Linear Equations and Solving Systems of Two Equations

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Linear Equations

- Only simple variables are allowed in linear equations.
  - **No x^2, y^3, $\sqrt{x}$, etc.**

non-linear

$2x + y - z = 4$ ✔

$2x + y^2 - z = 4$ ✘

Linear vs non-linear

Dimensions

A **Linear Equation** can be in 2 dimensions … (such as **x** and **y**)	
… or in 3 dimensions … (it makes a plane)	
… or 4 dimensions …	
… or more!	
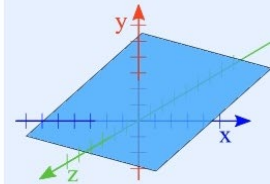
Systems of Linear Equations

Solving systems of equations in two variables

A system of a linear equation comprises two or more equations and one seeks a common solution to the equations. In a system of linear equations, each equation corresponds with a straight line corresponds and one seeks out the point where the two lines intersect.
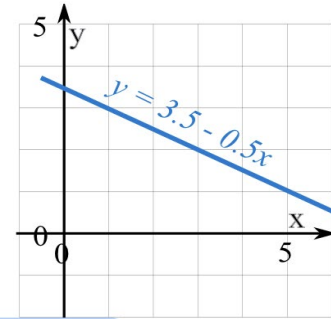
How to solve a system of equations:

Step 1: Solve one of the equations for one of the variables. Let's solve the first eq. For y:...

Step 2: Substitute that eq. into the other eq., and solve for x.

Step 3: Substitute the given value x into one of the original equations and solve for y.

Systems of Linear Equations

$y = 3.5 - 0.5x$

A [Linear Equation](#) is an **equation** for a **line**.

A linear equation is not always in the form **y = 3.5 − 0.5x**,

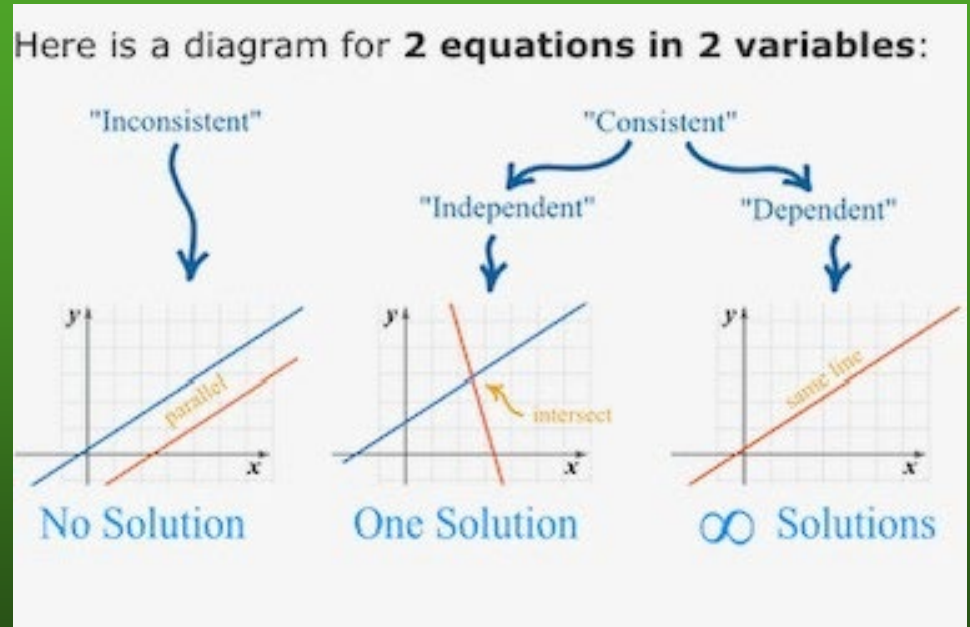It can also be like **y = 0.5(7 − x)**

Or like **y + 0.5x = 3.5**

Or like **y + 0.5x − 3.5 = 0** and more.

(Note: those are all the same linear equation!)

The Possible Three Cases of Solving Linear Equations

- No solution
  - In this case, the equations are called inconsistent.
- One solution
  - The equations are consistent.
- Infinitely many solutions
  - The equations are called consistent.

Here is a diagram for **2 equations in 2 variables**:

"Inconsistent"

"Consistent"

"Independent"

"Dependent"

parallel

intersect

same line

No Solution

One Solution

∞ Solutions

Methods of Solving Systems of Equations

- The three methods of solving systems of equations are substitution, elimination, and graphing.
- Solving by Substitution
    - Write one of the equations so that it is in the style of "variable = …"
    - Substitute that variable in the other equation
    - Solve the other equations

- Solving by Elimination
    - Eliminate means to remove variables until there is only one left.
    - Multiply an equation by a constant (except 0)
    - Add or subtract an equation to another equation.

Graphing Diagram

- Solving by Graphing

  - Graph each equation separately
  - Label the intersection, which will be the solution

Example: Solve these two equations:

$x + y = 6$

$-3x + y = 2$

The two equations are shown on this graph:

Our task is to find where the two lines cross.

Well, we can see where they cross, so it is already solved graphically.

Example of System of Linear Equations

Two Variables

$$2x + y = 5$$

$$-x + y = 2$$

We can use any of the three methods to find the solution.

Three Variables

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

$$x - y - z = 0$$

$$x + y + 3z = 12$$

Only Elimination and Substitution can be used to find the solution