

Solving Systems of Equations Model Problems

Graphing

$\bullet \begin{cases} y = -5x + 3 \\ y = x - 3 \end{cases}$

$(1, -2)$

Elimination (Given Opposites)

$$\begin{cases} -6x - 2y = -16 \\ 9x + 2y = 22 \end{cases}$$

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

$$x = 2$$

$(2, 2)$

$$\begin{aligned} 9x + 2y &= 22 \\ 9(2) + 2y &= 22 \\ 18 + 2y &= 22 \\ -18 & \quad -18 \\ \hline 2y &= 4 \\ \frac{2y}{2} &= \frac{4}{2} \\ y &= 2 \end{aligned}$$

Substitution (Both y =)

$$\begin{cases} y = -8x + 7 \\ y = -5x + 4 \end{cases}$$

$$\begin{aligned} -5x + 4 &= -8x + 7 \\ +8x & \quad +8x \\ \hline 3x + 4 &= 7 \\ -4 & \quad -4 \\ \hline 3x &= 3 \\ \frac{3x}{3} &= \frac{3}{3} \\ x &= 1 \end{aligned}$$

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

$(1, -1)$

Elimination (One Multiplication)

$$\begin{cases} 2(-x - 12y = 2) \rightarrow -2x - 24y = 4 \\ 2x - 6y = 26 \rightarrow +2x - 6y = 26 \end{cases}$$

$$\begin{aligned} -2x - 24y &= 4 \\ +2x - 6y &= 26 \\ \hline -30y &= 30 \\ \frac{-30y}{-30} &= \frac{30}{-30} \\ y &= -1 \end{aligned}$$

$$\begin{aligned} 2x - 6y &= 26 \\ 2x - 6(-1) &= 26 \\ 2x + 6 &= 26 \\ -6 & \quad -6 \\ \hline 2x &= 20 \\ \frac{2x}{2} &= \frac{20}{2} \quad x = 10 \end{aligned}$$

$(10, -1)$

Substitution (One y = or x =)

$$\begin{cases} -8x - 3y = 7 \\ y = 2x + 7 \end{cases}$$

$$\begin{aligned} -8x - 3(2x + 7) &= 7 \\ -8x - 6x - 21 &= 7 \\ -14x - 21 &= 7 \\ +21 & \quad +21 \\ \hline -14x &= 28 \\ \frac{-14x}{-14} &= \frac{28}{-14} \\ x &= -2 \end{aligned}$$

$$\begin{aligned} y &= 2x + 7 \\ y &= 2(-2) + 7 \\ y &= -4 + 7 \\ y &= 3 \end{aligned}$$

$(-2, 3)$

Elimination (Both Multiplication)

$$\begin{cases} 4(6x - 2y = -8) \rightarrow 24x - 8y = -32 \\ 6(-4x - 3y = -12) \rightarrow -24x - 18y = -72 \end{cases}$$

$$\begin{aligned} 24x - 8y &= -32 \\ -24x - 18y &= -72 \\ \hline -26y &= -104 \\ \frac{-26y}{-26} &= \frac{-104}{-26} \\ y &= 4 \end{aligned}$$

$$\begin{aligned} 6x - 2y &= -8 \\ 6x - 2(4) &= -8 \\ 6x - 8 &= -8 \\ +8 & \quad +8 \\ \hline 6x &= 0 \\ \frac{6x}{6} &= \frac{0}{6} \\ x &= 0 \end{aligned}$$

$(0, 4)$

Infinite Solutions: All variables drop out and the resulting equation is true (ex. $0 = 0$ OR $4 = 4$).

No Solutions: All variables drop out and the resulting equation is false (ex. $0 = 5$ OR $7 = 10$).