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SOLVING LINEAR SYSTEMS USING ELIMINATION Guide Notes

LINEAR SYSTEM OF EQUATIONS: is a set of equations with the same pair of variables. When we are solving systems using the ***Elimination Method***, we either add or subtract the equations to get an equation in one variable.
For two variable systems, there are three possible types: Independent, inconsistent and dependent.

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

4. $\begin{cases} 4x - 3y = 5 \\ x + y = 0 \end{cases}$

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

5. $\begin{cases} x + y = 4 \\ 5x - 4y = 6 \end{cases}$

3. $\begin{cases} 3x + 2y = 7 \\ 6x + 4y = 14 \end{cases}$

6. $\begin{cases} 6x - y = 3 \\ 5x - 2y = -1 \end{cases}$

INDEPENDENT SYSTEM is a system where two distinct non-parallel lines intersect at one specific point (x,y).

Systems:

1	4	5	6

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INCONSISTENT SYSTEM is a system where two distinct lines are parallel. Since parallel lines never intersect, then there can be no solution.

System:

2

DEPENDENT SYSTEM is a system which has infinite solutions.

System:

3

Sample Problems: Find the solution of the following systems using Elimination and identify the type of linear system

1. $$\begin{cases} x + y = 2 & \textbf{(I)} \\ 2x - y = 3 & \textbf{(II)} \end{cases}$$

We interchange the "x" or "y" coefficients from equation I and equation II to eliminate one of the variables. In this case, we are going to eliminate the "y" coefficients of both equations, like follows:

$$\begin{cases} (x + y = 2) \\ (2x - y = 3) \end{cases}$$

As both coefficients have different signs, we do not have to assign a negative sign to one of the coefficients so they can eliminate each other.

The result would be:

$$3x = 5 \qquad \rightarrow x = \frac{5}{3}$$

The value of "y" is calculated from equation I

$$\mathrm{y} = 2 - \mathrm{x} \quad \rightarrow \mathrm{y} = 2 - \left(\frac{5}{3}\right) \; \rightarrow \; y = \frac{1}{3}$$

Solution (5/3, 1/3). Independent System

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2. $$\begin{cases} 4x - y = 2 & \text{(I)} \\ 8x - 2y = 4 & \text{(II)} \end{cases}$$

We interchange the "x" or "y" coefficients from equation I and equation II to eliminate one of the variables. In this case, we are going to eliminate the "y" coefficients of both equations, like follows:

$$\begin{cases} 2(4x - y = 2) \\ -1(8x - 2y = 4) \end{cases}$$

As both coefficients have equal signs, we have to assign a negative sign to one of the coefficients so they can eliminate each other.

Applying distributive property:

$$\begin{cases} 8x - 2y = 4 \\ -8x + 2y = -4 \end{cases}$$

The result would be:

$$0 = 0$$

Infinite Solutions. Independent System

3. $$\begin{cases} -2x + 2y = 5 & \text{(I)} \\ -x + y = 4 & \text{(II)} \end{cases}$$

We interchange the "x" or "y" coefficients from equation I and equation II to eliminate one of the variables. In this case, we are going to eliminate the "y" coefficients of both equations, like follows:

$$\begin{cases} 1(-2x + 2y = 5) \\ -2(-x + y = 4) \end{cases}$$

As both coefficients have equal signs, we have to assign a negative sign to one of the coefficients so they can eliminate each other.

Applying distributive property:

$$\begin{cases} -2x + 2y = 5 \\ 2x - 2y = -8 \end{cases}$$

The result would be:

$$0 = -3$$

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No Solution. Inconsistent System