Board –ICSE	Class – 9th	Topic – Solving Simultaneous Equation

Q1. Solve the following system of equations using the method of elimination by substitution. $x + y = 7$ and $3x - 2y = 11$.

Soln. Step 1: $x + y = 7 \Rightarrow y = 7 - x$

Step 2: $3x - 2y = 11 \Rightarrow 3x - 2(7 - x) = 11$

$\Rightarrow 3x - 14 + 2x = 11$

$\Rightarrow 5x = 25$ and $x = 5$

Step 3: $y = 7 - x \Rightarrow y = 7 - 5 = 2$

$\therefore$ Solution is : $x = 5$ and $y = 2$

Q2. Instead of finding the value of y in terms of x; if we find the value of x in terms of y and proceed as above; the result will remain the same, For this :

Soln. Step 1:

$$x + y = 7 \Rightarrow x = 7 - y$$

Step 2:

$$\begin{aligned} 3x - 2y = 11 &\Rightarrow 3(7 - y) - 2y = 11 \\ &\Rightarrow 21 - 3y - 2y = 11 \\ &\Rightarrow -5y = -10 \text{ and } y = 2 \end{aligned}$$

Step 3:

$$x = 7 - y \Rightarrow x = 7 - 2 = 5$$

$\therefore$ Solution is : $x = 5$ and $y = 2$

Q3. Solve using elimination by substitution :

$$\frac{x+7}{5} - \frac{2x-y}{4} = 3y - 5 \text{ and } \frac{4x-3}{6} + \frac{5y-7}{2} = 18 - 5x$$

Soln. $\frac{x+7}{5} - \frac{2x-y}{4} = 3y - 5$

$$\Rightarrow \frac{4(x+7) - 5(2x-y)}{20} = 3y - 5$$

i.e. $4x + 28 - 10x + 5y = 60y - 100$

$\Rightarrow -6x - 55y = -128$

i.e.

$$6x = 128 - 55y \text{ and } x = \frac{128 - 55y}{6}$$

$$\frac{4x-3}{6} + \frac{5y-7}{2} = 18 - 5x \Rightarrow \frac{4x - 3 + 15y - 21}{6} = 18 - 5x$$

i.e. $4x + 15y - 24 = 108 - 30x \Rightarrow 34x + 15y = 132$

$\Rightarrow\ 34\left(\frac{128-55y}{6}\right)+15y=132$

$\left[\because x=\frac{128-55y}{6}\right]$

$\Rightarrow 34\times128-34\times55y+90y=132\times6$

$\Rightarrow\ 4352-1870y+90y=792$

$\Rightarrow\ 1780y=3560$ i.e. $y=\frac{3560}{1780}=2$

$\therefore\ x=\frac{128-55y}{6}=\frac{128-55\times2}{6}=\frac{18}{6}=3$

Solution is : $x=3$ and $y=2$

Q4. 3 Solve, using the method of elimination by equating coefficients :

$3x-4y=10$ and $5x-3y=24$

Soln. $3x-4y=10$ ..... (i)

$5x-3y=24$ .....(ii)

Step 1 : Multiply equation (i) by 5 and equation (ii) by 3.

The resulting equations are :

$$\begin{array}{rrr} 15x & -20y & = 50 \\ 15x & -\ 9y & = 72 \\ - & + & - \\ \hline & -11y & = 22 \\ \hline & - & -22 \\ & \therefore & 509 \end{array}$$

Step 2 : [Subtractin

Step 3 : $y=2$

Hence, $x=6$ and $y=2$

$\Rightarrow\ x=\frac{18}{3}=6$

Step 4 : Substituting $y=2$, in eq. (i), we get :

$3x-4\times2=10$

Q5. Solve, using the method of elimination by equating coefficients :

$x + y = 3.3$ and $\frac{0.6}{3x - 2y} = -1$. Given $3x - 2y \neq 0$

Soln.

$$x + y = 3.3$$

$$\frac{0.6}{3x - 2y} = -1 \Rightarrow 0.6 = -3x + 2y$$

$$3x - 2y = -0.6$$

Eq, (i) $\times 2 \Rightarrow$ $2x + 2y = 6.6$ (On adding)

$$5x = 6$$

$$\Rightarrow \quad x = \frac{6}{5} = 1 \cdot 2$$

$$x + y = 3 \cdot 3 \Rightarrow 1 \cdot 2 + y = 3 \cdot 3 \text{ i.e. } y = 2 \cdot 1$$

$\therefore$ Solution is : $x = 1.2$ and $y = 2.1$

Q6. Solve : $65x - 33y = 97$ and $33x - 65y = 1$

Soln. In this example, the coefficient of x in the first equation is numerically equal to the coefficient of y in the second equation and the coefficient of y in the first equation is numerically equal to the coefficient of x in the second equation.

Such equations are solved by the method, given below:

$$65x - 33y = 97 \quad \text{..... (i)}$$

and, $\quad 33x - 65y = 1 \quad \text{..... (ii)}$

On adding (i) and (ii), we get :

$$98x - 98y = 98$$

$$\Rightarrow \quad x - y = 1 \quad \text{..... (iii)} \quad \text{[Dividing each term by 98]}$$

On subtracting (ii) from (i), we get :

$$32x + 32y = 96$$

$$\Rightarrow \quad x + y = 3 \quad \text{..... (iv)} \quad \text{[Dividing each term by 32]}$$

Now, on solving equations (iii) and (iv), we get :

$x = 2$ and $y = 1$ **Ans.**

Q7. Solve by cross-multiplication :

$2x + 3y = 6$ and $6x - 5y = 4$

Soln. $2x + 3y = 6 \Rightarrow 2x + 3y - 6 = 0 \equiv a_1x + b_1y + c_1 = 0$

and, $6x - 5y = 4 \Rightarrow 6x - 5y - 4 = 0 \equiv a_2x + b_2y + c_2 = 0$

$$\Rightarrow \begin{matrix} b_1 & c_1 & a_1 & b_1 \\ b_2 & c_2 & a_2 & b_2 \end{matrix} = \begin{matrix} 3 & -6 & 2 & 3 \\ -5 & -4 & 6 & -5 \end{matrix}$$

$$\therefore \quad \frac{x}{3 \times -6 \atop -5 \times -4} = \frac{y}{-6 \times 2 \atop -4 \times 6} = \frac{1}{2 \times 3 \atop 6 \times -5}$$

$$\Rightarrow \frac{x}{(-12) - (30)} = \frac{y}{(-36) - (-8)} = \frac{1}{(-10) - (18)}$$

$$\Rightarrow \frac{x}{-12 - 30} = \frac{y}{-36 + 8} = \frac{1}{-10 - 18}$$

$$\Rightarrow \frac{x}{-42} = \frac{y}{-28} = \frac{1}{-28}$$

$$\Rightarrow \frac{x}{-42} = \frac{1}{-28} \text{ and } \frac{y}{-28} = \frac{1}{-28}$$

$$\Rightarrow x = \frac{-42}{-28} \text{ and } y = \frac{-28}{-28} \text{ i.e., } x = 1\frac{1}{2} \text{ and } y = 1$$

Q8. Solve by cross-multiplication :

$3x + y = 13$ and $x - 3y + 9 = 0$

Soln. Given equations are : $3x + y - 13 = 0$ and $x - 3y + 9 = 0$

Comparing

$a_1x + b_1y + c_1 = 0$ with $3x + y - 13 = 0$

and,

$a_2x + b_2y + c_2 = 0$ with $x - 3y + 9 = 0$, we get :

$$\begin{matrix} b_1 & c_1 & a_1 & b_1 \\ b_2 & c_2 & a_2 & b_2 \end{matrix} = \begin{matrix} 1 & -13 & 3 & 1 \\ -3 & 9 & 1 & -3 \end{matrix}$$

$$\therefore \quad \frac{x}{1 \times -13 \atop -3 \times 9} = \frac{y}{-13 \times 3 \atop 9 \times 1} = \frac{1}{3 \times 1 \atop 1 \times -3}$$

$$\Rightarrow \frac{x}{(9)-(39)} = \frac{y}{(-13)-(27)} = \frac{1}{(-9)-(1)}$$

$$\Rightarrow \frac{x}{-30} = \frac{y}{-40} = \frac{1}{-10}$$

$$\Rightarrow x = 3 \text{ and } y = 4$$