SYSTEM OF LINEAR EQUATIONS

SUBSTITUTION METHOD

System of Equations:

$$\begin{cases} x + y = 5 \quad (1) \\ 2x - y = 4 \quad (2) \end{cases}$$

Step 1: Solve one equation for one variable

From equation (1):

$$x + y = 5$$
$$\Rightarrow x = 5 - y \quad (3)$$

Step 2: Substitute equation (3) into the other equation

Substitute $x = 5 - y$ into equation (2):

$$2x - y = 4$$
$$2(5 - y) - y = 4$$
$$10 - 2y - y = 4$$
$$10 - 3y = 4$$

Step 3: Solve the resulting equation

$$10 - 3y = 4$$
$$-3y = 4 - 10$$
$$-3y = -6$$
$$y = 2$$

Step 4: Substitute the value of y into equation (3) to find x

$$x = 5 - y = 5$$
$$x = 5 - 2$$
$$x = 3$$

Solution to the system:

$$x = 3, \quad y = 2$$

Verification:

Equation (1): $x + y = 3 + 2 = 5$ ✔

Equation (2): $2x - y = 2(3) - 2 = 6 - 2 = 4$ ✔

EQUALIZATION METHOD

System of Equations:

$$\begin{cases} x + y = 5 \quad (1) \\ 2x - y = 4 \quad (2) \end{cases}$$

Step 1: Solve both equations for the same variable

Let's solve for x in both equations.

From equation (1):

$$x = 5 - y \quad (3)$$

From equation (2):

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

Step 2: Set the two expressions for x equal to each other

$$5 - y = \frac{4 + y}{2}$$

Step 3: Eliminate the denominator and solve

Multiply both sides by 2:

$$2(5 - y) = 4 + y$$
$$10 - 2y = 4 + y$$

Solve for y:

$$10 - 2y = 4 + y$$
$$10 - 4 = y + 2y$$
$$6 = 3y$$
$$y = 2$$

Step 4: Substitute $y = 2$ into one of the expressions for x

Using equation (3):

$$x = 5 - y = 5 - 2 = 3$$

Solution to the system:

$$x = 3, \quad y = 2$$

Verification:

Equation (1): $x + y = 3 + 2 = 5$ ✔

Equation (2): $2x - y = 2(3) - 2 = 6 - 2 = 4$ ✔

ELMINATION METHOD

System of Equations:

$$\begin{cases} x + y = 5 \quad (1) \\ 2x - y = 4 \quad (2) \end{cases}$$

🔷 Step 2: Add the two equations to eliminate one variable

We notice that the y-terms are **opposites**: $+y$ and $-y$.

So we can **add** the equations directly:

$$\begin{aligned} x + y &= 5 \quad (1) \\ 2x - y &= 4 \quad (2) \end{aligned}$$

$$\begin{gathered} (x + y) + (2x - y) = 5 + 4 \\ x + 2x + y - y = 9 \\ 3x = 9 \\ x = 3 \end{gathered}$$

🔷 Step 3: Substitute the value of x into one of the original equations

Let's use equation (1):

$$\begin{gathered} x + y = 5 \\ 3 + y = 5 \\ y = 5 - 3 = 2 \end{gathered}$$

✅ Solution to the system:

$$x = 3, \quad y = 2$$

🔎 Verification:

Equation (1): $3 + 2 = 5$ ✔

Equation (2): $2(3) - 2 = 6 - 2 = 4$ ✔