5.1 - Review of Linear Systems

January 22, 2020 10:38 AM

Unit 4: Systems of Equations & Linear Inequalities

Topic	Assignment
5.1: Review of Linear Systems	Pg. 188 # 1 – 2, 4 – 11 Use Desmos for any question that says to use a graphing calculator
5.2: Solving Nonlinear Systems of Equations	Pg. 195 # 1 – 3, 5 – 8 Use Desmos for any question that says to use a graphing calculator
5.3: Graphing Linear Inequalities in Two Variables	Pg. 205 # 1 – 7 Use Desmos for any question that says to use a graphing calculator
5.4: Solving Systems of Linear Inequalities	Pg. 214 # 1 – 8 Use Desmos for any question that says to use a graphing calculator
5.5: Determining an Optimal Solution	Pg. 221 # 1 – 9
5.6: Modelling & Linear Programming	Pg. 230 # 1 – 7 Use Desmos for any question that says to use a graphing calculator

Recall that a linear equation is an equation that has a degree of one (ie. the variable in the equation is raised only to the power of one).

You've mostly seen linear equations in the following two forms:

$Ax+By+C=0$ **"General Form"**
- A, B, C are integers
- A is positive

ex: $2x-3y+4=0$

$y=mx+b$ **"Slope-Intercept Form"**
- $m=$ slope $\left(\frac{\text{rise}}{\text{run}}\right)$
- $b=$ y-intercept.

ex: $y=2x-4$

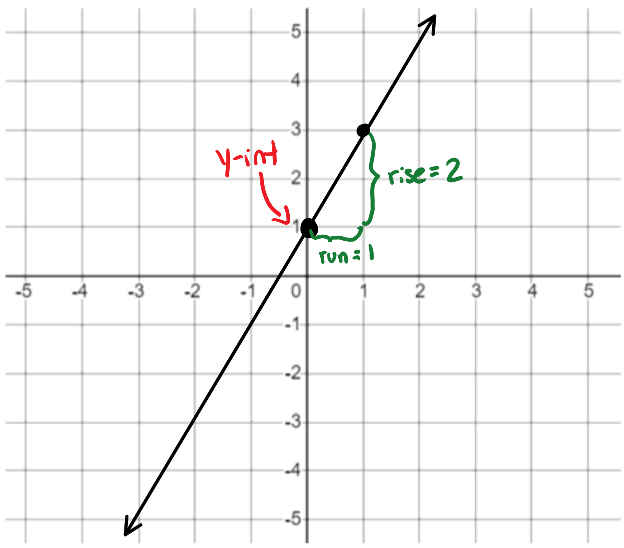
Example

Graph the linear equation $y = 2x + 1$

↳ $y=mx+b$

$m=2$ ⇝ slope $= \frac{2 \leftarrow \text{rise}}{1 \leftarrow \text{run}}$

$b=1$ ⇝ y-int



Graphing equations in general form is a little harder. You have two options:

Method 1: Convert to Slope-Intercept Form

You want to isolate for the dependent variable (usually "*y*") and simplify. This will leave you in slope-intercept form, then you can graph as normal.

Example

Graph the equation $4x + 2y - 2 = 0$

$4x + 2y - \cancel{2} = 0$
$\quad +\cancel{2} \quad +2$

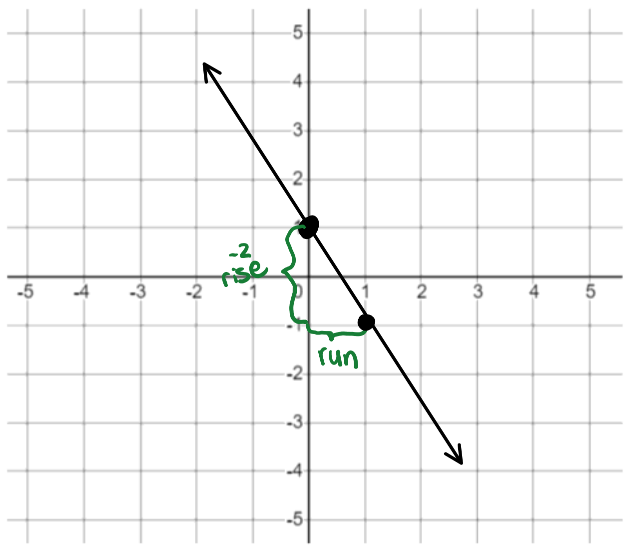
$\cancel{4x} + 2y = 2$
$-\cancel{4x} \quad -4x$

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

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

$y = -2x + 1$

$y = mx + b$
$m = -2 = \frac{-2}{1}$
$b = 1$



Method 2: Determine the x and y-Intercepts and Connect Them

Remember,

x-intercepts occur when $y = 0$

y-intercepts occur when $x = 0$

So, we can substitute y = 0 and x = 0 to determine the corresponding intercepts and connect them with a line, and then extend the line.

Example

Graph the equation $4x + 2y - 2 = 0$

x-int

when y=0 ....

$4x+2y-2=0$

$4(x)+2(0)-2=0$

$4x-2=0$

$+2 \quad +2$

$\frac{4x}{4}=\frac{2}{4}$

$x=\frac{2}{4}=\frac{1}{2}$

$\therefore \left(\frac{1}{2}, 0\right)$

y-int

when x=0...

$4x+2y-2=0$

$4(0)+2y-2=0$

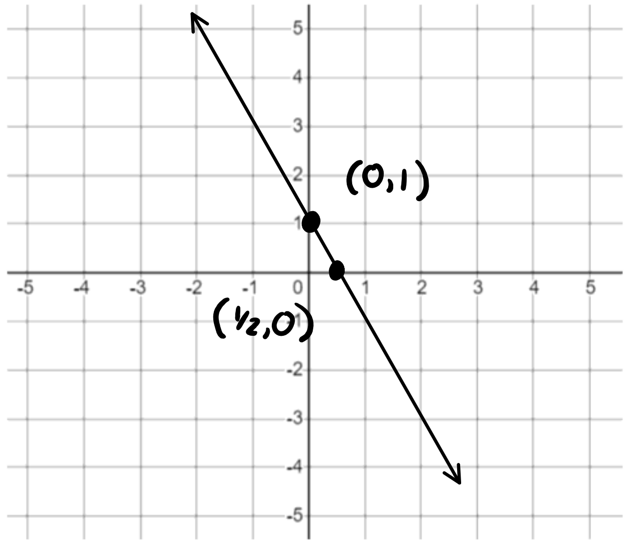
$2y-2=0$

$+2 \quad +2$

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

$y=\frac{2}{2}=1$

$\therefore (0,1)$

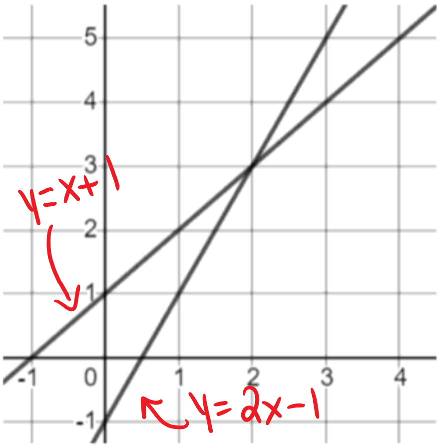


Recall from math 10 the concept of a **system of linear equations**.

In math, a " system " of equations is when 2 or more equations are compared at the same time.

A system of linear equations is when all the equations in the system are linear.

We are said to have "solved" the system when we find points (ie. x and y coordinates) that satisfy the system. Graphically, these points occur where the lines overlap.



Here, I've graphed two linear equations:

$y = 2x - 1$ (the one with y-int of -1)
$y = x + 1$ (the one with the y-int of 1)

As we can see, even if we extended these lines out to infinity, they would cross only at one point.

In this example, that point is __(2, 3)__. We say that point is the solution to this system of linear equations.

ie. $x=2$, $y=3$

Since we know how to graph lines, we can graph them and see where they intersect, or if we have access to a graphing calculator (such as Desmos) we can graph them there, and see where they intersect.

Example

Solve the following system of equations first without a calculator, then verify your answer with a calculator:

$6x - 3y - 3 = 0$
$y = 9x - 1$
$\hookrightarrow m = \frac{9}{1}$

$6x-3y-3=0$
$-3y=-6x+3$
$y=2x-1$
$\hookrightarrow m=\frac{2}{1}$