

Solving Systems of Equations by Elimination

GOAL

1. Same Number
2. Different Sign

Procedure:

1. Multiply one equation by a number to reach the **GOAL** above.
2. Add the two equations together to eliminate one variable and solve for the remaining variable.
3. Plug in the variable solved for in Step 2 back into one of the original equations.

Examples:

$$\begin{array}{r} 2x + y = 2 \\ + \quad 1x - 1y = 4 \\ \hline 3x + 0 = 6 \end{array}$$

$$\frac{3x}{3} = \frac{6}{3} \quad x = 2$$

$$\begin{array}{r} 2(2) + y = 2 \\ 4 + y = 2 \\ -4 \quad -4 \\ \hline y = -2 \end{array}$$

Solution: (2, -2)

$$\begin{array}{r} 2x + y = 3 \\ -x + 3y = -12 \end{array} \xrightarrow{\text{multiply by 2}} \begin{array}{r} + \quad 2x + 1y = 3 \\ -2x + 6y = -24 \\ \hline 0 + 7y = -21 \end{array}$$

$$\frac{7y}{7} = \frac{-21}{7}$$

y = -3

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

Solution: (3, -3)

$$\begin{array}{l} x + 3y = -5 \\ 4x - 1y = 6 \end{array} \quad \text{multiply by (3)} \rightarrow \begin{array}{l} + \quad x + 3y = -5 \\ + \quad 12x - 3y = 18 \\ \hline 13x + 0 = 13 \end{array}$$

$$\frac{13x}{13} = \frac{13}{13}$$

$$x = 1$$

$$\begin{array}{r} + \quad 3y = -5 \\ - \quad \quad -1 \\ \hline 3y = -6 \\ \frac{3y}{3} = \frac{-6}{3} \end{array}$$

$$y = -2$$

$$\boxed{\text{Solution: } (1, -2)}$$

$$\begin{array}{l} x - 3y = 6 \\ x - 3y = -3 \end{array} \quad \text{multiply by (-1)} \rightarrow \begin{array}{l} + \quad x - 3y = 6 \\ + \quad -x + 3y = 3 \\ \hline 0 + 0 = 9 \\ 0 = 9 \end{array}$$

$$\boxed{\text{No Solution}}$$

$$\begin{array}{l} 2x - y = 1 \\ 6x - 3y = 3 \end{array} \quad \text{multiply by (-3)} \rightarrow \begin{array}{l} -6x + 3y = -3 \\ + \quad 6x - 3y = 3 \\ \hline 0 + 0 = 0 \\ 0 = 0 \end{array}$$

$$\boxed{\text{Infinitely Many}}$$