

Chapter 6. Simultaneous (Linear) Equations (Including Problems)

Exercise 6(A)

Solution 1:

$$8x + 5y = 9 \dots (1)$$

$$3x + 2y = 4 \dots (2)$$

$$(2) \Rightarrow y = \frac{9 - 8x}{5}$$

Putting this value of y in (2)

$$3x + 2 \left(\frac{9 - 8x}{5} \right) = 4$$

$$15x + 18 - 16x = 20$$

$$x = -2$$

$$\text{From (1) } y = \left(\frac{9 - 8x}{5} \right) = \frac{9 - 8(-2)}{5} = \frac{25}{5} = 5$$

$$y = 5$$

Solution 2:

$$2x - 3y = 7 \dots (1)$$

$$5x + y = 9 \dots (2)$$

$$(2) \Rightarrow y = 9 - 5x$$

Putting this value of y in (1)

$$2x - 3(9 - 5x) = 7$$

$$2x - 27 + 15x = 7$$

$$17x = 34$$

$$x = 2$$

From (2)

$$y = 9 - 5(2)$$

$$y = -1$$

Solution 3:

$$2x + 3y = 8 \dots (1)$$

$$2x = 2 + 3y \dots (2)$$

$$(2) \Rightarrow 2x = 2 + 3y$$

Putting this value of 2x in (1)

$$2 + 3y + 3y = 8$$

$$6y = 6$$

$$y = 1$$

$$\text{From (2) } 2x = 2 + 3(1)$$

$$x = \frac{5}{2}$$

$$x = 2.5$$

Solution 4:

The given pair of linear equations are

$$0.2x + 0.1y = 25 \dots \dots \dots (i)$$

$$2(x - 2) - 1.6y = 116 \dots \dots \dots (ii)$$

Consider equation (i)

$$0.2x + 0.1y = 25$$

$$\Rightarrow 0.2x = 25 - 0.1y$$

$$\Rightarrow x = \frac{(25 - 0.1y)}{0.2} \dots \dots \dots (iii)$$

Substitute the value of x from equation (iii) in equation (ii).

$$2(x - 2) - 1.6y = 116$$

$$\Rightarrow 2\left(\frac{(25 - 0.1y)}{0.2} - 2\right) - 1.6y = 116$$

$$\Rightarrow 10(25 - 0.1y) - 4 - 1.6y = 116$$

$$\Rightarrow 250 - y - 4 - 1.6y = 116$$

$$\Rightarrow -2.6y = -130$$

$$\Rightarrow y = 50 \dots \dots \dots (iv)$$

Substitute the value of y from equation (iv) in equation (iii).

$$x = \frac{(25 - 0.1y)}{0.2}$$

$$\Rightarrow x = \frac{(25 - 0.1(50))}{0.2}$$

$$\Rightarrow x = \frac{(25 - 5)}{0.2}$$

$$\Rightarrow x = 100$$

$\therefore$ Solution is $x = 100$ and $y = 50$.

Solution 5:

$$6x = 7y + 7 \dots (1)$$

$$7y - x = 8 \dots (2)$$

$$(2) \Rightarrow x = 7y - 8$$

Putting this value of x in (1)

$$6(7y - 8) = 7y + 7$$

$$42y - 48 = 7y + 7$$

$$35y = 55$$

$$y = \frac{11}{7}$$

$$\text{From (2) } x = 7\left(\frac{11}{7}\right) - 8$$

$$x = 3$$

Solution 6:

$$y = 4x - 7 \dots (1)$$

$$16x - 5y = 25 \dots (2)$$

$$(1) \Rightarrow y = 4x - 7$$

Putting this value of y in (2)

$$16x - 5(4x - 7) = 25$$

$$16x - 20x + 35 = 25$$

$$-4x = -10$$

$$x = \frac{5}{2}$$

From (1)

$$y = 4\left(\frac{5}{2}\right) - 7$$

$$\Rightarrow y = 10 - 7$$

$$\Rightarrow y = 3$$

$$y = 10 - 7 = 3$$

Solution is $x = \frac{5}{2}$ and $y = 3$.

Solution 7:

$$2x + 7y = 39 \dots (1)$$

$$3x + 5y = 31 \dots (2)$$

$$(1) \Rightarrow x = \frac{39 - 7y}{2}$$

Putting this value of x in (2)

$$3\left(\frac{39 - 7y}{2}\right) + 5y = 31$$

$$117 - 21y + 10y = 62$$

$$-11y = -55$$

$$y = 5$$

$$\text{From (1) } x = \frac{39 - 7(5)}{2}$$

$$x = \frac{4}{2}$$

$$x = 2$$

Solution 8:

The given pair of linear equations are

$$1.5x + 0.1y = 6.2 \dots\dots\dots(i)$$

$$3x - 0.4y = 11.2 \dots\dots\dots(ii)$$

Consider equation (i)

$$1.5x + 0.1y = 6.2$$

$$\Rightarrow 1.5x = 6.2 - 0.1y$$

$$\Rightarrow x = \frac{(6.2 - 0.1y)}{1.5} \dots\dots\dots(iii)$$

Substitute the value of x from equation (iii) in equation (ii).

$$3x - 0.4y = 11.2$$

$$\Rightarrow 3\left(\frac{(6.2 - 0.1y)}{1.5}\right) - 0.4y = 11.2$$

$$\Rightarrow 2(6.2 - 0.1y) - 0.4y = 11.2$$

$$\Rightarrow 12.4 - 0.2y - 0.4y = 11.2$$

$$\Rightarrow -0.6y = -1.2$$

$$\Rightarrow y = 2 \dots\dots\dots(iv)$$

Substitute the value of y from equation (iv) in equation (iii).

$$x = \frac{(6.2 - 0.1y)}{1.5}$$

$$\Rightarrow x = \frac{(6.2 - 0.1(2))}{1.5}$$

$$\Rightarrow x = \frac{(6.2 - 0.2)}{1.5}$$

$$\Rightarrow x = 4$$

$\therefore$ Solution is $x = 4$ and $y = 2$.

Solution 9:

Given equations are

$$2(x - 3) + 3(y - 5) = 0 \dots\dots(1)$$

$$5(x - 1) + 4(y - 4) = 0 \dots\dots(2)$$

From (1), we get

$$2x - 6 + 3y - 15 = 0$$

$$\Rightarrow 2x - 21 + 3y = 0$$

$$\Rightarrow 2x = 21 - 3y$$

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

From (2), we get

$$5(x - 1) + 4(y - 4) = 0$$

$$\Rightarrow 5x - 5 + 4y - 16 = 0$$

$$\Rightarrow 5x + 4y - 21 = 0 \dots\dots(3)$$

Substituting $x = \frac{21 - 3y}{2}$ in (3), we get

$$5\left(\frac{21 - 3y}{2}\right) + 4y - 21 = 0$$

$$\Rightarrow \frac{105 - 15y}{2} + 4y - 21 = 0$$

$$\Rightarrow 105 - 15y + 8y - 42 = 0$$

$$\Rightarrow -7y + 63 = 0$$

$$\Rightarrow 7y = 63$$

$$\Rightarrow y = 9$$

Substituting $y = 9$ in $x = \frac{21 - 3y}{2}$, we get

$$x = \frac{21 - 3(9)}{2} = \frac{21 - 27}{2} = \frac{-6}{2} = -3$$

$\therefore$ Solution is $x = -3$ and $y = 9$

Solution 10:

$$\frac{2x+1}{7} + \frac{5y-3}{3} = 12 \quad (\text{given})$$

$$\Rightarrow \frac{3(2x+1) + 7(5y-3)}{21} = 12$$

$$\Rightarrow 6x + 3 + 35y - 21 = 252$$

$$\Rightarrow 6x + 35y - 18 = 252$$

$$\Rightarrow 6x + 35y = 270$$

$$\Rightarrow 6x = 270 - 35y$$

$$\Rightarrow x = \frac{270 - 35y}{6}$$

$$\frac{3x+2}{2} - \frac{4y+3}{9} = 13 \quad (\text{given})$$

$$\Rightarrow \frac{9(3x+2) - 2(4y+3)}{18} = 13$$

$$\Rightarrow 27x + 18 - 8y - 6 = 234$$

$$\Rightarrow 27x - 8y + 12 = 234$$

$$\Rightarrow 27x - 8y = 222 \quad \dots(1)$$

Substituting $x = \frac{270 - 35y}{6}$ in (1), we get

$$27\left(\frac{270 - 35y}{6}\right) - 8y = 222$$

$$\Rightarrow 7290 - 945y - 48y = 1332$$

$$\Rightarrow -993y = -5958$$

$$\Rightarrow y = 6$$

Substituting $y = 6$ in $x = \frac{270 - 35y}{6}$, we get

$$x = \frac{270 - 35 \times 6}{6} = \frac{270 - 210}{6} = \frac{60}{6} = 10$$

$\therefore$ Solution is $x = 10$ and $y = 6$

Exercise 6(B)**Solution 1:**

$$13 + 2y = 9x \dots(1)$$

$$3y = 7x \dots(2)$$

Multiplying equation no. (1) by 3 and (2) by 2, we get,

$$39 + 6y = 27x \quad \dots(1)$$

$$6y = 14x \quad \dots(2)$$

$$\begin{array}{r} - \quad - \quad - \\ 39 = 13x \end{array}$$

$$x = 3$$

From (2)

$$3y = 7(3)$$

$$y = 7$$

Solution 2:

$$3x - y = 23 \dots (1)$$

$$\frac{x}{3} + \frac{y}{4} = 4$$

$$4x + 3y = 48 \dots (2)$$

Multiplying equation no. (1) by 3

$$9x - 3y = 69 \quad \dots (3)$$

$$4x + 3y = 48$$

$$\hline 13x = 117$$

$$x = 9$$

From (1)

$$3(9) - y = 23$$

$$y = 27 - 23$$

$$y = 4$$

Solution 3:

The given pair of linear equations are

$$\frac{5y}{2} - \frac{x}{3} = 8$$

$$\Rightarrow -\frac{x}{3} + \frac{5y}{2} = 8 \dots (i) \quad [\text{On simplifying}]$$

$$\frac{y}{2} + \frac{5x}{3} = 12$$

$$\Rightarrow \frac{5x}{3} + \frac{y}{2} = 12 \dots (ii) \quad [\text{On simplifying}]$$

Multiply equation (i) by 5, we get:

$$-\frac{5x}{3} + \frac{25y}{2} = 40$$

$$\frac{5x}{3} + \frac{y}{2} = 12 \quad [\text{Equation (ii)}]$$

$$\begin{array}{r} + \quad + \quad + \\ \hline \end{array} \quad [\text{Adding}]$$

$$\frac{26y}{2} = 52$$

$$\Rightarrow 13y = 52$$

$$\Rightarrow y = 4$$

Substituting $y = 4$ in equation (i), we get

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

$$\Rightarrow -\frac{x}{3} = 8 - 10$$

$$\Rightarrow x = 6$$

$\therefore$ Solution is $x = 6$ and $y = 4$.

Solution 4:

$$\frac{1}{5}(x-2) = \frac{1}{4}(1-y) \Rightarrow 4x + 5y = 13 \quad \dots(1)$$

$$26x + 3y = -4 \quad \dots(2)$$

Multiplying equation no. (1) by 3 and (2) by 5.

$$12x + 15y = 39 \quad \dots(3)$$

$$130x + 15y = -20$$

$$\begin{array}{r} - \quad - \quad + \\ \hline -115x = 59 \end{array}$$

$$x = -\frac{59}{115}$$

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

From (1)

$$4\left(-\frac{1}{2}\right) + 5y = 13$$

$$5y = 13 + 2$$

$$y = 3$$

Solution 5:

$$y = 2x - 6$$

$$y = 0$$

$$\Rightarrow 2x - y = 6 \quad \dots(1)$$

$$\underline{y = 2} \quad \dots(2)$$

$$2x = 6$$

$$x = 3, y = 0$$

Solution 6:

The given pair of linear equations are

$$\frac{x-y}{6} = 2(4-x)$$

$$\Rightarrow 13x - y = 48 \dots\dots\dots(i) \quad [\text{On simplifying}]$$

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

$$\Rightarrow x - y = 12 \dots\dots\dots(ii) \quad [\text{On simplifying}]$$

Multiply equation (ii) by 13, we get:

$$\begin{array}{rcl} 13x - 13y & = & 156 \\ 13x - y & = & 48 \quad [\text{Equation (i)}] \\ \hline - & + & - \\ & -12y & = 108 \\ \Rightarrow y & = & -9 \end{array} \quad [\text{Subtracting}]$$

Substituting $y = -9$ in equation (i), we get

$$13x - (-9) = 48$$

$$\Rightarrow 13x = 39$$

$$\Rightarrow x = 3$$

$\therefore$ Solution is $x = 3$ and $y = -9$.

Solution 7:

$$3 - (x - 5) = 4 + 2$$

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

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

$$\Rightarrow x + y = 6 \dots(1)$$

$$2x + 5y = 4 \dots(2)$$

Multiplying equation no. (1) by 2.

$$2x + 2y = 12$$

$$2x + 5y = 4$$

$$\begin{array}{rcl} - & - & - \\ \hline & -3y & = 8 \quad \Rightarrow y = \frac{-8}{3} \end{array}$$

From (1)

$$x - \frac{8}{3} = 6 \quad \Rightarrow x = \frac{26}{3}$$

Solution 8:

$$2x - 3y - 3 = 0$$

$$\frac{2x}{3} + 4y + \frac{1}{2} = 0$$

$$\Rightarrow 2x - 3y = 3 \dots (1)$$

$$\Rightarrow 4x + 24y = -3 \dots (2)$$

Multiplying equation no. (1) by 8.

$$16x - 24y = 24 \quad \dots (3)$$

$$\underline{4x + 24y = -3}$$

$$20x = 21 \Rightarrow x = \frac{21}{20}$$

From (1)

$$2\left(\frac{21}{20}\right) - 3y = 3$$

$$-3y = 3 - \frac{21}{10} \Rightarrow y = \frac{-3}{10}$$

Solution 9:

$$13x + 11y = 70 \dots (1)$$

$$11x + 13y = 74 \dots (2)$$

Adding (1) and (2)

$$24x + 24y = 144$$

$$x + y = 6 \dots (3)$$

subtracting (2) from (1)

$$2x - 2y = -4$$

$$x - y = -2 \dots (4)$$

$$x + y = 6 \dots (3)$$

$$\underline{2x = 4} \Rightarrow x = 2$$

From (3)

$$2 + y = 6 \Rightarrow y = 4$$

Solution 10:

$$41x + 53y = 135 \dots (1)$$

$$53x + 41y = 147 \dots (2)$$

Adding (1) and (2)

$$94x + 94y = 282$$

$$x + y = 3 \dots (3)$$

Subtracting (2) from (1)

$$-12x + 12y = -12$$

$$-x + y = -1 \quad \dots (4)$$

$$\begin{array}{r} x + y = 3 \\ \hline 2y = 2 \quad \Rightarrow y = 1 \end{array}$$

From (3)

$$x + 1 = 3 \Rightarrow x = 2$$

Solution 11:

$$2x + y = 23 \dots (1)$$

$$4x - y = 19 \dots (2)$$

Adding equation (1) and (2) we get,

$$2x + y = 23$$

$$4x - y = 19$$

$$\begin{array}{r} 6x = 42 \quad \Rightarrow x = 7 \end{array}$$

From (1)

$$2(7) + y = 23$$

$$y = 23 - 14$$

$$\Rightarrow y = 9$$

$$\therefore x - 3y = 7 - 3(9) = -20$$

$$\text{And } 5y - 2x = 5(9) - 2(7) = 45 - 14 = 31$$

Solution 12:

$$10y = 7x - 4$$

$$-7x + 10y = -4 \dots (1)$$

$$12x + 18y = 1 \dots (2)$$

Multiplying equation no. (1) by 12 and (2) by 7.

$$-84x + 120y = -48 \quad \dots (3)$$

$$84x + 126y = 7$$

$$246y = -41 \Rightarrow y = \frac{-1}{6}$$

From (1)

$$-7x + 10\left(\frac{-1}{6}\right) = -4$$

$$-7x = -4 + \frac{5}{3} \Rightarrow x = \frac{1}{3}$$

$$\therefore 4\left(\frac{1}{3}\right) + 6\left(\frac{-1}{6}\right) = \frac{1}{3} \text{ and } 8y - x = 8\left(\frac{-1}{6}\right) - \frac{1}{3} = \frac{-5}{3}$$

Solution 13:

(i)

The given pair of linear equations are

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

$$\Rightarrow 55x + 6y = 128 \dots (i) \text{ [On simplifying]}$$

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

$$\Rightarrow 15x + 34y = 132 \dots (ii) \text{ [On simplifying]}$$

Multiply equation (i) by 3 and equation (ii) by 11, we get:

$$165x + 18y = 384$$

$$165x + 374y = 1452$$

$$\begin{array}{r} - \\ - \\ - \\ \hline -356y = -1068 \end{array} \quad \text{[Subtracting]}$$

$$\Rightarrow y = 3$$

Substituting $y = 3$ in equation (i), we get

$$55x + 6(3) = 128$$

$$\Rightarrow 55x = 110$$

$$\Rightarrow x = 2$$

$\therefore$ Solution is $x = 2$ and $y = 3$.

(ii)

The given pair of linear equations are

$$4x = 17 - \frac{x - y}{8}$$

$$\Rightarrow 33x - y = 136 \dots\dots\dots(i) \text{ [On simplifying]}$$

$$2y + x = 2 + \frac{5y + 2}{3}$$

$$\Rightarrow 3x + y = 8 \dots\dots\dots(ii) \text{ [On simplifying]}$$

Multiply equation (ii) by 11, we get:

$$\begin{array}{rcl} 33x + 11y & = & 88 \\ 33x - y & = & 136 \quad \text{[Equation (i)]} \\ - & + & - \quad \text{[Subtracting]} \\ \hline 12y & = & -48 \\ \Rightarrow y & = & -4 \end{array}$$

Substituting $y = -4$ in equation (i), we get:

$$\begin{aligned} 33x - (-4) &= 136 \\ \Rightarrow 33x &= 132 \\ \Rightarrow x &= 4 \end{aligned}$$

$\therefore$ Solution is $x = 4$ and $y = -4$.

Solution 14:

Let $x = 2$ and $y = 1$ be a solution of the equation

$$\begin{aligned} 2x + 3y &= m \\ \Rightarrow 2(2) + 3(1) &= m \\ \Rightarrow 4 + 3 &= m \\ \Rightarrow m &= 7 \end{aligned}$$

$\therefore$ If $x = 2$ and $y = 1$ is the solution of the equation $2x + 3y = m$ then the value of m is 7.

Solution 15:

$$10\% \text{ of } x + 20\% \text{ of } y = 24$$

$$\Rightarrow 0.1x + 0.2y = 24 \dots\dots\dots(i) \quad \text{[On simplyfying]}$$

$$3x - y = 20 \dots\dots\dots(ii)$$

Multiply equation (ii) by 0.2, we get:

$$0.6x - 0.2y = 4$$

$$0.1x + 0.2y = 24 \quad \text{[Equation (i)]}$$

$$\begin{array}{r} + \quad + \quad + \\ \hline \end{array} \quad \text{[Adding]}$$

$$0.7x = 28$$

$$\Rightarrow x = 40$$

Substituting $x = 40$ in equation (i), we get

$$0.1(40) + 0.2y = 24$$

$$\Rightarrow 0.2y = 20$$

$$\Rightarrow y = 100$$

$\therefore$ Solution is $x = 40$ and $y = 100$.

Solution 16:

The value of expression $mx - ny$ is 3 when $x = 5$ and $y = 6$.

$$\Rightarrow 5m - 6n = 3 \dots\dots\dots(i)$$

The value of expression $mx - ny$ is 8 when $x = 6$ and $y = 5$.

$$\Rightarrow 6m - 5n = 8 \dots\dots\dots(ii)$$

Multiply equation (i) by 6 and equation (ii) by 5, we get:

$$30m - 36n = 18 \quad \text{[Equation (i)]}$$

$$30m - 25n = 40 \quad \text{[Equation (ii)]}$$

$$\begin{array}{r} - \quad + \quad - \\ \hline \end{array} \quad \text{[Subtracting]}$$

$$-11n = -22$$

$$\Rightarrow n = 2$$

Substituting $n = 2$ in equation (i), we get

$$5m - 6(2) = 3$$

$$\Rightarrow 5m = 15$$

$$\Rightarrow m = 3$$

$\therefore$ Solution is $m = 3$ and $n = 2$.

Solution 17:

$$11(x - 5) + 10(y - 2) + 54 = 0 \quad (\text{given})$$

$$\Rightarrow 11x - 55 + 10y - 20 + 54 = 0$$

$$\Rightarrow 11x + 10y - 21 = 0$$

$$\Rightarrow 11x + 10y = 21 \quad \dots(1)$$

$$7(2x - 1) + 9(3y - 1) = 25 \quad (\text{given})$$

$$\Rightarrow 14x - 7 + 27y - 9 = 25$$

$$\Rightarrow 14x + 27y - 16 = 25$$

$$\Rightarrow 14x + 27y = 41 \quad \dots(2)$$

Multiplying equation (1) by 27 and equation (2) by 10, we get

$$297x + 270y = 567 \quad \dots(3)$$

$$140x + 270y = 410 \quad \dots(4)$$

Subtracting equation (4) from equation (3), we get

$$157x = 157$$

$$\Rightarrow x = 1$$

Substituting $x = 1$ in equation (1), we get

$$11 \times 1 + 10y = 21$$

$$\Rightarrow 10y = 10$$

$$\Rightarrow y = 1$$

$\therefore$ Solution set is $x = 1$ and $y = 1$.

Solution 18:

$$\frac{7+x}{5} - \frac{2x-y}{4} = 3y-5 \quad (\text{given})$$

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

$$\Rightarrow 28 + 4x - 10x + 5y = 60y - 100$$

$$\Rightarrow -6x - 55y = -128 \quad \dots(1)$$

$$\frac{5y-7}{2} + \frac{4x-3}{6} = 18-5x \quad (\text{given})$$

$$\Rightarrow 3(5y-7) + 4x-3 = 6(18-5x)$$

$$\Rightarrow 15y - 21 + 4x - 3 = 108 - 30x$$

$$\Rightarrow 34x + 15y = 132 \quad \dots(2)$$

Multiplying equation (1) by 34 and equation (2) by 6, we get

$$-204x - 1870y = -4352 \quad \dots(3)$$

$$204x + 90y = 792 \quad \dots(4)$$

Adding equations (3) and (4), we get

$$-1780y = -3560$$

$$\Rightarrow y = 2$$

Substituting $y = 2$ in equation (1), we get

$$-6x - 55 \times 2 = -128$$

$$\Rightarrow -6x - 110 = -128$$

$$\Rightarrow -6x = -18$$

$$\Rightarrow x = 3$$

$\therefore$ Solution is $x = 3$ and $y = 2$

Solution 19:

$$4x + \frac{x-y}{8} = 17 \quad (\text{given})$$

$$\Rightarrow 32x + x - y = 136$$

$$\Rightarrow 33x - y = 136 \quad \dots(1)$$

$$2y + x - \frac{5y+2}{3} = 2 \quad (\text{given})$$

$$\Rightarrow 6y + 3x - 5y - 2 = 6$$

$$\Rightarrow 3x + y = 8 \quad \dots(2)$$

Adding equations (1) and (2), we get

$$36x = 144$$

$$\Rightarrow x = 4$$

Substituting $x = 4$ in equation (2), we get

$$3 \times 4 + y = 8$$

$$\Rightarrow 12 + y = 8$$

$$\Rightarrow y = -4$$

$\therefore$ Solution is $x = 4$ and $y = -4$

Exercise 6(C)**Solution 1:**

Given equations are $4x + 3y = 17$ and $3x - 4y + 6 = 0$

Comparing with $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$, we have

$$a_1 = 4, b_1 = 3, c_1 = -17 \quad \text{and} \quad a_2 = 3, b_2 = -4, c_2 = 6$$

$$\text{Now, } x = \frac{b_1c_2 - b_2c_1}{a_1b_2 - a_2b_1} \quad \text{and} \quad y = \frac{c_1a_2 - c_2a_1}{a_1b_2 - a_2b_1}$$

$$\Rightarrow x = \frac{3 \times 6 - (-4) \times (-17)}{4 \times (-4) - 3 \times 3} \quad \text{and} \quad y = \frac{-17 \times 3 - 6 \times 4}{4 \times (-4) - 3 \times 3}$$

$$\Rightarrow x = \frac{18 - 68}{-16 - 9} \quad \text{and} \quad y = \frac{-51 - 24}{-16 - 9}$$

$$\Rightarrow x = \frac{-50}{-25} \quad \text{and} \quad y = \frac{-75}{-25}$$

$$\Rightarrow x = 2 \quad \text{and} \quad y = 3$$

Solution 2:

Given equations are $3x + 4y = 11$ and $2x + 3y = 8$

Comparing with $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$, we have

$$a_1 = 3, b_1 = 4, c_1 = -11 \quad \text{and} \quad a_2 = 2, b_2 = 3, c_2 = -8$$

$$\text{Now, } x = \frac{b_1c_2 - b_2c_1}{a_1b_2 - a_2b_1} \quad \text{and} \quad y = \frac{c_1a_2 - c_2a_1}{a_1b_2 - a_2b_1}$$

$$\Rightarrow x = \frac{4 \times (-8) - 3 \times (-11)}{3 \times 3 - 2 \times 4} \quad \text{and} \quad y = \frac{-11 \times 2 - (-8) \times 3}{3 \times 3 - 2 \times 4}$$

$$\Rightarrow x = \frac{-32 + 33}{9 - 8} \quad \text{and} \quad y = \frac{-22 + 24}{9 - 8}$$

$$\Rightarrow x = 1 \quad \text{and} \quad y = 2$$

Solution 3:

Given equations are $6x + 7y - 11 = 0$ and $5x + 2y = 13$

Comparing with $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$, we have

$$a_1 = 6, b_1 = 7, c_1 = -11 \quad \text{and} \quad a_2 = 5, b_2 = 2, c_2 = -13$$

$$\text{Now, } x = \frac{b_1c_2 - b_2c_1}{a_1b_2 - a_2b_1} \quad \text{and} \quad y = \frac{c_1a_2 - c_2a_1}{a_1b_2 - a_2b_1}$$

$$\Rightarrow x = \frac{7 \times (-13) - 2 \times (-11)}{6 \times 2 - 5 \times 7} \quad \text{and} \quad y = \frac{-11 \times 5 - (-13) \times 6}{6 \times 2 - 5 \times 7}$$

$$\Rightarrow x = \frac{-91 + 22}{12 - 35} \quad \text{and} \quad y = \frac{-55 + 78}{12 - 35}$$

$$\Rightarrow x = \frac{-69}{-23} \quad \text{and} \quad y = \frac{23}{-23}$$

$$\Rightarrow x = 3 \quad \text{and} \quad y = -1$$

Solution 4:

Given equations are $5x + 4y + 14 = 0$ and $3x = -10 - 4y$

Comparing with $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$, we have

$$a_1 = 5, b_1 = 4, c_1 = 14 \quad \text{and} \quad a_2 = 3, b_2 = 4, c_2 = 10$$

$$\text{Now, } x = \frac{b_1c_2 - b_2c_1}{a_1b_2 - a_2b_1} \quad \text{and} \quad y = \frac{c_1a_2 - c_2a_1}{a_1b_2 - a_2b_1}$$

$$\Rightarrow x = \frac{4 \times 10 - 4 \times 14}{5 \times 4 - 3 \times 4} \quad \text{and} \quad y = \frac{14 \times 3 - 10 \times 5}{5 \times 4 - 3 \times 4}$$

$$\Rightarrow x = \frac{40 - 56}{20 - 12} \quad \text{and} \quad y = \frac{42 - 50}{20 - 12}$$

$$\Rightarrow x = \frac{-16}{8} \quad \text{and} \quad y = \frac{-8}{8}$$

$$\Rightarrow x = -2 \quad \text{and} \quad y = -1$$

Solution 5:

Given equations are $x - y + 2 = 0$ and $7x + 9y = 130$

Comparing with $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$, we have

$a_1 = 1, b_1 = -1, c_1 = 2$ and $a_2 = 7, b_2 = 9, c_2 = -130$

$$\text{Now, } x = \frac{b_1c_2 - b_2c_1}{a_1b_2 - a_2b_1} \quad \text{and} \quad y = \frac{c_1a_2 - c_2a_1}{a_1b_2 - a_2b_1}$$

$$\Rightarrow x = \frac{-1 \times (-130) - 9 \times 2}{1 \times 9 - 7 \times (-1)} \quad \text{and} \quad y = \frac{2 \times 7 - (-130) \times 1}{1 \times 9 - 7 \times (-1)}$$

$$\Rightarrow x = \frac{130 - 18}{9 + 7} \quad \text{and} \quad y = \frac{14 + 130}{9 + 7}$$

$$\Rightarrow x = \frac{112}{16} \quad \text{and} \quad y = \frac{144}{16}$$

$$\Rightarrow x = 7 \quad \text{and} \quad y = 9$$

Solution 6:

Given equations are $4x - y = 5$ and $5y - 4x = 7$

Comparing with $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$, we have

$a_1 = 4, b_1 = -1, c_1 = -5$ and $a_2 = -4, b_2 = 5, c_2 = -7$

$$\text{Now, } x = \frac{b_1c_2 - b_2c_1}{a_1b_2 - a_2b_1} \quad \text{and} \quad y = \frac{c_1a_2 - c_2a_1}{a_1b_2 - a_2b_1}$$

$$\Rightarrow x = \frac{-1 \times (-7) - 5 \times (-5)}{4 \times 5 - (-4) \times (-1)} \quad \text{and} \quad y = \frac{(-5) \times (-4) - (-7) \times 4}{4 \times 5 - (-4) \times (-1)}$$

$$\Rightarrow x = \frac{7 + 25}{20 - 4} \quad \text{and} \quad y = \frac{20 + 28}{20 - 4}$$

$$\Rightarrow x = \frac{32}{16} \quad \text{and} \quad y = \frac{48}{16}$$

$$\Rightarrow x = 2 \quad \text{and} \quad y = 3$$

Solution 7:

Given equations are $4x - 3y = 0$ and $2x + 3y = 18$

Comparing with $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$, we have

$a_1 = 4, b_1 = -3, c_1 = 0$ and $a_2 = 2, b_2 = 3, c_2 = -18$

$$\text{Now, } x = \frac{b_1c_2 - b_2c_1}{a_1b_2 - a_2b_1} \quad \text{and} \quad y = \frac{c_1a_2 - c_2a_1}{a_1b_2 - a_2b_1}$$

$$\Rightarrow x = \frac{-3 \times (-18) - 3 \times 0}{4 \times 3 - 2 \times (-3)} \quad \text{and} \quad y = \frac{0 \times 2 - (-18) \times 4}{4 \times 3 - 2 \times (-3)}$$

$$\Rightarrow x = \frac{54 - 0}{12 + 6} \quad \text{and} \quad y = \frac{0 + 72}{12 + 6}$$

$$\Rightarrow x = \frac{54}{18} \quad \text{and} \quad y = \frac{72}{18}$$

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

Solution 8:

Given equations are $8x + 5y = 9$ and $3x + 2y = 4$

Comparing with $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$, we have

$$a_1 = 8, b_1 = 5, c_1 = -9 \text{ and } a_2 = 3, b_2 = 2, c_2 = -4$$

$$\text{Now, } x = \frac{b_1c_2 - b_2c_1}{a_1b_2 - a_2b_1} \text{ and } y = \frac{c_1a_2 - c_2a_1}{a_1b_2 - a_2b_1}$$

$$\Rightarrow x = \frac{5 \times (-4) - 2 \times (-9)}{8 \times 2 - 3 \times 5} \text{ and } y = \frac{-9 \times 3 - (-4) \times 8}{8 \times 2 - 3 \times 5}$$

$$\Rightarrow x = \frac{-20 + 18}{16 - 15} \text{ and } y = \frac{-27 + 32}{16 - 15}$$

$$\Rightarrow x = \frac{-2}{1} \text{ and } y = \frac{5}{1}$$

$$\Rightarrow x = -2 \text{ and } y = 5$$

Solution 9:

Given equations are $4x - 3y - 11 = 0$ and $6x + 7y - 5 = 0$

Comparing with $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$, we have

$$a_1 = 4, b_1 = -3, c_1 = -11 \text{ and } a_2 = 6, b_2 = 7, c_2 = -5$$

$$\text{Now, } x = \frac{b_1c_2 - b_2c_1}{a_1b_2 - a_2b_1} \text{ and } y = \frac{c_1a_2 - c_2a_1}{a_1b_2 - a_2b_1}$$

$$\Rightarrow x = \frac{-3 \times (-5) - 7 \times (-11)}{4 \times 7 - 6 \times (-3)} \text{ and } y = \frac{-11 \times 6 - (-5) \times 4}{4 \times 7 - 6 \times (-3)}$$

$$\Rightarrow x = \frac{15 + 77}{28 + 18} \text{ and } y = \frac{-66 + 20}{28 + 18}$$

$$\Rightarrow x = \frac{92}{46} \text{ and } y = \frac{-46}{46}$$

$$\Rightarrow x = 2 \text{ and } y = -1$$

Solution 10:

Given equations are $4x + 6y = 15$ and $3x - 4y = 7$

Comparing with $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$, we have

$a_1 = 4$, $b_1 = 6$, $c_1 = -15$ and $a_2 = 3$, $b_2 = -4$, $c_2 = -7$

$$\text{Now, } x = \frac{b_1c_2 - b_2c_1}{a_1b_2 - a_2b_1} \quad \text{and} \quad y = \frac{c_1a_2 - c_2a_1}{a_1b_2 - a_2b_1}$$

$$\Rightarrow x = \frac{6 \times (-7) - (-4) \times (-15)}{4 \times (-4) - 3 \times 6} \quad \text{and} \quad y = \frac{-15 \times 3 - (-7) \times 4}{4 \times (-4) - 3 \times 6}$$

$$\Rightarrow x = \frac{-42 - 60}{-16 - 18} \quad \text{and} \quad y = \frac{-45 + 28}{-16 - 18}$$

$$\Rightarrow x = \frac{-102}{-34} \quad \text{and} \quad y = \frac{-17}{-34}$$

$$\Rightarrow x = 3 \quad \text{and} \quad y = \frac{1}{2}$$

Exercise 6(D)**Solution 1:**

$$\frac{9}{x} - \frac{4}{y} = 8 \quad \dots(1)$$

$$\frac{13}{x} + \frac{7}{y} = 101 \quad \dots(2)$$

Multiplying equation no. (1) by 7 and (2) by 4.

$$\frac{63}{x} - \frac{28}{y} = 56 \quad \dots(3)$$

$$\frac{52}{x} + \frac{28}{y} = 404 \quad \dots(4)$$

$$\frac{115}{x} = 460$$

$$x = \frac{115}{460} \Rightarrow x = \frac{1}{4}$$

From (1)

$$9 \times \left(\frac{4}{1} \right) - \frac{4}{y} = 8$$

$$-\frac{4}{y} = -28 \Rightarrow y = \frac{1}{7}$$

Solution 2:

$$\frac{3}{x} + \frac{2}{y} = 10 \quad \dots(i)$$

$$\frac{9}{x} - \frac{7}{y} = 10.5 \quad \dots(ii)$$

Multiplying equation (i) by 3, we get

$$\frac{9}{x} + \frac{6}{y} = 30 \quad \dots(iii)$$

Subtracting (ii) from (iii), we get

$$\frac{13}{y} = 19.5$$

$$\Rightarrow y = \frac{13}{19.5} = \frac{2}{3}$$

From (i),

$$\frac{3}{x} + \frac{2 \times 3}{2} = 10$$

$$\Rightarrow \frac{3}{x} + 3 = 10$$

$$\Rightarrow \frac{3}{x} = 7$$

$$\Rightarrow x = \frac{3}{7}$$

Solution 3:

$$5x + \frac{8}{y} = 19 \quad \dots(i)$$

$$3x - \frac{4}{y} = 7 \quad \dots(ii)$$

Multiplying equation (ii) by 2, we get

$$6x - \frac{8}{y} = 14 \quad \dots(iii)$$

Adding (i) and (iii), we get

$$11x = 33$$

$$\Rightarrow x = 3$$

Substituting $x = 3$ in equation (i), we get

$$5(3) + \frac{8}{y} = 19$$

$$\Rightarrow \frac{8}{y} = 19 - 15$$

$$\Rightarrow y = \frac{8}{4} = 2$$

Solution 4:

$$4x + \frac{6}{y} = 15 \quad \dots(i)$$

$$3x - \frac{4}{y} = 7 \quad \dots(ii)$$

Multiplying (i) by 4 and (ii) by 6

$$16x + \frac{24}{y} = 60 \quad \dots(iii)$$

$$18x - \frac{24}{y} = 42 \quad \dots(iv)$$

Adding (iii) and (iv), we get

$$34x = 102$$

$$\Rightarrow x = 3$$

Substituting $x = 3$ in (i), we get

$$4(3) + \frac{6}{y} = 15$$

$$\Rightarrow \frac{6}{y} = 15 - 12$$

$$\Rightarrow y = \frac{6}{3} = 2$$

Now, $y = ax - 2$

$$\Rightarrow 2 = a(3) - 2$$

$$\Rightarrow 2 = 3a - 2$$

$$\Rightarrow 3a = 4$$

$$\Rightarrow a = \frac{4}{3} = 1\frac{1}{3}$$

Solution 5:

$$\frac{3}{x} - \frac{2}{y} = 0 \quad \dots(1)$$

$$\frac{2}{x} + \frac{5}{y} = 19 \quad \dots(2)$$

Multiplying equation no. (1) by 5 and (2) by 2.

$$\frac{15}{x} - \frac{10}{y} = 0 \quad \dots(3)$$

$$\frac{4}{x} + \frac{10}{y} = 38 \quad \dots(4)$$

$$\frac{19}{x} = 38 \quad \Rightarrow x = \frac{1}{2}$$

$$\text{From (1)} \quad 3\left(\frac{1}{2}\right) - \frac{2}{y} = 0 \quad \Rightarrow y = \frac{1}{3}$$

$$\therefore y = ax + 3$$

$$\frac{1}{3} = a\left(\frac{1}{2}\right) + 3$$

$$\frac{a}{2} = \frac{-8}{3} \Rightarrow a = \frac{-16}{3}$$

Solution 6:

(i)

$$\frac{20}{x+y} + \frac{3}{x-y} = 7 \quad \dots(1)$$

$$\frac{8}{x+y} - \frac{15}{x+y} = 5 \quad \dots(2)$$

Multiplying equation no. (1) by 8 and (2) by 3.

$$\frac{160}{x+y} + \frac{24}{x-y} = 56 \quad \dots(3)$$

$$\frac{-45}{x+y} + \frac{24}{x-y} = 15 \quad \dots(4)$$

$$\begin{array}{r} - \quad - \quad - \\ \hline \frac{205}{x+y} = 41 \end{array}$$

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

From (1)

$$\frac{20}{5} + \frac{3}{x-y} = 7$$

$$\frac{3}{x-y} = 3$$

$$x - y = 1 \quad \dots(6)$$

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

$$x - y = 1 \quad \dots(6)$$

$$2x = 6$$

$$x = 3$$

from (5)

$$3 + y = 5 \Rightarrow y = 2$$

(ii)

Let $a = 3x + 4y$ and $b = 3x - 2y$

$$\therefore \frac{34}{3x+4y} + \frac{15}{3x-2y} = 5$$

$$\Rightarrow \frac{34}{a} + \frac{15}{b} = 5 \dots\dots\dots(i)$$

$$\frac{25}{3x-2y} - \frac{8.50}{3x+4y} = 4.5$$

$$\Rightarrow -\frac{8.50}{a} + \frac{25}{b} = 4.5 \dots\dots\dots(ii)$$

Multiply equation (ii) by 4, we get :

$$-\frac{34}{a} + \frac{100}{b} = 18$$

$$\frac{34}{a} + \frac{15}{b} = 5 \quad \text{[Equation (i)]}$$

$$+ \quad + \quad + \quad \text{[Adding]}$$

$$\frac{115}{b} = 23$$

$$\Rightarrow b = 5$$

$$\Rightarrow 3x - 2y = 5 \dots\dots\dots(iii)$$

Substituting $b = 5$ in equation (i), we get

$$\frac{34}{a} + \frac{15}{5} = 5$$

$$\Rightarrow 2a = 34$$

$$\Rightarrow a = 17$$

$$\Rightarrow 3x + 4y = 17 \dots\dots\dots(iv)$$

Subtracting equation (iv) from equation (iii), we get::

$$3x - 2y = 5$$

$$3x + 4y = 17$$

$$\begin{array}{r} - \quad - \quad - \\ \hline -6y = -12 \end{array}$$

$$\Rightarrow y = 2$$

Substituting $y = 2$ in equation (iii), we get

$$3x - 2(2) = 5$$

$$\Rightarrow 3x = 9$$

$$\Rightarrow x = 3$$

$\therefore$ Solution is $x = 3$ and $y = 2$.

Solution 7:

(i)

$$x + y = 2xy \quad \dots(1)$$

$$x - y = 6xy \quad \dots(2)$$

$$\underline{x - y = 6xy} \quad \dots(2)$$

$$2x = 8xy$$

$$2 = 8y$$

$$y = \frac{1}{4}$$

From (1)

$$x + \frac{1}{4} = 2x \left(\frac{1}{4} \right)$$

$$\frac{1}{2}x = \frac{-1}{4}$$

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

(ii)

$$x + y = 7xy \quad \dots(1)$$

$$2x - 3 = -xy \quad \dots(2)$$

Multiplying equation no. (1) by 3.

$$3x + 3y = 21xy \quad \dots(3)$$

$$\underline{2x - 3y = -xy} \quad \dots(4)$$

$$5x = 20xy$$

$$y = \frac{1}{4}$$

From (1)

$$x + \frac{1}{4} = 7x \left(\frac{1}{4} \right)$$

$$\frac{1}{4} = \frac{3}{4}x$$

$$x = \frac{1}{3}$$

Solution 8:

Given equations are $\frac{a}{x} - \frac{b}{y} = 0$ and $\frac{ab^2}{x} + \frac{a^2b}{y} = a^2 + b^2$

Taking $\frac{1}{x} = u$ and $\frac{1}{y} = v$, the above system of equations become

$$au - bv + 0 = 0$$

$$ab^2u + a^2bv - (a^2 + b^2) = 0$$

By cross-multiplication, we have

$$\frac{u}{-b \times [-(a^2 + b^2)] - a^2b \times 0} = \frac{-v}{a \times [-(a^2 + b^2)] - ab^2 \times 0} = \frac{1}{a \times a^2b - ab^2 \times (-b)}$$

$$\Rightarrow \frac{u}{b(a^2 + b^2)} = \frac{-v}{-a(a^2 + b^2)} = \frac{1}{a^3b + ab^3}$$

$$\Rightarrow \frac{u}{b(a^2 + b^2)} = \frac{v}{a(a^2 + b^2)} = \frac{1}{ab(a^2 + b^2)}$$

$$\Rightarrow u = \frac{b(a^2 + b^2)}{ab(a^2 + b^2)} \quad \text{and} \quad v = \frac{a(a^2 + b^2)}{ab(a^2 + b^2)}$$

$$\Rightarrow u = \frac{1}{a} \quad \text{and} \quad v = \frac{1}{b}$$

$$\Rightarrow \frac{1}{x} = \frac{1}{a} \quad \text{and} \quad \frac{1}{y} = \frac{1}{b}$$

$$\Rightarrow x = a \quad \text{and} \quad y = b$$

Solution 9:

$$\frac{2xy}{x+y} = \frac{3}{2}$$

$$\Rightarrow \frac{x+y}{xy} = \frac{4}{3}$$

$$\Rightarrow \frac{1}{x} + \frac{1}{y} = \frac{4}{3} \quad \dots(1)$$

$$\frac{xy}{2x-y} = -\frac{3}{10}$$

$$\Rightarrow \frac{2x-y}{xy} = -\frac{10}{3}$$

$$\Rightarrow -\frac{1}{x} + \frac{2}{y} = -\frac{10}{3} \quad \dots(2)$$

$$\text{Let } \frac{1}{x} = u \quad \text{and} \quad \frac{1}{y} = v$$

Then, equations (1) and (2) become

$$u + v = \frac{4}{3} \quad \text{and} \quad -u + 2v = -\frac{10}{3}$$

$$\Rightarrow 3u + 3v = 4 \quad \text{and} \quad -3u + 6v = -10$$

Adding, we have

$$9v = -6$$

$$\Rightarrow v = -\frac{6}{9} = -\frac{2}{3}$$

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

Substituting $y = -\frac{3}{2}$ in (1), we have

$$\frac{1}{x} - \frac{2}{3} = \frac{4}{3}$$

$$\Rightarrow \frac{1}{x} = \frac{6}{3} = 2$$

$$\Rightarrow x = \frac{1}{2}$$

$$\text{Hence, } x = \frac{1}{2} \quad \text{and} \quad y = -\frac{3}{2}$$

Solution 10:

Given equations are $\frac{3}{2x} + \frac{2}{3y} = -\frac{1}{3}$ and $\frac{3}{4x} + \frac{1}{2y} = -\frac{1}{8}$

Let $\frac{1}{x} = u$ and $\frac{1}{y} = v$

Then, the system of equations become

$$\frac{3}{2}u + \frac{2}{3}v = -\frac{1}{3} \text{ and } \frac{3}{4}u + \frac{1}{2}v = -\frac{1}{8}$$

$$\Rightarrow \frac{9u + 4v}{6} = -\frac{1}{3} \text{ and } \frac{3u + 2v}{4} = -\frac{1}{8}$$

$$\Rightarrow 27u + 12v = -6 \text{ and } 24u + 16v = -4$$

$$\Rightarrow 27u + 12v + 6 = 0 \text{ and } 24u + 16v + 4 = 0$$

$$\Rightarrow \frac{u}{12 \times 4 - 16 \times 6} = \frac{-v}{27 \times 4 - 24 \times 6} = \frac{1}{27 \times 16 - 24 \times 12}$$

$$\Rightarrow \frac{u}{48 - 96} = \frac{-v}{108 - 144} = \frac{1}{432 - 288}$$

$$\Rightarrow \frac{u}{-48} = \frac{-v}{-36} = \frac{1}{144}$$

$$\Rightarrow \frac{u}{-48} = \frac{v}{36} = \frac{1}{144}$$

$$\Rightarrow u = \frac{-48}{144} = -\frac{1}{3} \text{ and } v = \frac{36}{144} = \frac{1}{4}$$

$$\Rightarrow \frac{1}{x} = -\frac{1}{3} \text{ and } \frac{1}{y} = \frac{1}{4}$$

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

Exercise 6(E)

Solution 1:

Let the two numbers be x and y

According to the question,

$$\frac{x}{y} = \frac{2}{3}$$

$$3x - 2y = 0 \dots(1)$$

$$\text{Also, } \frac{x-2}{y-8} = \frac{3}{2}$$

$$2x - 3y = -20 \dots(2)$$

Multiplying equation no. (1) by 2 and (2) by 3 and subtracting

$$6x - 4y = 0$$

$$6x - 9y = -60$$

$$\begin{array}{r} - \quad + \quad + \\ \hline 5y = 60 \end{array}$$

$$y = 12$$

From (1), we get

$$3x - 2(12) = 0$$

$$x = \frac{24}{3}$$

$$x = 8$$

Thus, the numbers are 8 and 12.

Solution 2:

Let the smaller number be x

and the larger number be y.

According to the question,

$$\frac{x}{y} = \frac{4}{7}$$

$$7x - 4y = 0 \dots(1)$$

$$\text{and, } 3y + 2x = 59 \dots(2)$$

Multiplying equation no. (1) by 3 and (2) by 4 and adding them

$$21x - 12y = 0 \quad \dots(3)$$

$$\frac{8x + 12y = 236 \quad \dots(4)}{29x = 236}$$

$$x = \frac{236}{29}$$

From (1)

$$7\left(\frac{236}{29}\right) = 4y$$

$$y = 7\left(\frac{59}{29}\right)$$

$$y = \frac{413}{29}$$

Hence, the number are $\frac{236}{29}$ and $\frac{413}{29}$.

Solution 3:

Let x be the greater number and y be the smaller number.

When the greater of the two numbers increased by 1

divides the sum of the numbers, the result is $\frac{3}{2}$.

$$\Rightarrow \frac{x+y}{(x+1)} = \frac{3}{2}$$

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

$$\Rightarrow x - 2y = -3 \dots\dots\dots (i)$$

When the difference of these number is divided by the smaller,

the result is $\frac{1}{2}$.

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

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

$$\Rightarrow 2x - 3y = 0 \dots\dots\dots (ii)$$

Multiply equation (i) by 2, we get:

$$2x - 4y = -6$$

$$2x - 3y = 0 \quad \quad \quad \text{[Equation (ii)]}$$

$$\begin{array}{r} - \quad + \quad - \\ \hline \end{array} \quad \quad \quad \text{[Subtracting]}$$

$$-y = -6$$

$$\Rightarrow y = 6$$

Substituting $y = 6$ in equation (i), we get

$$x - 2(6) = -3$$

$$\Rightarrow x = 9$$

$\therefore$ 9 is the greater number and 6 is the smaller number.

Solution 4:

Let the common multiple between the numbers be x .

So, the numbers are $4x$ and $5x$.

According to the question,

$$\frac{4x - 30}{5x - 30} = \frac{1}{2}$$

$$\Rightarrow 8x - 60 = 5x - 30$$

$$\Rightarrow 3x = 30$$

$$\Rightarrow x = 10$$

So, $4x = 4(10) = 40$ and $5x = 5(10) = 50$

Thus, the numbers are 40 and 50.

Solution 5:

Let the numerator and denominator a fraction be x and y respectively .

According to the question,

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

$$3x - 2y = -8 \dots (1)$$

And,

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

$$3x - y = -1 \quad \dots (2)$$

Now subtracting,

$$3x - y = -1 \quad \dots (2)$$

$$3x - 2y = -8 \quad \dots (1)$$

$$\begin{array}{r} - \quad + \quad + \\ \hline y = 7 \end{array}$$

From (1),

$$3x - 2(7) = -8$$

$$3x = -8 + 14$$

$$x = 2$$

$$\text{Required fraction} = \frac{2}{7}$$

Solution 6:

Let the numerator and denominator of a fraction be x and y respectively. Then the fraction will be $\frac{x}{y}$

According to the question,

$$x + y = 7 \dots (1)$$

$$5y - 4x = 8 \dots (2)$$

Multiplying equation no. (1) by 4 and add with (2),

$$4x + 4y = 28 \quad \dots (3)$$

$$\begin{array}{r} -4x + 5y = 8 \\ \hline \end{array}$$

$$9y = 36$$

$$y = 4$$

From (1)

$$x + 4 = 7$$

$$x = 3$$

$$\text{Required fraction} = \frac{3}{4}$$

Solution 7:

Let the numerator of the fraction be x and the denominator be y .

So, the fraction is $\frac{x}{y}$.

According to the question,

$$\frac{2x}{y+1} = 1 \Rightarrow 2x = y + 1 \Rightarrow 2x - y = 1 \dots (i)$$

$$\text{and } \frac{x+4}{2y} = \frac{1}{2} \Rightarrow 2x + 8 = 2y \Rightarrow 2x - 2y = -8 \dots (ii)$$

Solving equations (i) and (ii), we get

$$y = 9$$

Putting the value of y in (i), we get

$$2x - (9) = 1 \Rightarrow 2x = 1 + 9 \Rightarrow x = 5$$

So, the fraction is $\frac{5}{9}$.

Solution 8:

Let the numerator of the fraction be x and denominator of the fraction be y .

$$\text{Then, the fraction} = \frac{x}{y}$$

According to given condition, we have

$$\frac{x-5}{y-3} = \frac{1}{2}$$

$$\Rightarrow 2x - 10 = y - 3$$

$$\Rightarrow 2x - y = 7 \quad \dots(i)$$

And,

$$x + 5 = y$$

$$\Rightarrow x - y = -5 \quad \dots(ii)$$

Subtracting (ii) from (i), we get

$$x = 12$$

$$\Rightarrow y = x + 5 = 12 + 5 = 17$$

hence, the fraction is $\frac{12}{17}$.

Solution 9:

Let the numerator of the fraction be x and denominator of the fraction be y .

$$\text{Then, the fraction} = \frac{x}{y}$$

According to given condition, we have

$$\frac{x-5}{y-3} = \frac{1}{2}$$

$$\Rightarrow 2x - 10 = y - 3$$

$$\Rightarrow 2x - y = 7 \quad \dots(i)$$

And,

$$x + 5 = y$$

$$\Rightarrow x - y = -5 \quad \dots(ii)$$

Subtracting (ii) from (i), we get

$$x = 12$$

$$\Rightarrow y = x + 5 = 12 + 5 = 17$$

hence, the fraction is $\frac{12}{17}$.

Solution 10:

Let the digit at unit's place be x and the digit at ten's place be y .

Required no. = $10y + x$

If the digit's are reversed

Reversed no. = $10x + y$

According to the question,

$$x + y = 7 \dots (1)$$

and,

$$10x + y - 2 = 2(10y + x).$$

$$8x - 19y = 2 \dots (2)$$

Multiplying equation no. (1) by 19.

$$19x + 19y = 133 \quad \dots (3)$$

Now adding equation(2) and (3)

$$19x + 19y = 133 \quad \dots (3)$$

$$\underline{8x - 19y = 2} \quad \dots (2)$$

$$27x = 135$$

$$x = 5$$

From (1)

$$5 + y = 7$$

$$y = 2$$

Required number is

$$10(2) + 5$$

$$= 25.$$

Solution 11:

Let the digit at unit's place be x and the digit at ten's place be y .

Required no. = $10y + x$

According to the question

$$y = 3x \Rightarrow 3x - y = 0 \dots (1)$$

and, $10y + x + x = 32$

$$10y + 2x = 32 \dots (2)$$

Multiplying equation no. (1) by 10

$$30x - 10y = 0 \quad \dots (3)$$

Now adding (3) and (2)

$$30x - 10y = 0 \quad \dots (3)$$

$$\underline{2x + 10y = 32} \quad \dots (2)$$

$$32x = 32$$

$$x = 1$$

From (1), we get

$$y = 3(1) = 3$$

Required no is

$$10(3) + 1 = 31$$

Solution 12:

Let the digit a unit's place be x and the digit at ten's place be y .

Required no. = $10y + x$.

According to the question,

$$y - 2x = 2$$

$$-2x + y = 2 \dots (1)$$

and,

$$(10x + y) - 3(y + x) = 5$$

$$7x - 2y = 5 \dots (2)$$

Multiplying equation no. (1) by 2.

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

Now adding (2) and (3)

$$-4x + 2y = 4$$

$$7x - 2y = 5$$

$$\hline 3x = 9$$

$$x = 3$$

From (1), we get

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

$$\Rightarrow y = 8$$

Required number is

$$10(8) + 3 = 83.$$

Solution 13:

Let x be the number at the ten's place

and y be the number at the unit's place.

So, the number is $10x + y$.

Four times a certain two-digit number is seven times the number obtained on interchanging its digits.

$$\Rightarrow 4(10x + y) = 7(10y + x)$$

$$\Rightarrow 40x + 4y = 70y + 7x$$

$$\Rightarrow 33x - 66y = 0$$

$$\Rightarrow x - 2y = 0 \dots \dots \dots (i)$$

If the difference between the digits is 4, then

$$\Rightarrow x - y = 4 \dots \dots \dots (ii)$$

Subtracting equation (i) from equation (ii), we get:

$$x - y = 4$$

$$x - 2y = 0 \quad \text{[Equation (i)]}$$

$$\begin{array}{r} - \\ + \\ \hline \end{array} \quad \text{[Subtracting]}$$

$$y = 4$$

Substituting $y = 4$ in equation (i), we get

$$x - 2(4) = 0$$

$$\Rightarrow x = 8$$

$\therefore$ The number is $10x + y = 10(8) + 4 = 84$.

Solution 14:

Let the tens digit of the number be x and the units digit be y .

So, the number is $10x + y$.

The number obtained by interchanging the digits will be $10y + x$.

According to question, we have

$$10x + y + 10y + x = 121$$

$$\Rightarrow 11x + 11y = 121$$

$$\Rightarrow 11(x + y) = 121$$

$$\Rightarrow x + y = 11 \quad \dots(i)$$

And,

$$x - y = 3 \quad \dots(ii)$$

Adding (i) and (ii), we get

$$2x = 14$$

$$\Rightarrow x = 7$$

$$\Rightarrow y = 11 - x = 11 - 7 = 4$$

Hence, the number is 74.

Solution 15:

Let the tens digit of the number be x and the units digit be y .

So, the number is $10x + y$.

According to the question,

$$10x + y = 8(x + y) \Rightarrow 2x = 7y \dots(i)$$

$$\text{and } 10x + y = 14(x - y) + 2 \text{ or } 10x + y = 14(y - x) + 2$$

$$\Rightarrow 4x - 15y = -2 \dots(ii) \text{ or } 24x - 13y = 2 \dots(iii)$$

Solving (i) and (ii), we get

$$y = 2 \text{ and } x = 7$$

Solving (i) and (iii), we get

$$y = \frac{2}{71}$$

This is not possible, since y is a digit and cannot be in fraction form.

So the number is 72.

Exercise 6(F)

Solution 1:

Let present age of A = x years

And present age of B = y years

According to the question,

Five years ago,

$$x - 5 = 4(y - 5)$$

$$x - 4y = -15 \dots (1)$$

Five years later,

$$x + 5 = 2(y + 5)$$

$$x - 2y = 5 \dots (2)$$

Now subtracting (1) from (2)

$$x - 2y = 5 \dots (2)$$

$$x - 4y = -15 \dots (1)$$

$$\begin{array}{r} - \quad + \quad + \\ \hline 2y = 20 \end{array}$$

$$y = 10$$

From (1)

$$x - 4(10) = -15$$

$$x = 25$$

Present ages of A and B are 25 years and 10 years respectively.

Solution 2:

Let A's present age be x years

and B's present age be y years

According to the question

$$x = y + 20$$

$$x - y = 20 \dots (1)$$

Five years ago,

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

$$x - 3y = -10 \dots (2)$$

Subtracting (1) from (2),

$$x - 3y = -10 \dots (2)$$

$$x - y = 20 \dots (1)$$

$$\begin{array}{r} - \quad + \quad - \\ \hline -2y = -30 \end{array}$$

$$y = 15$$

From (1)

$$x = 15 + 20$$

$$x = 35$$

Thus, present ages of A and B are 35 years and 15 years.

Solution 3:

Let the present age of the mother be x years
and the present age of the daughter be y year.

According to the question,

$$x - 4 = 4(y - 4) \Rightarrow x - 4 = 4y - 16 \Rightarrow x - 4y = -12 \dots (i)$$

$$\text{and } x + 6 = 2\frac{1}{2}(y + 6) \Rightarrow x + 6 = \frac{5}{2}y + 15 \Rightarrow x - \frac{5}{2}y = 9 \dots (ii)$$

Solving (i) and (ii), we get

$$y = 14 \text{ and } x = 44$$

Hence, the present age of the mother is 44 years
and the present age of the daughter is 14 years.

Solution 4:

Let the present age of the man be x years
and let the sum of the ages of his two children be y years.

According to the question,

$$x = 2y \dots (i)$$

$$\text{and } x + 20 = y + 40 \dots (ii) \dots (\text{Since he has two children})$$

Solving (i) and (ii), we get

$$2y + 20 = y + 40 \Rightarrow y = 20$$

$$\text{So, } x = 2y \Rightarrow x = 40$$

Hence, the present age of the man is 40 years.

Solution 5:

Let A's annual income = Rs. x

and B's annual income = Rs. y

According to the question,

$$\frac{x}{y} = \frac{3}{4}$$

$$4x - 3y = 0 \dots (1)$$

$$\text{and, } \frac{x - 5000}{y - 5000} = \frac{5}{7}$$

$$7x - 5y = 10000 \dots (2)$$

Multiplying equation no. (1) by 7 and (2) by 4 and subtracting (4) from (3)

$$28x - 21y = 0 \dots (3)$$

$$28x - 20y = 40000 \dots (4)$$

$$\begin{array}{r} - \quad + \quad - \\ \hline -y = -40000 \end{array}$$

$$y = 40,000$$

From (1)

$$4x - 3(40000) = 0$$

$$x = 30000$$

Thus, A's income is Rs. 30,000 and B's income is Rs. 40,000.

Solution 6:

Let the no. of pass candidates be x
and the no. of fail candidates be y .
According to the question,

$$\frac{x}{y} = \frac{y}{1}$$

$$x - 4y = 0 \dots (1)$$

$$\text{and } \frac{x - 20}{y - 10} = \frac{5}{1}$$

$$x - 5y = -30 \dots (2)$$

$$x - 4y = 0 \quad \dots (1)$$

$$x - 5y = -30 \quad \dots (2)$$

$$\begin{array}{r} - \quad + \quad + \\ \hline y = 30 \end{array}$$

From (1)

$$-4(30) = 0$$

$$x = 120$$

$$\text{Total students appeared} = x + y$$

$$= 120 + 30$$

$$= 150$$

Solution 7:

Let the number of pencils with A = x
and the number of pencils with B = y .

If A gives 10 pencils to B,

$$y + 10 = 2(x - 10)$$

$$2x - y = 30 \dots (1)$$

If B gives 10 pencils to A

$$y - 10 = x + 10$$

$$x - y = -20 \quad \dots (2)$$

$$2x - y = 30 \quad \dots (1)$$

$$\begin{array}{r} - \quad + \quad - \\ \hline -x = -50 \end{array}$$

$$x = 50$$

From (1)

$$2(50) - y = 30$$

$$y = 70$$

Thus, A has 50 pencils and B has 70 pencils.

Solution 8:

Let the number of adults = x
 and the number of children = y

According to the question,

$$x + y = 1250 \dots (1)$$

$$\text{and } 75x + 25y = 61250$$

$$3x + y = 2450 \quad \dots (2)$$

$$x + y = 1250 \quad \dots (1)$$

$$\begin{array}{r} - \quad - \quad - \\ \hline 2x = 1200 \end{array}$$

$$x = 600$$

From (1)

$$600 + y = 1250$$

$$y = 650$$

Thus, number of adults = 600

and the number of children = 650.

Solution 9:

Let the cost price of article A = Rs. x

and the cost price of articles B = Rs. y

According to the question,

$$(x + 5\% \text{ of } x) + (y + 7\% \text{ of } y) = 1167$$

$$\left(x + \frac{5}{100}x\right) + \left(y + \frac{7}{100}y\right) = 1167$$

$$\frac{21x}{20} + \frac{107y}{100} = 1167$$

$$105x + 107y = 116700 \dots (1)$$

$$\text{and } \frac{107x}{100} + \frac{105y}{100} = 1165$$

$$107x + 105y = 116500 \dots (2)$$

Adding (1) and (2)

$$212x + 212y = 233200$$

$$x + y = 1100 \dots (3)$$

subtracting (2) from (1)

$$-2x + 2y = 200$$

$$-x + y = 100 \quad \dots (4)$$

$$x + y = 1100 \quad \dots (3)$$

$$\hline 2y = 1200$$

$$y = 600$$

from (3)

$$x + 600 = 1100$$

$$x = 500$$

Thus, cost price of article A is Rs. 500.

and that of article B is Rs. 600.

Solution 10:

Let Pooja's 1 day work = $\frac{1}{x}$

and Ritu's 1 day work = $\frac{1}{y}$

According to the question,

$$\frac{1}{x} + \frac{1}{y} = \frac{7}{120} \quad \dots (1)$$

$$\text{and, } \frac{1}{x} = \frac{3}{4} \cdot \frac{1}{y}$$

$$y = \frac{3}{4}x \quad \dots (2)$$

Using the value of y from (2) in (1)

$$\frac{1}{x} + \frac{4}{3x} = \frac{7}{120}$$

$$\frac{1}{x} \left(\frac{7}{3} \right) = \frac{7}{120}$$

$$x = 40$$

$$\text{From (2) } y = \frac{3}{4}(40) = 30$$

$$y = 30$$

Pooja will complete the work in 40 days and Ritu will complete the work in 30 days.

Exercise 6(G)**Solution 1:**

Let Rohit has Rs. x

and Ajay has Rs. y

When Ajay gives Rs. 100 to Rohit

$$x + 100 = 2(y - 100)$$

$$x - 2y = -300 \dots (1)$$

When Rohit gives Rs. 10 to Ajay

$$6(x - 10) = y + 10$$

$$6x - y = 70 \dots (2)$$

Multiplying equation no. (2) By 2.

$$12x - 2y = 140 \quad \dots (3)$$

$$x - 2y = -300$$

$$\begin{array}{r} - \quad + \quad + \\ \hline 11x = 440 \end{array}$$

$$x = 40$$

From (1)

$$40 - 2y = -300$$

$$\Rightarrow -2y = -340$$

$$\Rightarrow y = 170$$

Thus, Rohit has Rs. 40

and Ajay has Rs. 170

Solution 2:

Let the digits in the tens place be x and the digit in the units place be y .

$$\therefore \text{Number} = 10x + y$$

$$\text{Number on reversing the digits} = 10y + x$$

$$\text{The difference between the digits} = x - y \text{ or } y - x$$

$$\text{Given : } (10x + y) + (10y + x) = 99$$

$$\Rightarrow 11x + 11y = 99$$

$$\Rightarrow x + y = 9 \dots (i)$$

$$x - y = 3 \dots (ii)$$

$$\text{or } y - x = 3 \dots (iii)$$

On solving equations (i) and (ii), we get

$$2x = 12 \Rightarrow x = 6$$

$$\text{So, } y = 3$$

On solving equations (i) and (iii), we get

$$2y = 12 \Rightarrow y = 6$$

$$\text{So, } x = 3$$

$$\text{Number} = 10x + y = 10(6) + 3 = 63$$

$$\text{or Number} = 10x + y = 10(3) + 6 = 36$$

$$\therefore \text{Required number} = 63 \text{ or } 36.$$

Solution 3:

Let the digit at ten's place be x

And the digit at unit's place be y

$$\text{Required number} = 10x + y$$

When the digits are interchanged,

$$\text{Reversed number} = 10y + x$$

According to the question,

$$7(10x + y) = 4(10y + x)$$

$$66x = 33y$$

$$2x - y = 0 \dots (1)$$

Also,

$$y - x = 3 \dots (2)$$

$$\begin{array}{rcl} -y + 2x & = & 0 \dots (1) \\ \hline x & = & 3 \end{array}$$

$$\text{From (1) } 2(3) - y = 0$$

$$y = 6$$

$$\text{Thus, Required number} = 10(3) + 6 = 36$$

Solution 4:

Let, the fare of ticket for station A be Rs. x

and the fare of ticket for station B be Rs. y

According, to the question

$$2x + 3y = 77 \dots (1)$$

$$\text{and } 3x + 5y = 124 \dots (2)$$

Multiplying equation no. (1) by 3 and (2) by 2.

$$6x + 9y = 231 \quad \dots (1)$$

$$6x + 10y = 248 \quad \dots (4)$$

$$\begin{array}{r} - \quad - \quad - \\ \hline -y = -17 \end{array}$$

$$y = 17$$

$$\text{From (1) } 2x + 3(17) = 77$$

$$2x = 77 - 51$$

$$2x = 26$$

$$x = 13$$

Thus, fare for station A = Rs. 13

and, fare for station B = Rs. 17.

Solution 5:

Let x be the number at the ten's place

and y be the number at the unit's place.

So the number is $10x + y$.

The sum of digit of a two digit number is 11.

$$\Rightarrow x + y = 11 \dots (i)$$

If the digit at ten's place is increased by 5

and the digit at unit place is decreased by 5,

the digits of the number are found to be reversed.

$$\Rightarrow 10(x + 5) + (y - 5) = 10y + x$$

$$\Rightarrow 9x - 9y = -45$$

$$\Rightarrow x - y = -5 \dots (ii)$$

Subtracting equation (i) from equation (ii), we get:

$$x - y = -5$$

$$x + y = 11 \quad \text{[Equation (i)]}$$

$$\begin{array}{r} - \quad - \quad - \\ \hline -2y = -16 \end{array} \quad \text{[Subtracting]}$$

$$-2y = -16$$

$$\Rightarrow y = 8$$

Substituting $y = 8$ in equation (i), we get

$$x + 8 = 11$$

$$\Rightarrow x = 3$$

$\therefore$ The number is $10x + y = 10(3) + 8 = 38$.

Solution 6:

Let the quantity of 90% acid solution be x litres and

The quantity of 97% acid solution be y litres

According to the question,

$$x + y = 21 \dots (1)$$

and 90% of x + 97% of y = 95% of 21

$$90x + 97y = 1995 \dots (2)$$

Multiplying equation no. (1) by 90, we get,

$$90x + 90y = 1890 \quad \dots (3)$$

$$90x + 97y = 1995 \quad \dots (2)$$

$$\begin{array}{r} - \quad - \quad + \\ \hline - 7y = -105 \end{array}$$

$$y = 15$$

$$\text{From (1)} x + 15 = 21$$

$$x = 6$$

Hence, 90% acid solution is 6 litres and 97% acid solution is 15 litres.

Solution 7:

Assume x kg of the first kind costing Rs. 250 per kg
and y kg of the second kind costing Rs. 350 per kg
sweets were bought.

It is estimated that 40 kg of sweets were needed.

$$\Rightarrow x + y = 40 \dots (i)$$

The total budget for the sweets was Rs. 11,800.

$$\Rightarrow 250x + 350y = 11,800 \dots (ii)$$

Multiply equation (i) by 250, we get:

$$250x + 250y = 10000$$

$$250x + 350y = 11,800 \quad \text{[Equation (ii)]}$$

$$\begin{array}{r} - \quad - \quad - \\ \hline - 100y = -1800 \end{array} \quad \text{[Subtracting]}$$

$$\Rightarrow y = 18$$

Substituting $y = 18$ in equation (i), we get

$$x + 18 = 40$$

$$\Rightarrow x = 22$$

$\therefore$ 22 kgs of the first kind costing Rs. 250 per kg
and 18 kgs of the second kind costing Rs. 350 per kg
sweets were bought.

Solution 8:

Weight of Mr. Ahuja = x kg
 and weight of Mrs. Ahuja = y kg.

After the dieting,

$$x - 5 = y$$

$$x - y = 5 \dots (1)$$

$$\text{and, } y - 4 = \frac{7}{8}x$$

$$7x - 8y = -32 \dots (2)$$

Multiplying equation no. (1) by 7, we get

$$7x - 7y = 35 \quad \dots (3)$$

Now subtracting (2) from (3)

$$7x - 7y = 35 \quad \dots (3)$$

$$7x - 8y = -32 \quad \dots (2)$$

$$\begin{array}{r} - \quad + \quad + \\ \hline y = 67 \end{array}$$

From (1)

$$x - 67 = 5 \Rightarrow x = 72$$

Thus, weight of Mr. Ahuja = 72 kg.

and that of Mr. Anuja = 67 kg.

Solution 9:

Let x be the constant expense per month of the family.

and y be the expense per month for a single member of the family.

For a family of 4 people,

the total monthly expense is Rs. 10,400.

$$\Rightarrow x + 4y = 10,400 \dots (i)$$

For a family of 7 people,

the total monthly expense is Rs. 15,800.

$$\Rightarrow x + 7y = 15,800 \dots (ii)$$

Subtracting equation (i) from equation (ii), we get:

$$\begin{array}{r} x + 7y = 15800 \\ x + 4y = 10400 \quad \text{[Equation (i)]} \\ \hline - \quad - \quad - \quad \text{[Subtracting]} \\ 3y = 5400 \\ \Rightarrow y = 1800 \end{array}$$

Substituting $y = 1800$ in equation (i), we get

$$x + 4(1800) = 10,400$$

$$\Rightarrow x = 3200$$

$\therefore$ The constant expense is Rs. 3,200 per month and
 the monthly expense of each member of a family is Rs. 1,800.

Solution 10:

Let the fixed charge be Rs. x and the charge per kilometer be Rs. y .

The charges for 10 km = Rs. $10y$

The charges for 15 km = Rs. $15y$

According to the question,

$$x + 10y = 315 \dots (i)$$

$$x + 15y = 465 \dots (ii)$$

Solving the equations, we get

$$-5y = -150 \Rightarrow y = 30$$

$$\text{and } x = 315 - 10y = 315 - 10(30) = 15$$

So, the fixed charges is Rs. 15 and the charges per kilometer is Rs. 30.

To travel 32 km, a person has to pay

$$\text{Rs. } 15 + \text{Rs. } 30(32) = \text{Rs. } 15 + \text{Rs. } 960 = \text{Rs. } 975$$

Solution 11:

Let the fixed charges be Rs. x and the charge for each extra day be Rs. y .

According to the question,

$$x + 4y = 27 \dots (i)$$

$$\text{and } x + 2y = 21 \dots (ii)$$

Solving the equations, we get

$$2y = 6 \Rightarrow y = 3$$

$$\text{and } x = 21 - 2y = 21 - 2(3) = 15$$

Hence, the fixed charges is Rs. 15 and the charge for each extra day is Rs. 3.

Solution 12:

Let the length of the rectangle be x units and the breadth of the rectangle be y units.

We know that, area of a rectangle = length $\times$ breadth = xy

According to the question,

$$xy - 9 = (x - 5)(y + 3)$$

$$\Rightarrow xy - 9 = xy + 3x - 5y - 15$$

$$\Rightarrow 3x - 5y = 6 \dots\dots(i)$$

$$xy + 67 = (x + 3)(y + 2)$$

$$\Rightarrow xy + 67 = xy + 2x + 3y + 6$$

$$\Rightarrow 2x + 3y = 61 \dots\dots(ii)$$

Multiply (i) by 2 and (ii) by 3, we get

$$6x - 10y = 12 \dots\dots(iii)$$

$$\text{and } 6x + 9y = 183 \dots\dots(iv)$$

Solving (iii) and (iv), we get

$$-19y = -171 \Rightarrow y = 9$$

$$\text{and } x = 17$$

Hence, the length of the rectangle is 17 units and the breadth of the rectangle is 9 units.

Solution 13:

Let the pipe with larger diameter and smaller diameter be pipes A and B respectively.

Also, let pipe A work at a rate of x hours / unit and pipe B work at a rate of y hours / unit.

According to the question,

$$x + y = \frac{1}{12} \Rightarrow 12x + 12y = 1 \dots\dots(i)$$

$$\text{and } 4x + 9y = \frac{1}{2} \Rightarrow 8x + 18y = 1 \dots\dots(ii)$$

Multiply (i) by 2 and (ii) by 3, we get

$$24x + 24y = 2 \text{ and } 24x + 54y = 3$$

$$\text{On solving we get, } 30y = 1 \Rightarrow y = \frac{1}{30}$$

$$\text{and } x = \frac{1}{20}$$

Hence, the pipe with larger diameter will take 20 hours to fill the swimming pool and the pipe with smaller diameter will take 30 hours to fill the swimming pool.