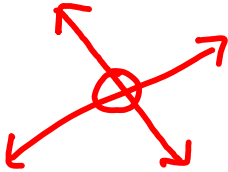


Solving Systems of Equations

A system of equations is any collection of equations. A solution to a linear system of equations is a point or set of points that makes both equations true at the same time.

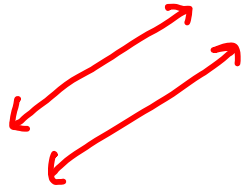
There are three possibilities for the solution to a 2x2 system of linear equations:

Intersecting Lines



Solution: (x,y)

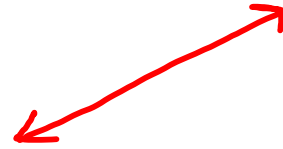
Parallel Lines



Solution:



Coinciding Lines



Solution:
{(x,y): equation of line}

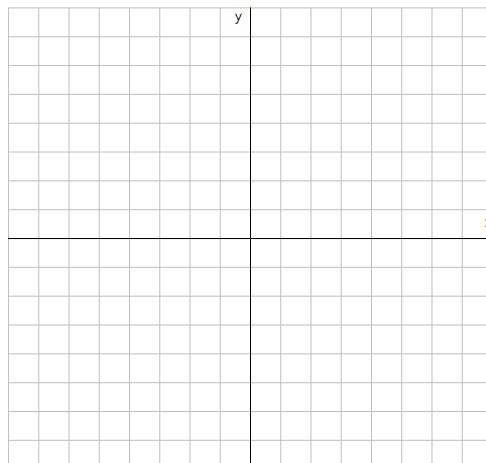
How to solve a 2x2 system graphically:

- 1) Graph each line on the same coordinate axes
- 2) Find the intersection point if it exists

Find the solution to the system:

$$x + y = -5$$

$$-2x + y = 1$$



How to solve a 2x2 system using the substitution method:

- 1) Solve one of the equations for one of its variables**
- 2) Substitute the expression for the variable found in step 1 into the other equation**
- 3) Find the value of one variable by solving the equation from step 2**
- 4) Find the value of the other variable by substituting the value found in step 3 into any equation of the system**
- 5) Check solution (optional)**

$$-3x - 5y = -17$$

$$4x = y - 8$$

$$y = \frac{1}{7}x + 3$$

$$x - 7y = -21$$

$$y = 2x - 3$$

$$2y - 4x = 4$$

How to solve a 2x2 system of equations using the elimination method:

- 1) Rewrite each equation in standard form: $Ax + By = C$
- 2) If necessary, multiply one or both equations by some nonzero number so that the coefficient of one variable in one equation is the opposite of its coefficient in the other equation
- 3) Add the equations
- 4) Find the value of one variable by solving the equation from step 3
- 5) Find the value of the other variable by substituting the value found in step 4 into either one of the original equations
- 6) Check solution (optional)

$$x + y = -5$$

$$-2x + y = 1$$

$$2x - 3y = 7$$

$$-4x + 6y = 14$$

$$4x + 3y = 1$$

$$3x + 2y = 2$$

How to solve a 3x3 system of equations using the elimination method:

- 1) Rewrite each equation in standard form: $Ax + By + Cz = D$
- 2) Choose a pair of equations and use the equations to eliminate ONE variable in the same way as we did elimination for equations in two variables
- 3) Choose any other pair of equations and eliminate the SAME VARIABLE as in step 2
- 4) Applying steps 2 and 3 should result in two equations in two variables which can be solved in the same way as a 2x2 system
- 5) Solve for the third variable by substituting the values of the variables found in step 4 into any one of the original equations containing the third variable and solving the resulting equation.

$$3x - 2y + z = 9$$

$$x + y - 2z = -8$$

$$-x - 2y + 3z = 13$$

$$-6x - 2y + 4z = -2$$

$$9x + 3y - 6z = 6$$

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

$$7x + 3y + z = -33$$

$$x - z = 16$$

$$5x + y + 3z = 1$$

$$2x + y - 3z = -4$$

$$4x - 2y + z = 9$$

$$3x + 5y - 2z = 5$$