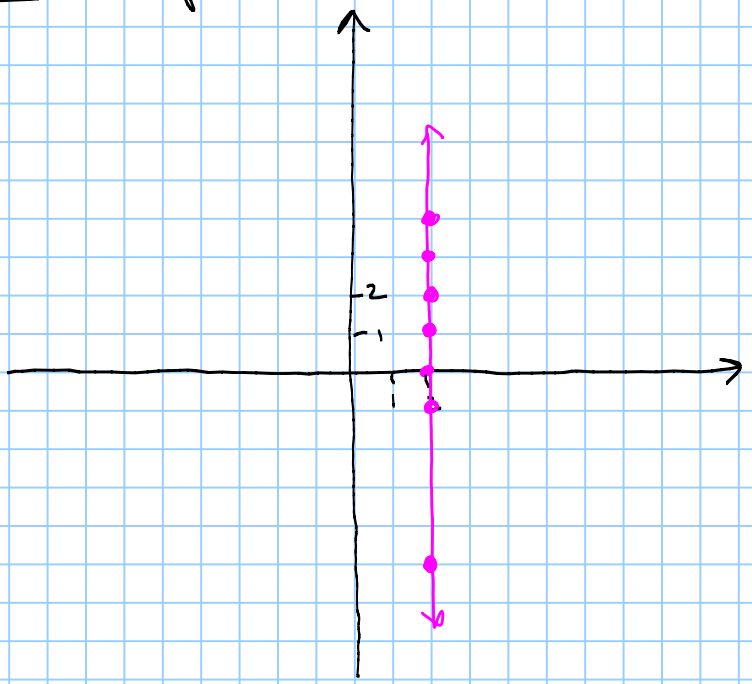
Example: Graph $2x+y=-1$ by solving for y first, then finding ordered pairs.

$$2x+y=-1$$
$$-2x \qquad -2x$$
$$y=-1-2x$$

x	$y=-1-2x$				
0	$y=-1-2(0)$	$=-1-0$	$=-1$		$(0,-1)$
-1	$=-1-2(-1)$	$=-1+2$	$=1$		$(-1,1)$
2	$=-1-2(2)$	$=-1-4$	$=-5$		$(2,-5)$
-4	$=-1-2(-4)$	$=-1+8$	$=7$		$(-4,7)$
3	$=-1-2(3)$	$=-1-6$	$=-7$		$(3,-7)$



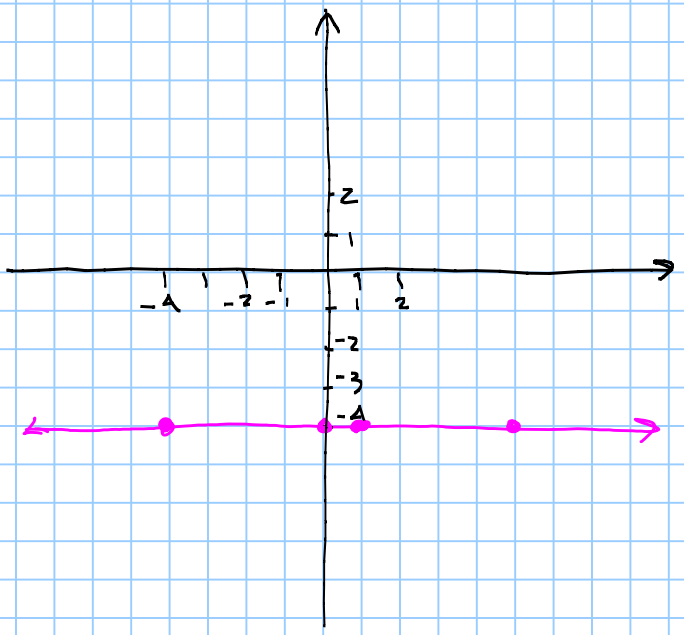
Ex: Graph the line $x=2$.



Find some solutions.

$(2,1)$
$(2,2)$
$(2,3)$
$(2,4)$
$(2,-1)$
$(2,-5)$
$(2,0)$
$(2,2\frac{3}{5})$ → $(2,\frac{13}{5})$

Ex: Graph the equation $y = -4$



Find solutions

$(1, -4)$

$(-4, -4)$

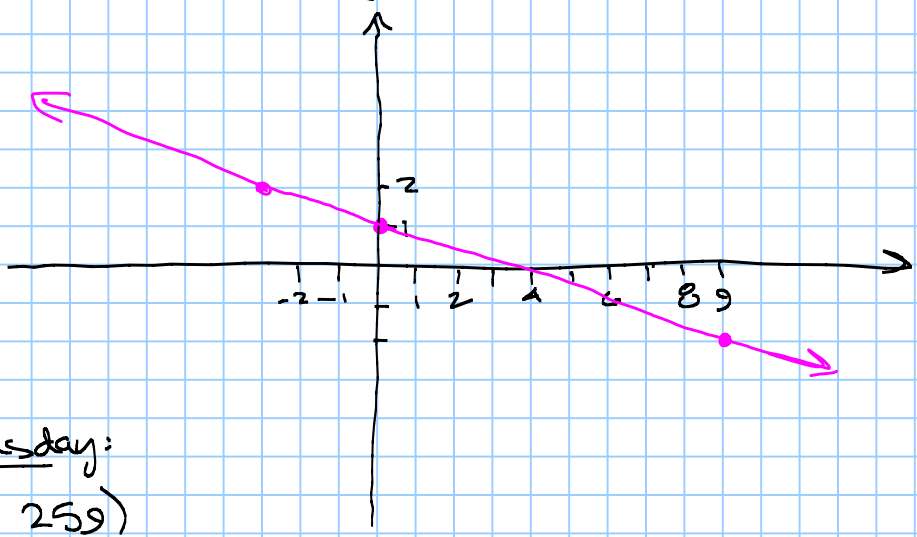
$(0, -4)$

$(5, -4)$

Ex: Graph the line. $x + 3y = 3$

Solve for x 1st: $x = 3 - 3y$

y	$x = 3 - 3y$	
1	$3 - 3(1) = 3 - 3 = 0$	$(0, 1)$
-2	$3 - 3(-2) = 3 + 6 = 9$	$(9, -2)$
2	$3 - 3(2) = 3 - 6 = -3$	$(-3, 2)$



Prereading Assignment for Tuesday:

Read Section 3.3 (pp 256 – 259)

Rework Example 2 (p. 258)

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