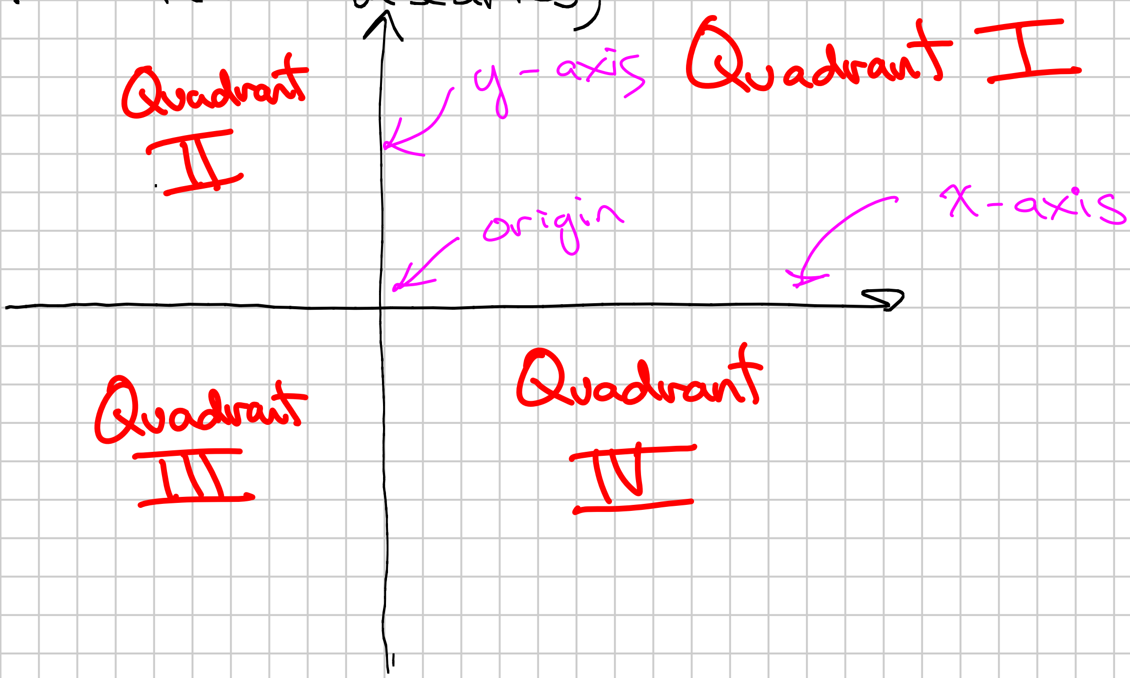
3.1: The Rectangular Coordinate System

Note Title

2/5/2015

The __rectangular coordinate system__ is also called the Cartesian coordinate system, the Cartesian plane, or the xy-plane. (Named after René Descartes)



Each location, or __point__, on the xy-plane is described by an __ordered pair__ in the form (x, y).

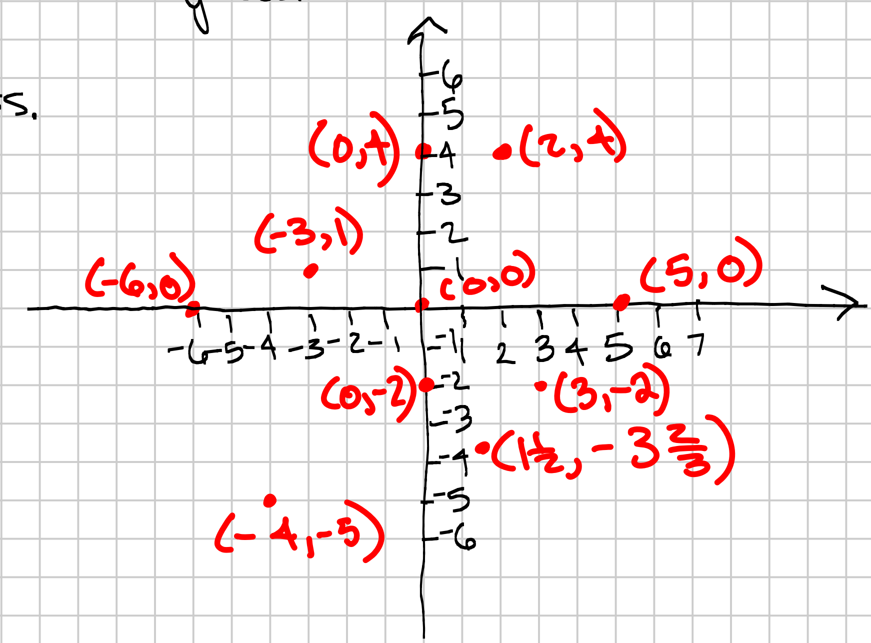
1st coordinate = x-coordinate

2nd coordinate = y-coordinate

__Ex:__ Plot these points.

$(2,4)$	$(0,4)$
$(-3,1)$	$(5,0)$
$(-4,-5)$	$(0,-2)$
$(3,-2)$	$(-6,0)$
$(\frac{3}{2}, -\frac{11}{3})$	$(0,0)$

↳ Rewrite: $(1\frac{1}{2}, -3\frac{2}{3})$



3.2: Linear Equations in Two Variables

A <u>linear equation in 2 variables</u> can be written as $Ax + By = C$, where A, B, C are real numbers.

A <u>solution</u> to a linear equation in two variables is an ordered pair that makes the equation <u>true</u>. (when we substitute the 1^{st} coordinate for x and the 2^{nd} coordinate for y).

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

$x = 4,\ y = 6$

$$3(4) - 2(6) = 1$$
$$12 - 12 = 1$$
$$0 = 1 \quad \text{False!}$$

$\boxed{\text{No, } (4,6) \text{ is } \underline{\text{not}} \text{ a solution.}}$

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

$x = 5,\ y = 7 \implies 3(5) - 2(7) = 1$

$$15 - 14 = 1$$
$$1 = 1 \quad \text{True!}$$

$\boxed{\text{Yes, } (5,7) \text{ is a solution.}}$

Is $(1,1)$ a solution?

$x = 1,\ y = 1 \implies 3(1) - 2(1) = 1$

$$3 - 2 = 1$$
$$1 = 1 \quad \text{True!}$$

$\boxed{\text{Yes, } (1,1) \text{ is a solution.}}$

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

$x = 3,\ y = 4 \implies 3(3) - 2(4) = 1$

$$9 - 8 = 1$$
$$1 = 1 \checkmark \quad \text{True!}$$

$\boxed{\text{Yes, } (3,4) \text{ is a solution}}$

3.2.2

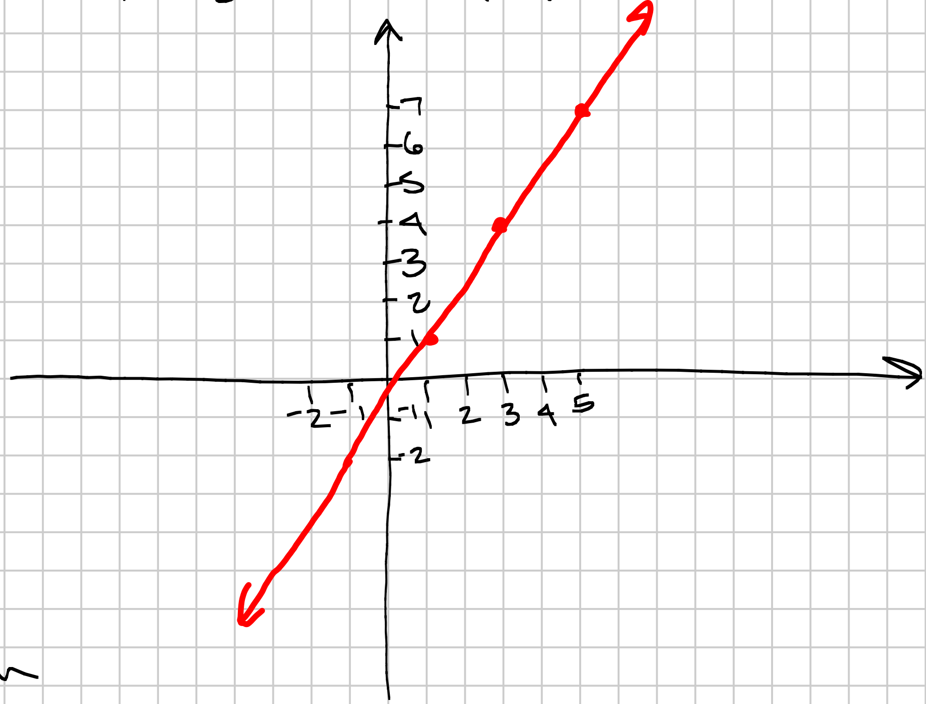
Previous example continued:

Let's graph the solutions that we found.

(1, 1)

(3, 4)

(5, 7)



The graph of an equation is the set of all ordered pairs that make the equation true.

3.2.3

Ex: Graph the line $-3x + 2y = -4$.
Use the given coordinates to create solutions.

given:

x	y
2	
4	
	5
	-2

or $(2, \ )$ $(4, \ )$ $(\ , 5)$ $(\ , -2)$

$$-3x + 2y = -4$$

$x = 2$

$$-3(2) + 2y = -4$$
$$-6 + 2y = -4$$
$$+6 \qquad +6$$
$$2y = 2$$
$$\frac{2y}{2} = \frac{2}{2}$$
$$y = 1$$

$(2, 1)$

$x = 4$

$$-3x + 2y = -4$$
$$-3(4) + 2y = -4$$
$$-12 + 2y = -4$$
$$+12 \qquad +12$$
$$2y = 8$$
$$\frac{2y}{2} = \frac{8}{2}$$
$$y = 4$$

$(4, 4)$

$y = 5$

$$-3x + 2y = -4$$
$$-3x + 2(5) = -4$$
$$-3x + 10 = -4$$
$$-10 \qquad -10$$
$$-3x = -14$$
$$\frac{-3x}{-3} = \frac{-14}{-3}$$
$$x = \frac{14}{3} = 4\frac{2}{3}$$

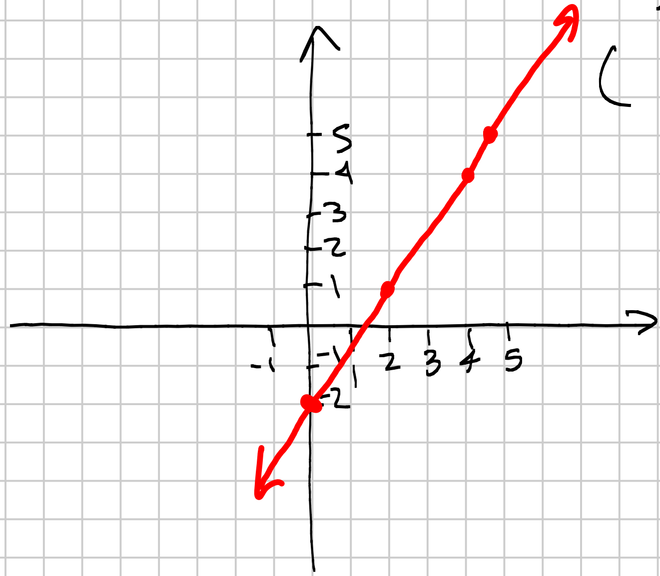
$(4\frac{2}{3}, 5)$

$y = -2$

$$-3x + 2y = -4$$
$$-3x + 2(-2) = -4$$
$$-3x - 4 = -4$$
$$+4 \qquad +4$$
$$-3x = 0$$
$$\frac{-3x}{-3} = \frac{0}{-3}$$
$$x = 0$$

$(0, -2)$

Points: $(0, -2)$
$(4\frac{2}{3}, 5)$
$(4, 4)$
$(2, 1)$



Ex: Find at least 5 ordered pair solutions. Graph the line. $\boxed{3.2.4}$

$$x - 2y = -6$$

$x = 2$

$$2 - 2y = -6$$
$$\underline{-2 \qquad\qquad -2}$$
$$-2y = -8$$
$$\frac{-2y}{-2} = \frac{-8}{-2}$$
$$y = 4$$
$$(2, 4)$$

$y = 6$

$$x - 2y = -6$$
$$x - 2(6) = -6$$
$$x - 12 = -6$$
$$\underline{+12 \qquad +12}$$
$$x = 6$$
$$(6, 6)$$

$$x - 2y = -6$$

$x = 8$

$$8 - 2y = -6$$
$$\underline{-8 \qquad\qquad -8}$$
$$-2y = -14$$
$$\frac{-2y}{-2} = \frac{-14}{-2}$$
$$y = 7$$
$$(8, 7)$$

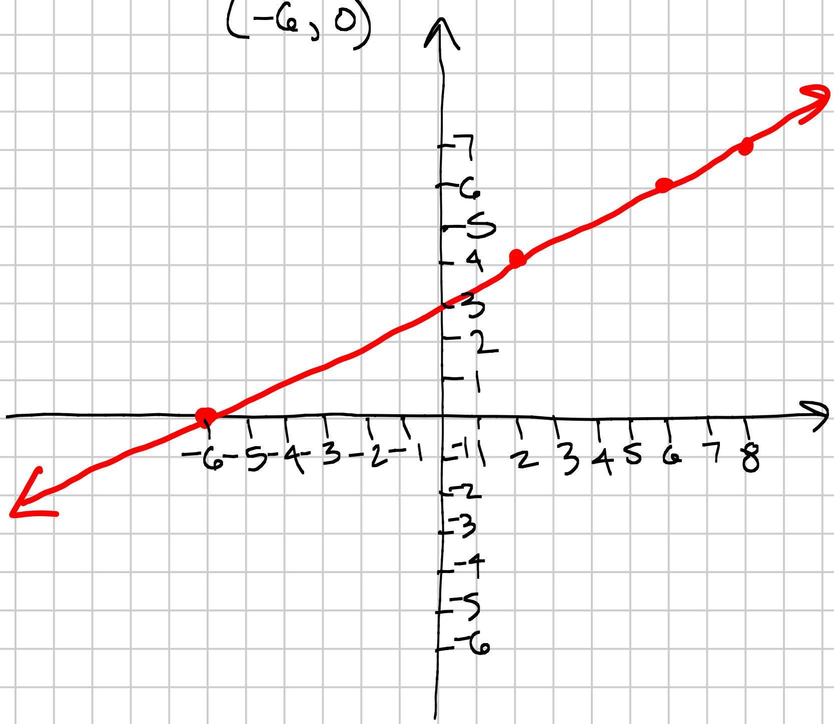
$$x - 2y = -6$$

$x = -6$

$$-6 - 2y = -6$$
$$\underline{+6 \qquad\qquad +6}$$
$$-2y = 0$$
$$\frac{-2y}{-2} = \frac{0}{-2}$$
$$y = 0$$
$$(-6, 0)$$

$y = -5$

$$x - 2y = -6$$
$$x - 2(-5) = -6$$
$$x + 10 = -6$$
$$\underline{-10 \qquad -10}$$
$$x = -16$$
$$(-16, -5)$$



Points: $(-16, -5)$ $(8, 7)$

$(-6, 0)$ $(2, 4)$

$(6, 6)$