

MAT 012

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

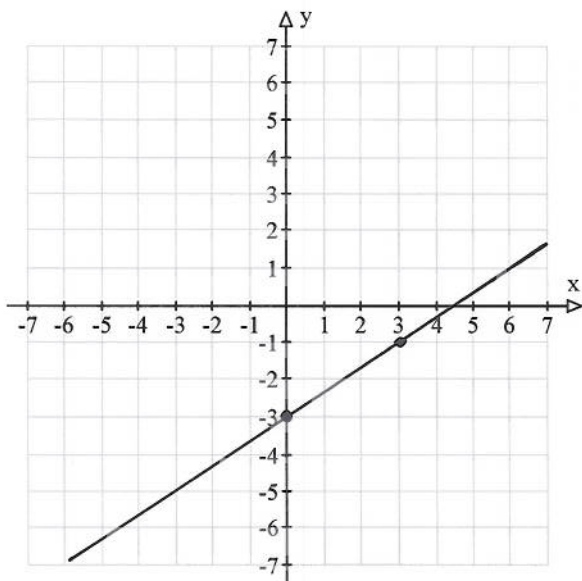
Lecture Notes: ch 8, Part A, Linear Functions

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.

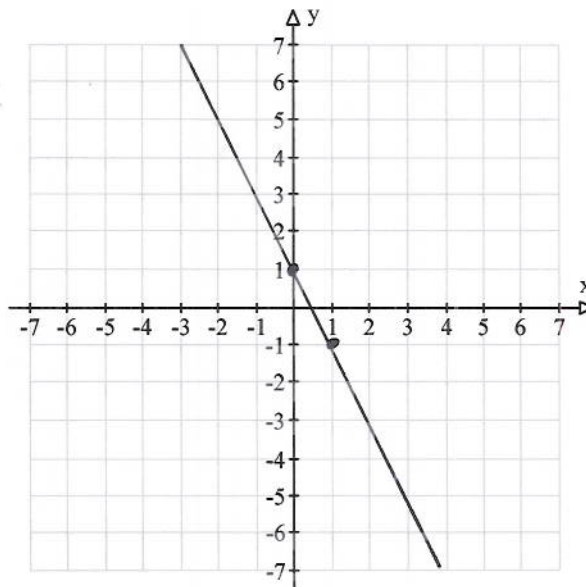
$$\begin{array}{r} -2x + 3y = -9 \\ +2x \qquad \qquad +2x \\ \hline \frac{3y}{3} = \frac{2x}{3} - \frac{9}{3} \\ y = \frac{2}{3}x - 3 \end{array}$$



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

Bring in slope-intercept form, then graph.

$$\begin{array}{r} -4x - 2y = -2 \\ +4x \qquad \qquad +4x \\ \hline \frac{-2y}{-2} = \frac{4x}{-2} - \frac{2}{-2} \\ y = -2x + 1 \end{array}$$



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 .

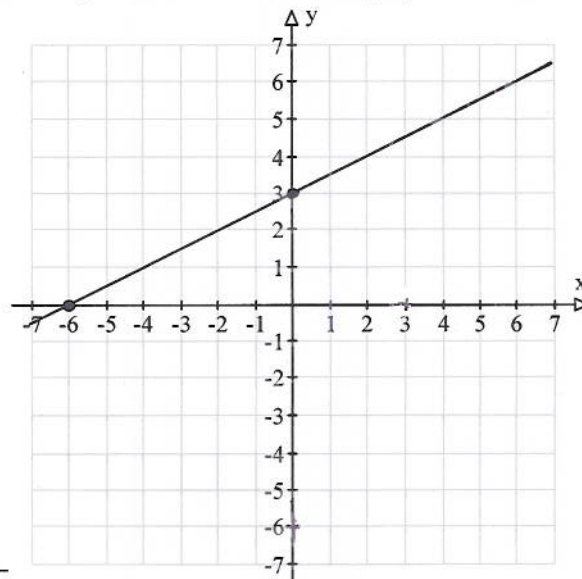
Example: Find the intercepts and graph $2y - x = 6$

x -intercept:
(give the point)

$$\begin{array}{l} y = 0 \\ 2 \cdot 0 - x = 6 \\ 0 - x = 6 \\ \frac{-x}{-1} = \frac{6}{-1} \\ x = -6 \\ (-6, 0) \end{array}$$

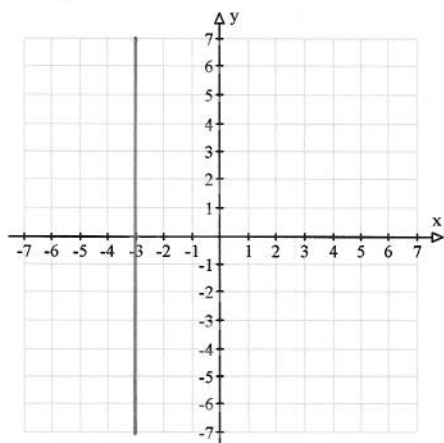
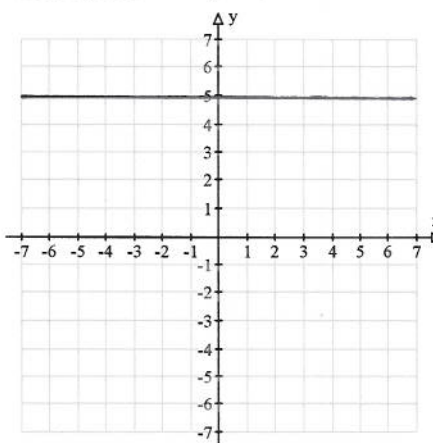
y -intercept:
(give the point)

$$\begin{array}{l} x = 0 \\ 2y - 0 = 6 \\ \frac{2y}{2} = \frac{6}{2} \\ y = 3 \\ (0, 3) \end{array}$$



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Special Cases:

 $x = \text{number}$ Example: $x = -3$ This graph is a vertical line. $y = \text{number}$ 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 $(x_1, y_1) = (-3, 5)$ and $(x_2, y_2) = (3, 1)$.

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)

$$y = mx + b$$

$$y = -\frac{2}{3}x + b \quad \begin{matrix} x & y \\ (-3, & 5) \end{matrix}$$

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

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

$$5 = 2 + b$$

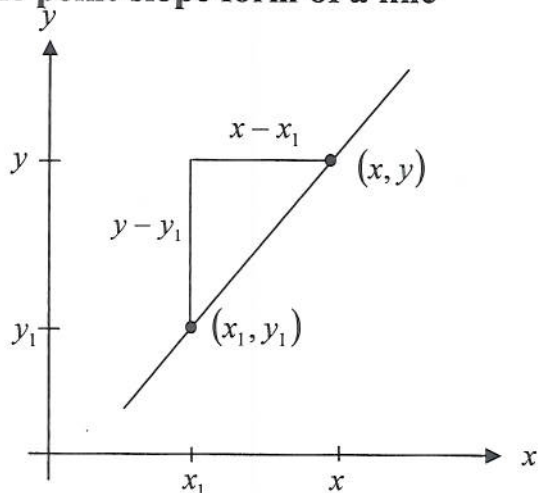
$$\frac{-2 \quad -2}{3} = b$$

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

Don't forget to state the equation:

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

The point-slope form of a line



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

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 $(-4, 9)$ and $(-1, -3)$.

a) Calculate 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**

$$\begin{aligned} y - y_1 &= m(x - x_1); (-4, 9) \\ y - 9 &= -4(x - (-4)) \\ y - 9 &= -4(x + 4) \end{aligned}$$

$$\begin{aligned} y - y_1 &= m(x - x_1) \text{ alternatively } (-1, -3) \\ y - (-3) &= -4(x - (-1)) \\ y + 3 &= -4(x + 1) \end{aligned}$$

c) Bring the equation in slope intercept form.

$$\begin{array}{r} y - 9 = -4x - 16 \\ + 9 \qquad \qquad + 9 \\ \hline y = -4x - 7 \end{array}$$

$$\begin{array}{r} y + 3 = -4x - 4 \\ -3 \qquad \qquad -3 \\ \hline y = -4x - 7 \end{array}$$

Does not have to be included