

General instructions for Students: Whatever be the notes provided, everything must be copied in the Maths copy and then do the HOMEWORK in the same copy.

CLASS – IX

MATHEMATICS

5. SIMULTANEOUS LINEAR EQUATIONS

System of simultaneous linear equations

Let us consider two linear equations in two variables,

$$a_1x + b_1y + c_1 = 0$$

$$a_2x + b_2y + c_2 = 0$$

These two equations are said to form a system of simultaneous linear equations.

For example, $x + y - 3 = 0$, $2x - 5y + 1 = 0$ is a system of simultaneous linear equations in the two variables x and y .

A solution to a system of simultaneous linear equations in the two variables x and y is an ordered pair of numbers which satisfied both equations.

Example, $x = 2, y = 1$ $x + y - 3 = 0$ LHS $\Rightarrow x + y - 3 = 2 + 1 - 3 = 0$ RHS

$$2x - 5y + 1 = 0 \quad \text{LHS} \Rightarrow 2x - 5y + 1 = 2(2) - 5(1) + 1 = 0 \quad \text{RHS}$$

$x = 2, y = 1$ is a solution of the system of simultaneous linear equations.

If there is only one solution, then the system of linear equations is said to be consistent and independent.

The various methods of solving a pair or a system of linear equations are:

1. Substitution method.
2. Elimination method.
3. Cross- multiplication method.

Solve the following systems of simultaneous linear equations by the substitution method.

1. (ii) $s - t = 3,$ $\frac{s}{3} + \frac{t}{2} = 6$

Solution: $s - t = 3$ (i)

$\frac{s}{3} + \frac{t}{2} = 6$ (ii)

(i) $\Rightarrow s - t = 3 \Rightarrow s = 3 + t$ (iii)

Substitute the value of 's' in equation (ii), we have

$\frac{s}{3} + \frac{t}{2} = 6 \Rightarrow \frac{t+3}{3} + \frac{t}{2} = 6$

$\Rightarrow \frac{2(t+3)+3t}{6} = 6$

$\Rightarrow 2t + 6 + 3t = 36$

$\Rightarrow 5t = 36 - 6$

$\Rightarrow 5t = 30 \Rightarrow t = 6$

Substitute the value of 't' in equation (iii), we have

$s = 3 + t = 3 + 6 = 9$

Hence, the solution is $s = 9$ and $t = 6$ **Ans.**

3. (i) $2x - \frac{3y}{4} = 3,$ $5x - 2y - 7 = 0$

Solution: $2x - \frac{3y}{4} = 3$ (i)

$5x - 2y - 7 = 0$ (ii)

(ii) $\Rightarrow 5x - 2y - 7 = 0 \Rightarrow 2y = 5x - 7 \Rightarrow y = \frac{5x-7}{2}$ (iii)

Substitute the value of 'y' in equation (i), we have

$2x - \frac{3y}{4} = 3 \Rightarrow 2x - \frac{3(\frac{5x-7}{2})}{4} = 3$

$\Rightarrow 2x - \frac{15x-21}{8} = 3$

$\Rightarrow \frac{16x-15x+21}{8} = 3$

$$\Rightarrow x + 21 = 24$$

$$\Rightarrow x = 3$$

Substitute the value of 'x' in equation (iii), we have

$$x = \frac{5x-7}{2} = \frac{5(3)-7}{2} = \frac{15-7}{2} = \frac{8}{2} = 4$$

Hence, the solution is $x = 3$ and $y = 4$ **Ans.**

HOMEWORK

EXERCISE- 5.1

QUESTION NUMBERS- 1(i), (iii); 2(ii) and 5

ELIMINATION METHOD

EXERCISE- 5.2

Solve the following systems of simultaneous linear equations by the elimination method.

1. (ii) $2x = 5y + 4$, $3x - 2y + 16 = 0$

Solution: $2x - 5y = 4$ (i)] $\times 2$

$$3x - 2y = -16$$
(ii)] $\times 5$

Multiplying equation (i) by 2 and equation (ii) by 5, we have

$$4x - 10y = 8$$

$$15x - 10y = -80$$

$$\begin{array}{r} (-) \quad (+) \quad (+) \\ \hline \end{array}$$

$$-11x = 88$$

$$x = -8$$

Substitute the value of 'x' in equation (i), we have

$$2x - 5y = 4 \Rightarrow 2(-8) - 5y = 4 \Rightarrow -16 - 5y = 4 \Rightarrow -5y = 4 + 16 \Rightarrow -5y = 20 \Rightarrow y = -4$$

Hence, the solution is $x = -8$ and $y = -4$ **Ans.**

3. (ii) $41x + 53y = 135$, $53x + 41y = 147$

Solution: $41x + 53y = 135$ (i)

$53x + 41y = 147$ (ii)

$$\begin{array}{r}
 41x + 53y = 135 \\
 \underline{53x + 41y = 147} \quad \text{Adding (i) and (ii)} \\
 94x + 94y = 282 \\
 \Rightarrow 94(x + y) = 282 \quad \Rightarrow x + y = 3 \quad \text{..... (iii)}
 \end{array}$$

$$\begin{array}{r}
 41x + 53y = 135 \\
 \underline{53x + 41y = 147} \quad \text{Subtracting (ii) from (i)} \\
 (-) \quad (-) \quad (-) \\
 -12x + 12y = -12 \\
 \Rightarrow -12(x - y) = -12 \quad \Rightarrow x - y = 1 \quad \text{.....(iv)}
 \end{array}$$

On adding (iii) and (iv), $x + y = 3$

$$\begin{array}{r}
 x + y = 3 \\
 \underline{x - y = 1} \\
 2x = 4
 \end{array}$$

$2x = 4$

$\Rightarrow x = 2$

Substitute the value of 'x' in equation (iv), we have

$x - y = 1 \Rightarrow 2 - y = 1 \Rightarrow y = 2 - 1 = 1$

Hence, the solution is $x = 2$ and $y = 1$ **Ans.**

7. (ii) $\frac{x+1}{2} + \frac{y-1}{3} = 8$, $\frac{x-1}{3} + \frac{y+1}{2} = 9$

Solution: $\frac{x+1}{2} + \frac{y-1}{3} = 8$ (i)

$\frac{x-1}{3} + \frac{y+1}{2} = 9$ (ii)

$$(i) \Rightarrow \frac{x+1}{2} + \frac{y-1}{3} = 8 \Rightarrow \frac{3(x+1)+2(y-1)}{6} = 8 \Rightarrow 3x + 3 + 2y - 2 = 48$$

$$\Rightarrow 3x + 2y = 47 \dots\dots\dots (iii)] \times 2$$

$$(ii) \Rightarrow \frac{x-1}{3} + \frac{y+1}{2} = 9 \Rightarrow \frac{2(x-1) + 3(y+1)}{6} = 9 \Rightarrow 2x - 2 + 3y + 3 = 54$$

$$\Rightarrow 2x + 3y = 53 \dots\dots\dots (iv)] \times 3$$

Multiplying equation (iii) by 2 and equation (iv) by 3, we have

$$6x + 4y = 94$$

$$6x + 9y = 159$$

On subtraction

$$(-) \quad (-) \quad (-)$$

$$- 5y = - 65$$

$$\Rightarrow y = 13$$

Substitute the value of 'y' in equation (iv), we have

$$2x + 3y = 53 \Rightarrow 2x + 3(13) = 53 \Rightarrow 2x = 53 - 39 \Rightarrow 2x = 14 \Rightarrow x = 7$$

Hence, the solution is $x = 7$ and $y = 13$ **Ans.**

HOMEWORK

EXERCISE- 5.2

QUESTION NUMBERS- 1(i), 2(i), 3(i), 5(i), 7(i) and 10
