UNIT 4: SOLVING SYSTEMS OF LINEAR EQUATIONS

Part A: Video Tutorial Section

Videos 1 and 2:

https://www.youtube.com/watch?v=OWS2xr7M6NY **(Solving Systems of Linear Equations by Graphing)**

https://www.youtube.com/watch?v=IOGI8Um-cBY **(More Examples of Solving Systems of Linear Equations by Graphing)**

Videos 3 and 4:

https://www.youtube.com/watch?v=8SFk17Ea5wo (**Substitution**)

https://www.youtube.com/watch?v=Q1L8bUDvzXw **(More Examples of Substitution)**

Vides 5 and 6:

https://www.youtube.com/watch?v=cz6UmZLWgEw(E**limination**)

https://www.youtube.com/watch?v=H9PgnVV1i04 **(More Examples of Elimination)**

Video 7 and 8:

https://www.youtube.com/watch?v=qac6SCBkOKg **(Solving Special Systems of Inequalities)**

https://www.youtube.com/watch?v=5qkyuHIE2GM (**More Examples of Solving Special Systems of Inequalities)**

Video 9 and 10:

https://www.youtube.com/watch?v=qac6SCBkOKg **(Systems of Linear Inequalities)**

https://www.youtube.com/watch?v=FWbcKade3rw **(More Examples of Systems of Linear Inequalities)**

Part B : Vocabulary, Hints and Explanations

Important Vocabulary Students Need to Understand!

system of linear equations	• **a set of two (or more) linear equations in the same variables**
a solution of a system of linear equations	• **an ordered pair that is a solution of each equation in the system. The solution of a system of linear equations is the point of intersection of the graph of the equations**
a system of linear inequalities	• **is a set of two or more linear inequalities in the same variables**
a solution of a system of linear inequalities	• **an ordered pair that is a solution of each inequality in the system**
graph of a system of linear inequalities	• **Is the graph of all of the solutions of the system.**

Students need to understand that a system of linear equations means that two or more equations are used AND the ordered pair will solve both (or all) the equations.

Ex: $y = 2x + 5$ and $y = -4x - 1$ represent a system equations. The solution set or ordered pair that will solve both equations is (-1,3)

A student may solve a system of equations by graphing, substitution, or elimination. Each system tends to lend itself to an easier solution method based upon the equations.

Solving a System of Linear Equations By Graphing:

Students may find this the "easiest" method as it is the most visual.

The student should recall how to graph a linear equation from Unit 2. If need be, review that unit.

The student needs to get the presented equation into **$y = mx + b$** format in order to easily graph the equation (see Unit 2).

The student then graphs each linear equation. The intersection of the two lines represents the solution to the system of equations.

The student can check his solution by "plugging in" the values of x and y into each equation. If the ordered pair solves both equations successfully, the student has solved the system of equations.

Solving a System of Linear Equations By Substitution:

This method of solving a system of equations works well when a either the y variable or the x variable can be "isolated" or stated as = in the equations.

Ex: $y = 2x - 4$

$7x - 2y = 5$

In this system of equations, the value of y is stated as $2x - 4$.

To solve a system of linear equations by substitution:

1. Solve one of the equations for one of the variables. (as in the example above)
2. Substitute the expression from step 1 into the other equation and solve for the variable (Hint: railroad problem that will require combining like terms!)
3. Substitute the value from Step 2 into the first equation

Using the above example:

$Y = 2x - 4$

$7x - 2y = 5$

Step 1: $y = 2x - 4$

Step 2: $7x - 2(2x - 4) = 5$

Distribute: $7x - 4x + 8 = 5$

Combine like terms: $3x + 8 = 5$

Solve for x (railroad problem) $3x = -3$

$X = -1$

Step 3: $y = 2(-1) - 4$

$Y = -2 - 4$

$Y = -6$

The solution to this system of equations is the ordered pair (x,y) OR (-1,-6)

Hint: It often helps to have the student write (x,y) oh his paper. This helps keep the pair in the correct order.

Solving a System of Linear Equations By Elimination:

When using elimination, the student is "eliminating" one of the variables by adding or subtracting. This method works well when either the x-values or the y-values "off-set" each other.

Adding Ex 1: $x + 3y = -2$

$X - 3y = 16$

The 3y and the –3y can be added together to "eliminate" the y variable. Leaving the student with

$2x = 14$ (an easy to solve equation)

Ex 2: $2x - y = 9$

$4x + y = 21$

The y and the –y can eliminate the y-value when added together, leaving the student with

$6x = 30$

Subtracting: Ex 1: $3x + 4y = -6$

$7x + 4y = -14$

The y- variable can be eliminated by subtraction. Leaving the student with

$-4x = 8$

To solve a system of linear equations by elimination:

1. Look for variables in the equation that when added or subtracted together will eliminate that variable.
2. Solve the resulting equation for the remaining variable
3. Substitute the value from step 2 into one of the original equations and solve.

Using the above example:

$2x – y = 9$
$4x + y = 21$

Step 1: Notice that the y-values will "cancel" or eliminate the y-value Resulting in the equation

$6x + 30$

Step 2: Solve $6x + 30$

$X = 5$

Step 3: Substitute $2(5) - y = 9$

$10 – y = 9$

$Y = 1$

The solution to both equations is the ordered pair (x,y) or (5,1)

To solve a system of linear equations by elimination using multiplication to create a pair of terms that has the same or opposite coefficients:

Th student may find that he can multiply one equation to create at least one pair of like terms that have the same of opposite coefficients.

Ex: Using the system of equations:

$-6x + 5y = 25$

$-2x – 4y = 14$

Step 1: The student realizes he can multiply 2(3) and create a value for x that creates a pair of terms with the same coefficient.

CAUTION!!!!! Be sure to reinforce that to use this method the student MUST multiply ALL terms in the equation!!!!

Step 2: Multiply $-2x – 4y = 14$ by 3

New equation is: $-6x – 12y = 42$

Step 3: Follow the process of elimination as outline above

Solving Special Systems of Linear Equations

A system of linear equations can have one solution, no solution, or infinite solutions.

One solution	The lines intersect at one point
No Solution	The lines are parallel

Infinite (Many) Solutions	The lines are the same line

Solving a System of Linear Inequalities By Graphing

A system of linear inequalities can be solved by graphing (see Unit 3). The student needs to graph each of the inequalities and shade the area for each. Where the two shaded areas meet is the solution set for the system of inequalities.

Hint: A student may benefit from using two different colors to graph both the line and the shaded area.