3.1: The Rectangular Coordinate System

Note Title

~~2/5/2015~~ 9/23/2015

Prereading

Ex 3 (p 231): $(-1,3)$, $(2,5)$, $(0,0)$, $(0,-3)$, $(4,0)$

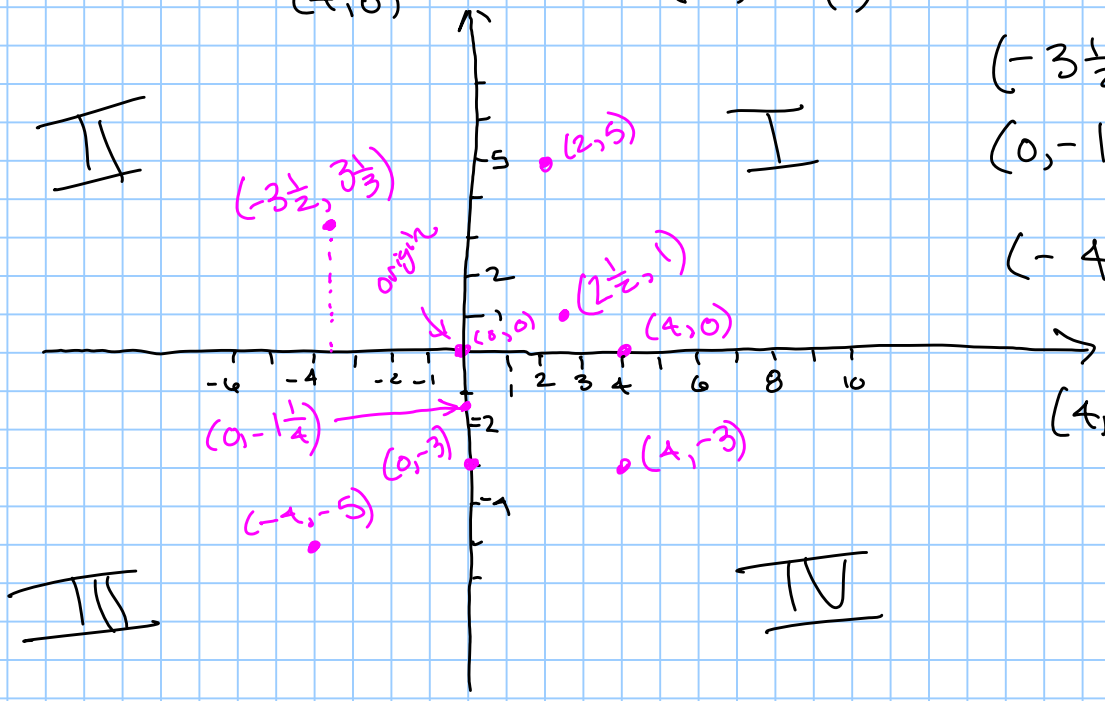
$(2\frac{1}{2}, 1)$, $(-\frac{7}{2}, \frac{10}{3})$, $(0, -\frac{5}{4})$ } write as mixed numbers:

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

$(0, -1\frac{1}{4})$

$(-4, -5)$

$(4, -3)$



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

A linear equation in 2 variables can be written as

$Ax + By = C$, where A, B, C are real numbers.

Note: linear eqn in 1 variable: ex: $2x + 5 = 9$

$2x = 4$

$x = 2$ one solution

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

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

$x=4, y=6 \Rightarrow 3(4)-2(6)=1$

$12-12=1$

$0=1$ False!

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

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

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

$15-14=1$

$1=1$ True!

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

Is $(7,10)$ a solution?

$x=7, y=10 \Rightarrow 3(7)-2(10)=1$

$21-20=1$

$1=1$

Yes, this is also a solution.

There are infinitely many solutions to this equation.

Let's graph the equation $3x-2y=1$

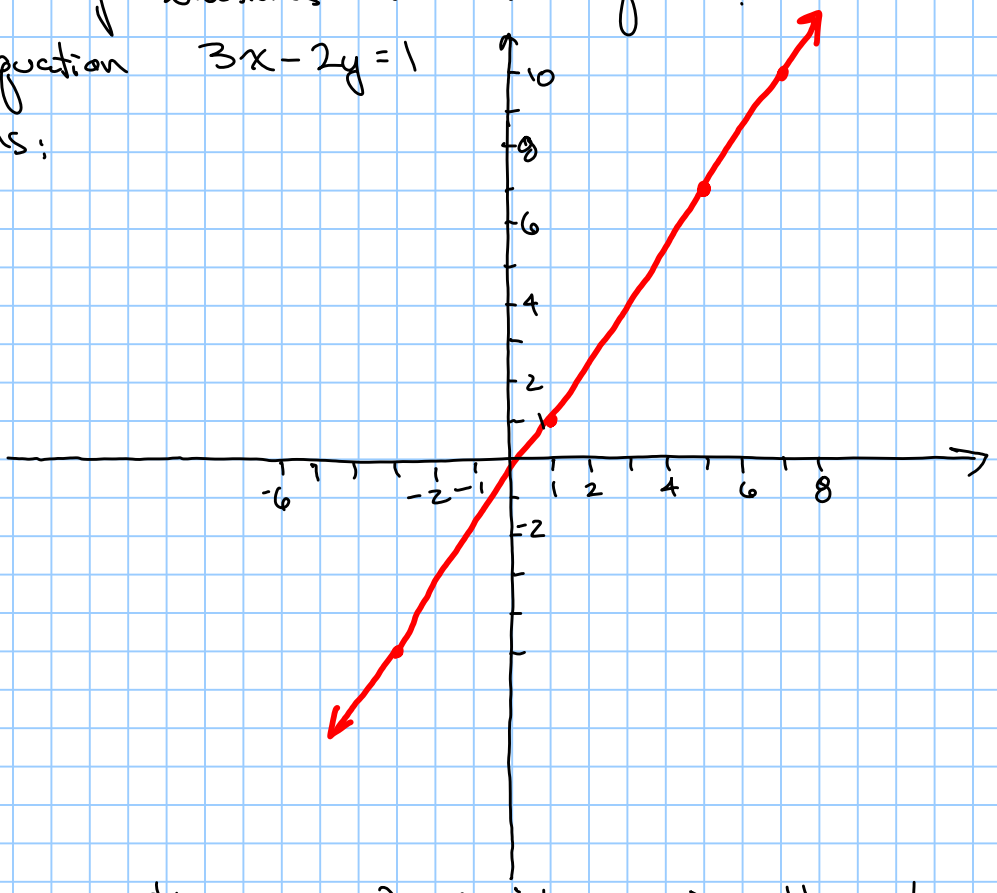
We have some solutions:

$(5,7)$

$(7,10)$

$(-3,-5)$

$(1,1)$



Try $(-3,-5)$:

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

$-9+10=1$

$1=1$ ✓

The graph of an equation in 2 variables is the set of all ordered pairs that make the equation true. So, the graph is the solution set. To graph an eqn means to draw an accurate picture of the solution set.

Example: Graph the line $-3x+2y=-4$

Choose a value for x or y, then solve for the other.

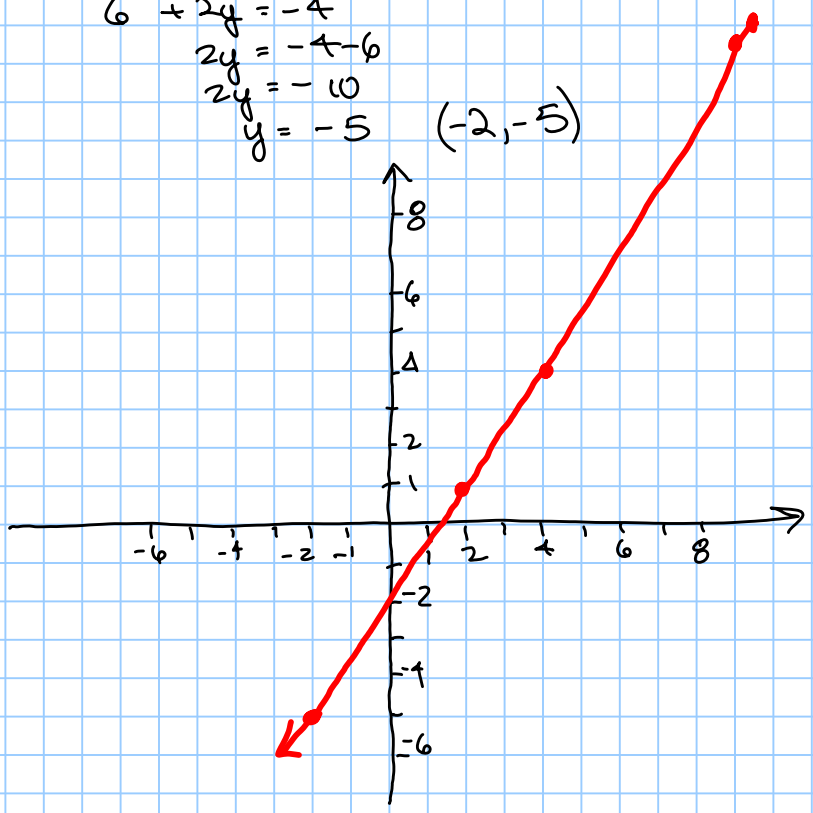
$x=9 \Rightarrow -3(9)+2y=-4$
$-27+2y=-4$
$2y=-4+27$
$2y=23$
$y=\frac{23}{2}=11\frac{1}{2}$ $\quad (9, 11\frac{1}{2})$

$x=2 \Rightarrow -3(2)+2y=-4$
$-6+2y=-4$
$2y=-4+6$
$2y=2$
$y=1$ $\quad (2,1)$

$y=12 \Rightarrow -3x+2(12)=-4$
$-3x+24=-4$
$-3x=-28$
$x=\frac{-28}{-3}=\frac{28}{3}=9\frac{1}{3}$
$(9\frac{1}{3}, 12)$

$y=-13 \Rightarrow -3x+2(-13)=-4$
$-3x-26=-4$
$-3x=-4+26$
$-3x=22$
$x=\frac{22}{-3}=-7\frac{1}{3}$
$(-7\frac{1}{3}, -13)$

$x=-2 \Rightarrow -3(-2)+2y=-4$
$6+2y=-4$
$2y=-4-6$
$2y=-10$
$y=-5$ $\quad (-2,-5)$



$(9, 11\frac{1}{2})$
$(2,1)$
$(9\frac{1}{3}, 12)$
$(-7\frac{1}{3}, -13)$
$(-2,-5)$

$-3x+2y=-4$
$x=4 \Rightarrow -3(4)+2y=-4$
$-12+2y=-4$
$2y=-4+12$
$2y=8$
$y=4$
$(4,4)$

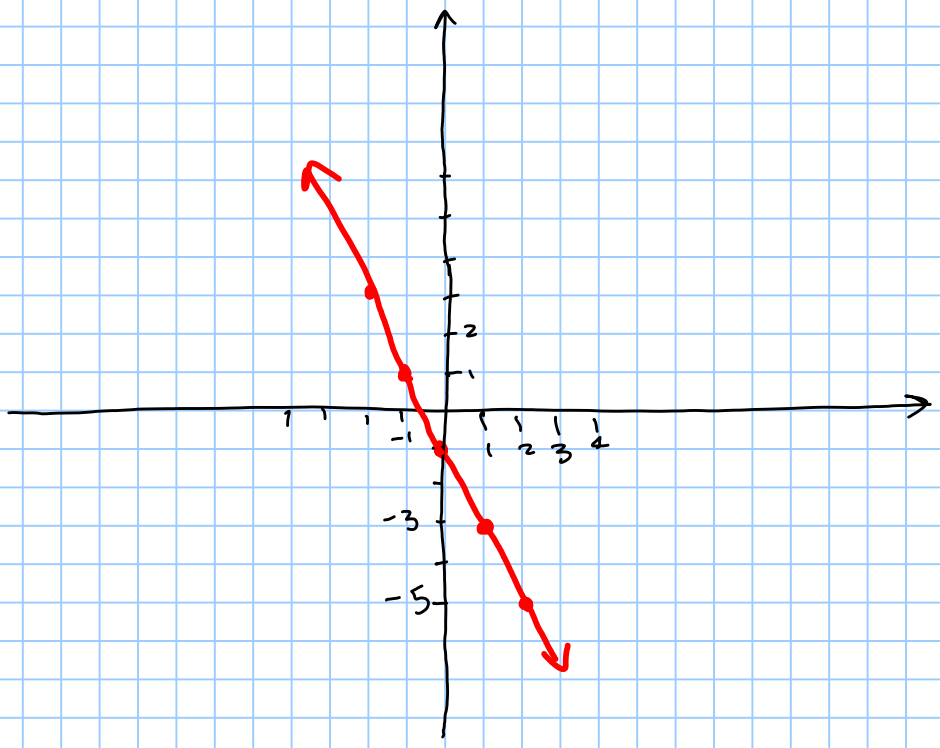
Ex: Graph $2x+y=-1$

Solve for y: $2x+y=-1$

$-2x \quad -2x$

$y=-2x-1$

x	$y=-2x-1$	
0	$y=-2(0)-1=0-1=-1$	$(0,-1)$
1	$y=-2(1)-1=-2-1=-3$	$(1,-3)$
2	$y=-2(2)-1=-4-1=-5$	$(2,-5)$
-1	$y=-2(-1)-1=2-1=1$	$(-1,1)$
-2	$y=-2(-2)-1=4-1=3$	$(-2,3)$



Ex: Solve for y.

$2x+3y=6$

$-2x \quad -2x$

$3y=-2x+6$

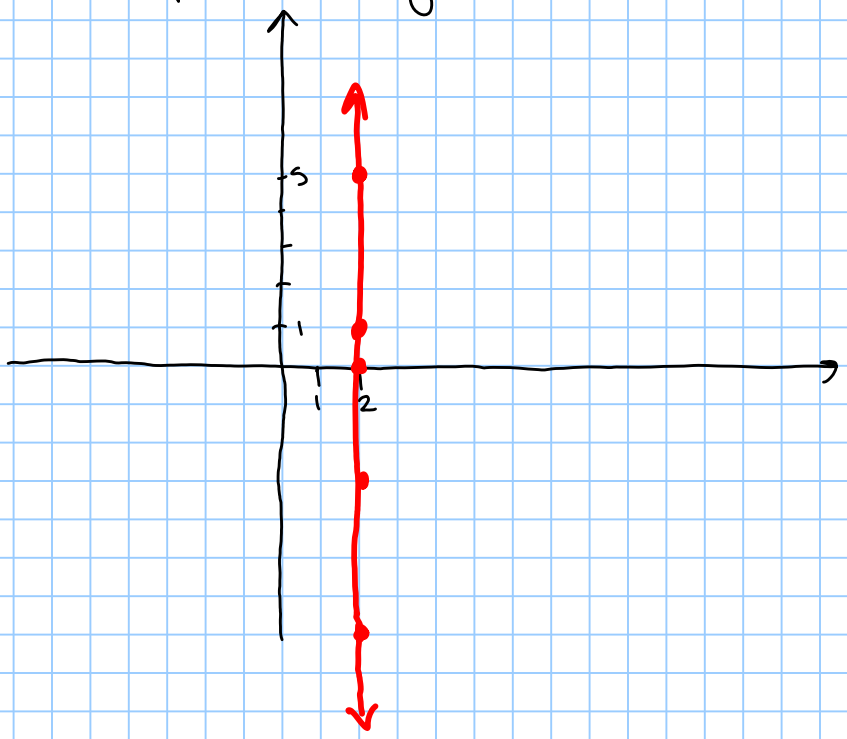
$\frac{3y}{3}=\frac{-2x}{3}+\frac{6}{3}$

$y=-\frac{2}{3}x+2$

x	$y=-\frac{2}{3}x+2$
0	$y=-\frac{2}{3}(0)+2=0+2=2$
3	$y=-\frac{2}{3}(3)+2=-2+2=0$
-6	$y=-\frac{2}{3}(-6)+2=4+2=6$

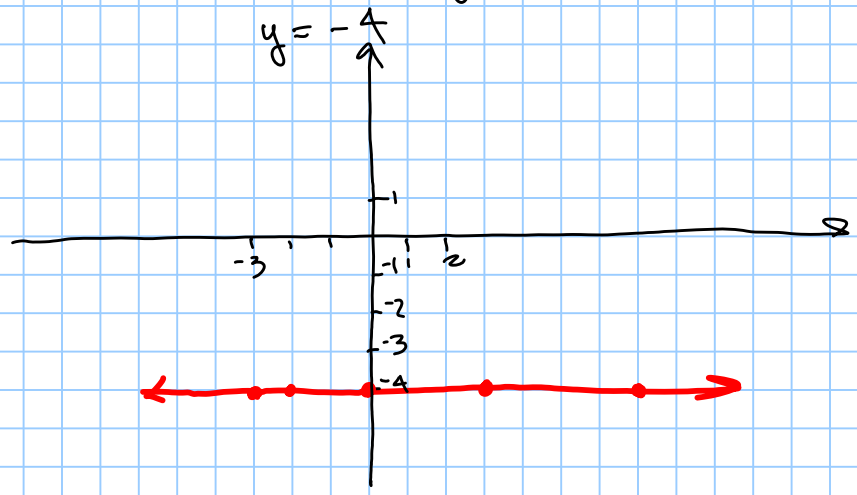
etc

Ex: Graph the equation $x = 2$.



(2, 13)
(2, 5)
(2, −7)
(2, −10)
(2, 0)
(2, 1)
(2, −3)

Ex: Graph the equation. $y = -4$

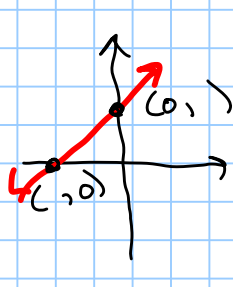


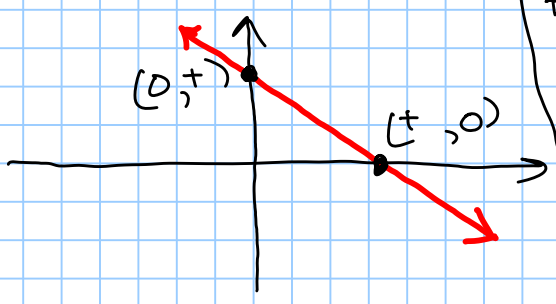
Solutions: (0, −4)
(3, −4)
(−3, −4)
(−2, −4)
(7, −4)

3.3: Graphing Linear Equations Using Intercepts

x-intercept: x-coordinate of the point where the graph intersects the x-axis.

y-intercept: y-coordinate of the point where the graph intersects the y-axis.





★ To find the x-intercept, set $y = 0$ and solve for x.

★ To find the y-intercept, we set $x = 0$ and solve for y.

★ ★

Ex: Graph the line using intercepts.

$$-2x + 3y = -18$$

Find the x-intercept: Set $y = 0$: $y = 0 \Rightarrow -2x + 3(0) = -18$

$$-2x + 0 = -18$$
$$-2x = -18$$
$$\frac{-2x}{-2} = \frac{-18}{-2}$$
$$x = 9 \quad (9, 0)$$

x-intercept: 9 sometimes written (9, 0)

Find the y-intercept: Set $x = 0$: $x = 0 \Rightarrow -2(0) + 3y = -18$

$$0 + 3y = -18$$
$$3y = -18$$
$$\frac{3y}{3} = \frac{-18}{3}$$
$$y = -6$$
$$(0, -6)$$

y-intercept: −6 sometimes written (0, −6)