Déjà Vu, It's Algebra 2!

Lesson 06

Linear Systems of Equations

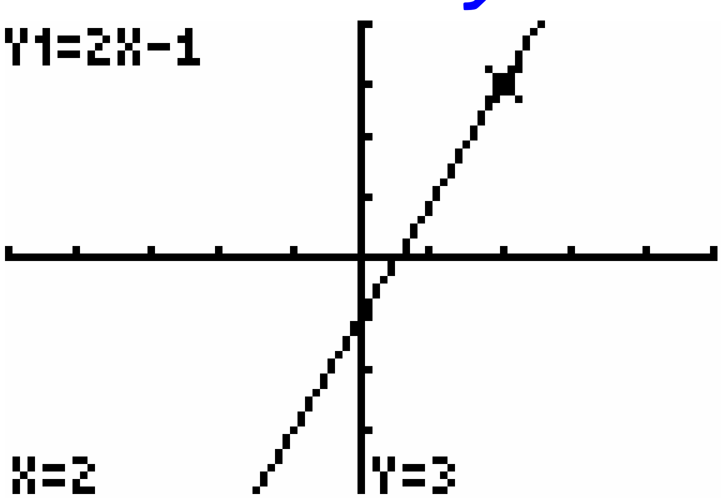
Systems of linear equations can be used to represent linear relationships involving different constant rates.

A system of equations is a set of two or more equations containing two or more variables.

A linear system is a system of equations containing only linear equations.

Recall that a line is an infinite set of points, ordered pairs, that are solutions to a linear equation.

$$y = 2x - 1$$



X	Y1
-2	-5
-1	-3
0	-1
1	1
2	3
3	5
4	7

X=2

A solution set to a system of equations is the set of all points that satisfy each equation in the system.

Example:

For the following system, determine if the following points are solutions:

$$\begin{cases} x - 2y = -6 \\ 2x = 8 - y \end{cases}$$

(A) $(2,4)$ (B) $(3,2)$

Can a linear system have more than one solution?

The graphical solution to a system is the point in common between the graphs of each line, or the POINT OF INTERSECTION.

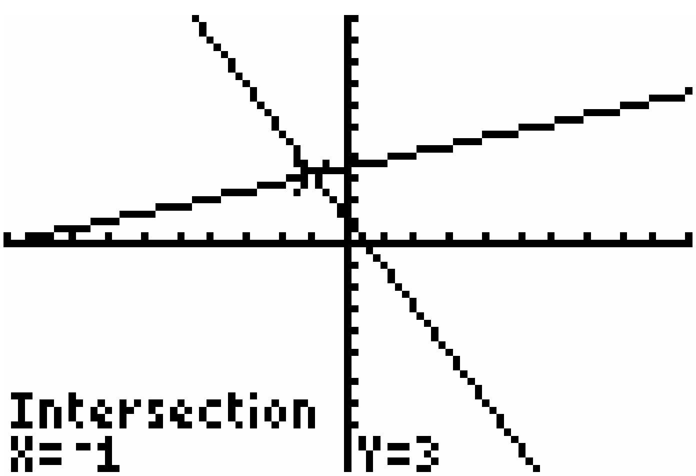
Example:

$$\begin{cases} x - 3y = -10 \\ 2x + y = 1 \end{cases}$$

Let's solve this one first by graphing.

So to answer the question:

Can a linear system have more than one solution?



X	Y1	Y2
-4	2	9
-3	2.3333	7
-2	2.6667	5
-1	3	3
0	3.3333	1
1	3.6667	-1
2	4	-3

X= -1

We can also solve systems algebraically using a variety of methods.

Method 1: Substitution

$$\begin{cases} x - 3y = -10 \\ 2x + y = 1 \end{cases}$$

Method 2: Linear Combination / Elimination

$$\begin{cases} x - 3y = -10 \\ 2x + y = 1 \end{cases}$$

Systems of equations can be used to model behavior in the real world. In these cases, we must create our own equations from given information.

Example:

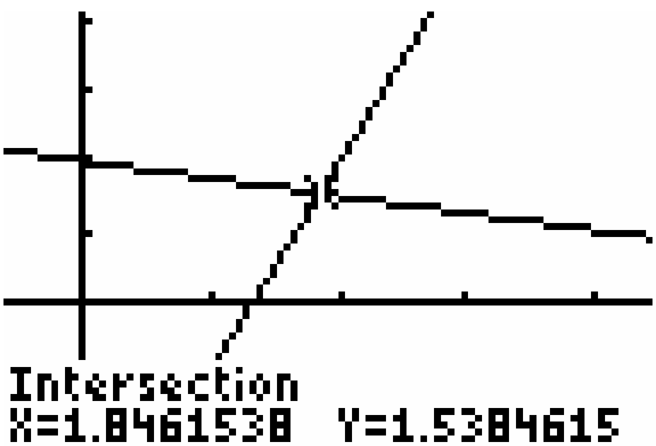
A veterinarian needs 60 pounds of dog food that is 15% protein. She will combine a beef mix that is 18% protein with a pork mix that is 9% protein. How many pounds of each does she need to make the 15% protein mix?

Déjà RE-Vu

How do you decide which method to use when solving linear systems?

Graphing and tables: When you're interested in a rough solution or estimation of a solution –or- when you have access to your graphing calculator.

$$\begin{cases} y = 3x - 4 \\ y = -\dfrac{1}{4}x + 2 \end{cases}$$



X	Y_1	Y_2
-1	-7	2.25
0	-4	2
1	-1	1.75
2	2	1.5
3	5	1.25
4	8	1
5	11	.75

X=2

Substitution: When it is simple to solve one of the equations for a single variable.

$$\begin{cases} -2x+5y=11 \\ 5x+y=-3 \end{cases}$$

Notice in this equation, solving for either variable in the first equation will produce fractional coefficients. In the second equation, though, it is easy to solve for the *y* variable.

Also realize that if both equations are solved for *y*, like in the first example, setting them equal to each other is a form of substitution.

$$\begin{cases} y=3x-4 \\ y=-\frac{1}{4}x+2 \end{cases} \rightarrow 3x-4=-\frac{1}{4}x+2$$

Also notice that if you don't like the fractions, you can multiple both sides by the least common denominator:

$$4(3x-4)=4\left(-\frac{1}{4}x+2\right)$$

$$12x-16=-x+8$$

$$13x=24$$

$$x=\frac{24}{13}=1.\overline{846153}$$

Linear Combo / Elimination: When variables have coefficients that are the same, opposite, a multiple of each other, or neither!! It requires each equation to be written in corresponding order.

$$\begin{cases} 4x + 7y = -25 \\ -12x - 7y = 19 \end{cases}$$

Notice the coefficients of y in each equation are opposites. Simple add the two equations.

The solution is $\left(\frac{3}{4}, -4\right)$

What about in this case?

$$\begin{cases} 5x - 3y = 42 \\ 8x + 5y = 28 \end{cases} \rightarrow \begin{cases} 5(5x - 3y = 42) \\ 3(8x + 5y = 28) \end{cases} \rightarrow \begin{cases} 25x - 15y = 210 \\ 24x + 15y = 84 \end{cases}$$

The solution is $(6, -4)$

Math is Power!!

References:

http://www.lenoir.k12.nc.us/banks/j0295472.gifU
Show Background from:
http://www.fs.uiuc.edu/blue/bluenote_Medex.htm