Solving Systems of Equations Video Lecture

Sections 4.1 - 4.4

Course Learning Objective:

Solve systems of linear equations.

Weekly Learning Objectives:

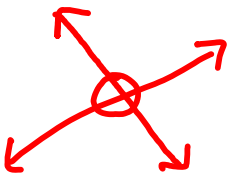
1) Solve a system of linear equations by graphing.
2) Use the substitution method to solve a system of linear equations.
3) Use the addition/elimination method to solve a system of linear equations.
4) Determine the number of solutions of a system of equations.

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.

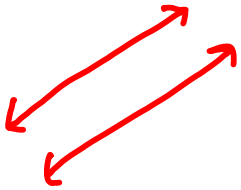
There are three possibilities for the solution to a 2x2 system of linear equations:

Intersecting Lines



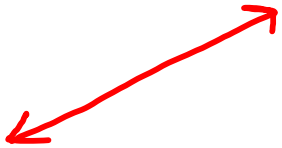
Solution: (x,y)

Parallel Lines



Solution: ∅

Coinciding Lines



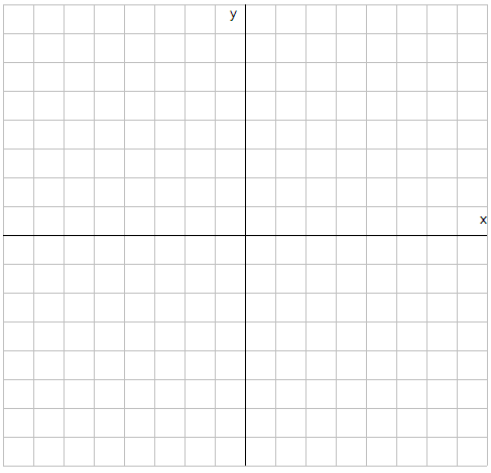
Solution:
{(x,y): equation of line}

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 euqation 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

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

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

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