MAT 012 **Review & Lecture Notes: ch 8, Part A, Linear Functions**

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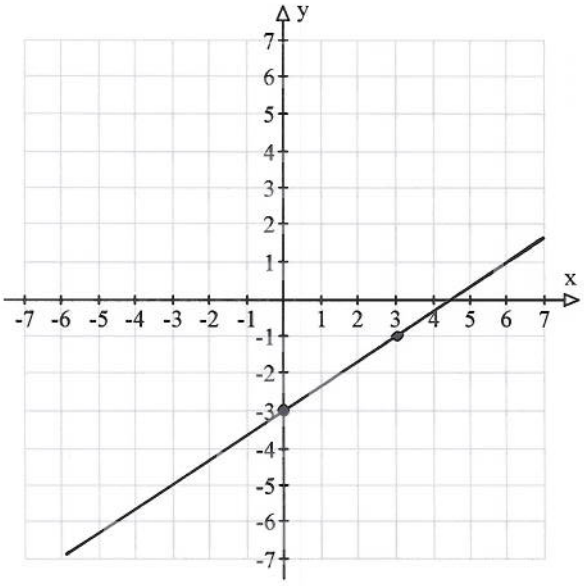
Lecture Notes: ch 8, Part A, Linear Functions

If you want to graph an equation given in standard form, convert the equation to slope intercept form (i.e. solve for y), then graph.

Example: $-2x + 3y = -9$

Bring in slope-intercept form, then graph.

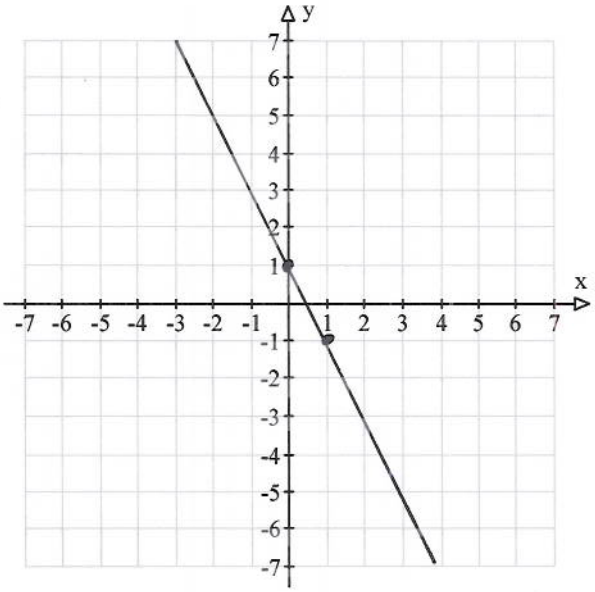
$$-2x + 3y = -9$$
$$+2x \qquad +2x$$
$$\frac{3y}{3} = \frac{2x}{3} - \frac{9}{3}$$
$$y = \frac{2}{3}x - 3$$



Example: $-4x - 2y = -2$

Bring in slope-intercept form, then graph.

$$-4x - 2y = -2$$
$$+4x \qquad +4x$$
$$\frac{-2y}{-2} = \frac{4x}{-2} - \frac{2}{-2}$$
$$y = -2x + 1$$



Intercepts

Sometimes, we pick the x-intercept and the y-intercept as two points from which to graph the line:

x-intercept: Let $y = 0$, solve for x.

y-intercept: Let $x = 0$, solve for y.

Example: Find the intercepts and graph $2y - x = 6$

x-intercept: (give the point)

$y = 0$

$2 \cdot 0 - x = 6$

$0 - x = 6$

$\frac{-x}{-1} = \frac{6}{-1}$

$x = -6$

$(-6, 0)$

y-intercept: (give the point)

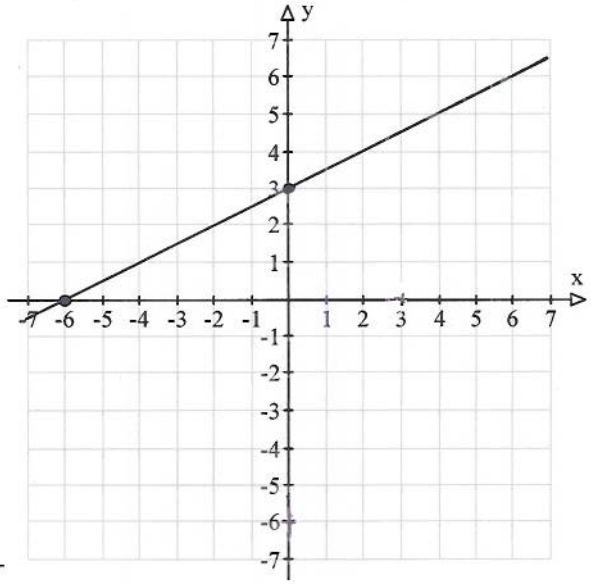
$x = 0$

$2y - 0 = 6$

$\frac{2y}{2} = \frac{6}{2}$

$y = 3$

$(0, 3)$



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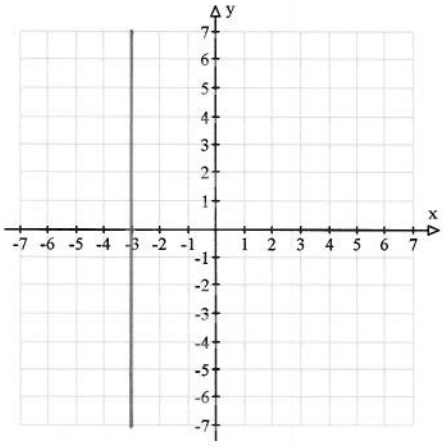
Special Cases:

$x =$ number

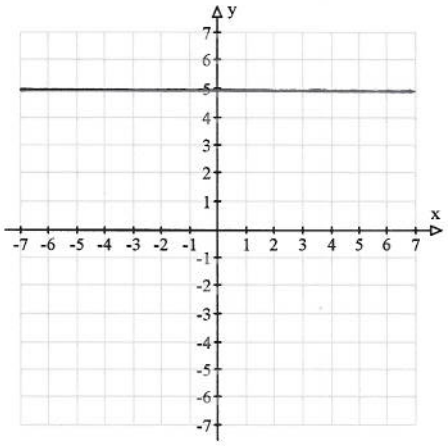
Example: $x = -3$



This graph is a vertical line.

$y =$ number

Example: $y = 5$



This graph is a horizontal line.

Find the equation of the line, given two points (slope intercept form)

Example: A line is passing through the points $(-3, 5)$ and $(3, 1)$. ($x_1\ y_1$ and $x_2\ y_2$)

a) Calculate the slope of the line.

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{1-5}{3-(-3)} = \frac{1-5}{3+3} = \frac{-4}{6} = -\frac{2}{3}$$

b) Find the equation of the line (*Using Algebra*)

$y = mx + b$

$y = -\frac{2}{3}x + b$ ($x\ y$: $(-3, 5)$)

$5 = -\frac{2}{3} \cdot (-3) + b$

$5 = -\frac{2}{3} \cdot \left(-\frac{3}{1}\right) + b$

$5 = 2 + b$

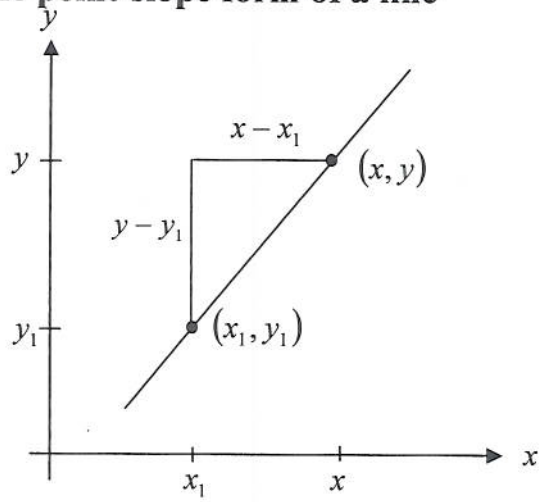
$-2 \quad -2$

$3 = b$

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

Don't forget to state the equation: $\boxed{y = -\frac{2}{3}x + 3}$

The point-slope form of a line



In this figure: $\frac{rise}{run} = \frac{y - y_1}{x - x_1} = m$

If we multiply the equation

$$\frac{y - y_1}{x - x_1} = m$$

by $(x - x_1)$ on both sides,
we obtain the point-slope form of the line

$$y - y_1 = m(x - x_1)$$

Point-Slope Form of a line: $y - y_1 = m(x - x_1)$

The point-slope form of the line can be set-up as long as m is known or can be found and one point on the line is known.
The point-slope form of the line can be simplified into the slope-intercept form $y = mx + b$.
(Distribute the m on the right hand side and bring the constant over to the other side.)

Example: A line is going through the points $(\overset{x_1}{-4}, \overset{y_1}{9})$ and $(\overset{x_2}{-1}, \overset{y_2}{-3})$.

a) Caluclate the slope of the line.

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-3-9}{-1-(-4)} = \frac{-3-9}{-1+4} = \frac{-12}{3} = -4$$

b) Set up an equation of the line in **point-slope form**

$y - y_1 = m(x - x_1)$; $(\overset{x_1}{-4}, \overset{y_1}{9})$
$y - 9 = -4(x - (-4))$
$y - 9 = -4(x + 4)$

c) Bring the equation in slope intercept form.

$y - 9 = -4x - 16$
$+9 \qquad +9$
$y = -4x - 7$

alternatively $(\overset{x_1}{-1}, \overset{y_1}{-3})$

$y - y_1 = m(x - x_1)$
$y - (-3) = -4(x - (-1))$
$y + 3 = -4(x + 1)$

$y + 3 = -4x - 4$
$-3 \qquad -3$
$y = -4x - 7$

Does not have to be included