

**How Do We Solve A System Of Linear Equations Algebraically?**  
**Addition Method**

Examples: Solve the following systems of equations using the addition method. Check your answer.

$$\begin{array}{r} 1) \quad 3x - y = 7 \\ + \quad 2x + y = 8 \\ \hline 5x = 15 \\ \frac{5x}{5} = \frac{15}{5} \\ \boxed{x = 3} \end{array}$$

$$\begin{array}{r} 3x - y = 7 \\ 3(3) - y = 7 \\ 9 - y = 7 \\ \underline{-9 \quad -9} \\ -y = -2 \\ \frac{-y}{-1} = \frac{-2}{-1} \\ \boxed{y = 2} \\ \boxed{(3, 2)} \end{array}$$

chk #1

$$\begin{array}{r} 3x - y = 7 \\ 3(3) - 2 = 7 \\ 9 - 2 = 7 \\ 7 = 7 \\ \checkmark \end{array}$$

chk #2

$$\begin{array}{r} 2x + y = 8 \\ 2(3) + 2 = 8 \\ 6 + 2 = 8 \\ 8 = 8 \end{array}$$

$$\begin{array}{r} 2) \quad 5x - 2y = 20 \\ -5 \quad 2x + 3y = 27 \\ \rightarrow \quad 10x - 4y = 40 \\ -x + -10x + 15y = -135 \\ \hline -19y = -95 \\ \frac{-19y}{-19} = \frac{-95}{-19} \\ \boxed{y = 5} \end{array}$$

$\boxed{(6, 5)}$

$$\begin{array}{r} 5x - 2y = 20 \\ 5x - 2(5) = 20 \\ 5x - 10 = 20 \\ \underline{+10 \quad +10} \\ 5x = 30 \\ \frac{5x}{5} = \frac{30}{5} \\ \boxed{x = 6} \end{array}$$

chk #1

$$\begin{array}{r} 5x - 2y = 20 \\ 5(6) - 2(5) = 20 \\ 30 - 10 = 20 \\ 20 = 20 \end{array}$$

chk #2

$$\begin{array}{r} 2x + 3y = 27 \\ 2(6) + 3(5) = 27 \\ 12 + 15 = 27 \\ 27 = 27 \end{array}$$

$$\begin{array}{r} 3) \quad 5a + b = 13 \\ -5 \quad 4a - 3b = 18 \\ \rightarrow \quad 20a + 4b = 52 \\ \rightarrow \quad -20a + 15b = -90 \\ \hline 19b = -38 \\ \frac{19b}{19} = \frac{-38}{19} \\ \boxed{b = -2} \end{array}$$

$\boxed{(3, -2)}$

$$\begin{array}{r} 5a + b = 13 \\ 5a + -2 = 13 \\ 5a - 2 = 13 \\ \underline{+2 \quad +2} \\ 5a = 15 \\ \frac{5a}{5} = \frac{15}{5} \\ \boxed{a = 3} \end{array}$$

chk #1

$$\begin{array}{r} 5a + b = 13 \\ 5(3) + -2 = 13 \\ 15 - 2 = 13 \\ 13 = 13 \end{array}$$

chk #2

$$\begin{array}{r} 4a - 3b = 18 \\ 4(3) - 3(-2) = 18 \\ 12 + 6 = 18 \\ 18 = 18 \end{array}$$

$$4) \begin{cases} 3(2x + 5y = -1) \\ 2(-3x + y = 10) \end{cases} \rightarrow \begin{cases} 6x + 15y = -3 \\ -6x + 2y = 20 \end{cases}$$

$$\frac{17y}{17} = \frac{17}{17}$$

$$y = 1$$

$$\begin{aligned} 2x + 5y &= -1 \\ 2x + 5(1) &= -1 \\ 2x + 5 &= -1 \\ \underline{-5 \quad -5} \\ 2x &= -6 \\ \underline{2 \quad 2} \\ x &= -3 \end{aligned}$$

check #1

$$\begin{aligned} 2x + 5y &= -1 \\ 2(-3) + 5(1) &= -1 \\ -6 + 5 &= -1 \\ -1 &= -1 \end{aligned}$$

check #2

$$\begin{aligned} -3x + y &= 10 \\ -3(-3) + 1 &= 10 \\ 9 + 1 &= 10 \\ 10 &= 10 \end{aligned}$$

$$(-3, 1)$$

$$5) \begin{cases} 5m + 3n = 14 \\ -5(2m + n = 6) \end{cases} \rightarrow \begin{cases} 5m + 3n = 14 \\ -10m - 5n = -30 \end{cases}$$

$$\frac{1n}{1} = \frac{-2}{1}$$

$$n = -2$$

$$\begin{aligned} 5m + 3n &= 14 \\ 5m + 3(-2) &= 14 \\ 5m - 6 &= 14 \\ \underline{+6 \quad +6} \\ 5m &= 20 \\ \underline{5 \quad 5} \\ m &= 4 \end{aligned}$$

check #1

$$\begin{aligned} 5m + 3n &= 14 \\ 5(4) + 3(-2) &= 14 \\ 20 - 6 &= 14 \\ 14 &= 14 \end{aligned}$$

check #2

$$\begin{aligned} 2m + n &= 6 \\ 2(4) + (-2) &= 6 \\ 8 - 2 &= 6 \\ 6 &= 6 \end{aligned}$$

$$(4, -2)$$

$$6) \begin{cases} 2(4x + 3y = 12) \\ 4(-2x + y = -16) \end{cases} \rightarrow \begin{cases} 8x + 6y = 24 \\ -8x + 4y = -64 \end{cases}$$

$$\frac{10y}{10} = \frac{-40}{10}$$

$$y = -4$$

$$\begin{aligned} 4x + 3y &= 12 \\ 4x + 3(-4) &= 12 \\ 4x - 12 &= 12 \\ \underline{+12 \quad +12} \\ 4x &= 24 \\ \underline{4 \quad 4} \\ x &= 6 \end{aligned}$$

check #1

$$\begin{aligned} 4x + 3y &= 12 \\ 4(6) + 3(-4) &= 12 \\ 24 - 12 &= 12 \\ 12 &= 12 \end{aligned}$$

check #2

$$\begin{aligned} -2x + y &= -16 \\ -2(6) + (-4) &= -16 \\ -12 - 4 &= -16 \\ -16 &= -16 \end{aligned}$$

$$(6, -4)$$