

Remediation Unit 6 Objective 4

Solving a System of Equations using Elimination Method

Steps for Elimination

1. Multiply one or both of the equations by a number so that the coefficients of one of the variables are opposites
2. Add the equations from step 1 together. Combining the equations will eliminate one of the variables.
3. Solve for the remaining variable.
4. Substitute the value from step 3 into the one of the original equations and find the value of the second variable.

Example

Solve the following system using Elimination: $\begin{cases} 9x + 2y = 0 \\ 3x - 5y = 17 \end{cases}$

Step 1: We need to use multiplication to get the same number, different signs in front of one of the variable. In this example, we will multiply the bottom equation by -3 so the x will then have -9 in front of it and will eliminate with the 9x in the first equation.

$$\begin{cases} 9x + 2y = 0 \\ 3x - 5y = 17 \end{cases} \quad (-3) \quad \leftarrow \text{Multiply ALL terms in the bottom equation by -3}$$

$$\begin{array}{l} \text{New Equation:} \quad -9x + 15y = -51 \\ 1^{\text{st}} \text{ Equation (did not change):} \quad 9x + 2y = 0 \end{array}$$

Step 2 and 3: ADD the equations together. The x variables will get eliminated. Then solve for y.

$$\begin{array}{r} -9x + 15y = -51 \\ + \quad 9x + 2y = 0 \\ \hline 17y = -51 \quad \leftarrow \text{Solve for y} \\ \\ y = -3 \end{array}$$

Step 4: Substitute -3 in for y and solve for x. It does not matter which equation you use.

Equation 1: $9x + 2y = 0$ \leftarrow substitute -3 in for y and solve for x

$$\begin{array}{r} 9x + 2(-3) = 0 \rightarrow 9x - 6 = 0 \\ \quad \quad \quad +6 \quad +6 \\ \quad \quad \quad \hline \quad \quad 9x = 6 \\ \quad \quad \quad 9 \quad 9 \\ \quad \quad \quad \hline \quad \quad x = \frac{2}{3} \end{array}$$

$$\text{Solution: } \left(\frac{2}{3}, -3 \right)$$

Special Cases

When you add the two equations together and BOTH variables get eliminated, the problem is a special case and the answer is either No Solution or All Points on the Line (Infinite).

<u>No Solution</u>	<u>All Points on the Line (Infinite Solutions)</u>
$\begin{array}{r} x - y = -2 \\ -x + y = 5 \\ \hline 0 = 3 \end{array} \leftarrow \text{This is a FALSE statement}$ <p style="text-align: center;">The answer is NO SOLUTION</p>	$\begin{array}{r} 2x + y = -5 \\ -2x - y = 5 \\ \hline 0 = 0 \end{array} \leftarrow \text{This is a TRUE statement}$ <p style="text-align: center;">The answer is ALL POINTS ON THE LINE</p>

Practice

Solve each system using the Elimination Method.

1.) $\begin{cases} x + y = -3 \\ x - 4y = -8 \end{cases}$

2.) $\begin{cases} -2x - y = 11 \\ -2x - 3y = 21 \end{cases}$

3.) $\begin{cases} 3x + 4y = 10 \\ 6x + 8y = -20 \end{cases}$

4.) $\begin{cases} 4x + 2y = -20 \\ 4x - 3y = -10 \end{cases}$

$$5.) \begin{cases} 2x - 4y = 6 \\ 4x - y = 5 \end{cases}$$

$$6.) \begin{cases} 3x + 4y = -4 \\ 2x - y = 1 \end{cases}$$

$$7.) \begin{cases} x - 4y = -20 \\ 4x - 3y = -28 \end{cases}$$

$$8.) \begin{cases} x - 3y = 8 \\ -2x + 6y = 10 \end{cases}$$

$$9.) \begin{cases} 3x - 5y = 13 \\ -4x - 2y = 26 \end{cases}$$

$$10.) \begin{cases} 3x - 4y = 16 \\ -2x - 3y = 12 \end{cases}$$