

# 1.9 Solving Linear Systems by Elimination

**Example:** Solve the following system of equations:

$$x + y = 5 \quad (1)$$

$$x - y = 1 \quad (2)$$

Add equations (1) and (2)

$$\begin{array}{r} x + y = 5 \\ x - y = 1 \\ \hline 2x = 6 \end{array}$$

$$x = 3$$

Sub  $x = 3$  in (1)

$$3 + y = 5 \quad (1)$$

$$y = 5 - 3$$

$$y = 2$$

**Solution: (3, 2)**

**Example 2:** Solve for  $x$  and  $y$ .

$$2x + 3y = 2 \quad (1)$$

$$5x - y = 22 \quad (2)$$

Multiply (2) by 3

$$15x - 3y = 66 \quad (2)$$

$$2x + 3y = 2 \quad (1)$$

Add

$$17x = 68$$

$$x = 4$$

Sub  $x = 4$  in (1)

$$2(4) + 3y = 2$$

$$8 + 3y = 2$$

$$3y = 2 - 8$$

$$3y = -6$$

$$y = -2$$

**Solution:  $(4, -2)$**

**Example 3:** Solve for  $x$  and  $y$ .

$$3x + 4y = 11 \quad (1)$$

$$5x + 7y = 20 \quad (2)$$

$$(1) \text{ by } -5 \quad \begin{array}{r} \hline -15x - 20y = -55 \quad (1) \end{array}$$

$$(2) \text{ by } 3 \quad \begin{array}{r} 15x + 21y = 60 \quad (2) \\ \hline \end{array}$$

Add  $y = 5$

Sub in (1)  $3x + 4(5) = 11$

$$3x + 20 = 11$$

$$3x = 11 - 20$$

$$3x = -9$$

$$x = -3$$

**Sol:  $(-3, 5)$**

**Example 4:** Solve for  $x$  and  $y$ .

$$\frac{3x}{10} - \frac{y}{4} = \frac{2}{5} \quad (1) \qquad 4(x + 1) + 3(y - 2) = 16 \quad (2)$$

$$4x + 4 + 3y - 6 = 16 \quad (2)$$

$$20 \left[ \frac{3x}{10} - \frac{y}{4} \right] = 20 \left[ \frac{2}{5} \right] \quad (1) \qquad 4x + 3y = 16 + 2 \quad (2)$$

$$4x + 3y = 18 \quad (2)$$

$$6x - 5y = 8 \quad (1)$$

$$4x + 3y = 18 \quad (2)$$

$$\begin{array}{r} 3 \times (1) \quad 18x - 15y = 24 \\ 5 \times (2) \quad 20x + 15y = 90 \\ \hline 38x \qquad \qquad = 114 \\ x = 3 \end{array}$$

$$y = 2$$

**Solution (3, 2)**

The cost of admission to an NAC concert was \$15 for students and \$60 for adults. If there were 724 people at the concert and there was \$33 945 in ticket sales, how many students attended the concert.

Let  $x$  = number of students

Let  $y$  = number of adults

$$x + y = 724 \quad (1)$$

$$15x + 60y = 33\,945 \quad (2)$$

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$$-60(1) \quad -60x - 60y = -43\,440 \quad (1)$$

$$15x + 60y = 33\,945 \quad (2)$$

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$$-45x \quad = -9\,495$$

$$x = 211$$

211 students

# Solve by Elimination

$$\begin{array}{l} 2x = 5 - 3y \quad (1) \longrightarrow 2x + 3y = 5 \quad (1) \\ 3x + 5y = 9 \quad (2) \longrightarrow 3x + 5y = 9 \quad (2) \end{array}$$