Simultaneous Linear Equations

SIMULTANEOUS LINEAR EQUATIONS

Exercise 5.1

Solution – 1 :-

(i) $x + y = 14$

$x - y = 4$

$\therefore$ $x + y = 14$

$x - y = 4$

$\therefore x = y + 4$

$x + y = 14$

$[y + 4] + y = 14$

$2y + 4 = 14$

$2y = 14 - 4$

$2y = 10$

$y = \dfrac{\cancel{10}^{5}}{\cancel{2}_{1}}$

$x + y = 14$

$x + 5 = 14$

$x = 14 - 5$

$x = 9$

$\therefore$ $x = 9, y = 5$

(ii) $s - t = 3$ —①

$\dfrac{s}{3} + \dfrac{t}{2} = 6$ —②

$2s + 3t = 6$

$t = \dfrac{6 - 2s}{3}$

① $\Rightarrow$ $s - t = 3$

$s - \left(\dfrac{6 - 2s}{3}\right) = 3$

$3s - 6 - 2s = 9$

$s - 6 = 9$

$s = 6 + 3$

$= 9$

$s - t = 3$

$9 - t = 3$

$-t = 3 - 9$

$+t = +6$

$t = 6$

$\therefore s = 9, \ t = 6.$

9 | Solution -1

(iii) | $2x + 3y = 9$ —①

$3x + 4y = 5$ —②

$4y = 5 - 3x$

$y = \dfrac{5 - 3x}{4}$

① ⟹ $2x + 3y = 9$

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

$8x + 15 - 9x = 36$

$-x = 36 - 15$

$-x = 21$

$x = -21$

∴ $2x + 3y = 9$

$2(-21) + 3y = 9$

$-42 + 3y = 9$

$3y = 9 + 42$

$3y = 51$

$y = \dfrac{51}{3} = 17$

∴ $x = -21, y = 17$

iv) $3x - 5y = 4$ — ①

$9x - 2y = 7$ — ②

⑧ $9x - 2y = 7$

$9x = 7 + 2y$

$x = \dfrac{7 + 2y}{9}$

$3x - 5y = 4$

$3\left(\dfrac{7 + 2y}{9}\right) - 5y = 4$

$21 + 6y - 45y = 36$

$-39y = 36 - 21$

$-39y = 15$

$-y = \dfrac{15}{39}$

$-y = 5/13$

$y = -5/13$

$3x - 5\left(\dfrac{-5}{13}\right) = 4$

$3x + \dfrac{25}{13} = 4$

$3x = 4 - \dfrac{25}{13}$

$3x = \dfrac{27}{13}$

$x = \dfrac{27}{13} \cdot \dfrac{3}{7}$

$x = \dfrac{9}{13}$

Solution - 23:-

(i) $a + 3b = 5$ —①

$7a - 8b = 6$ —②

$a = \dfrac{6 + 8b}{7}$

$a + 3b = 5$

$\dfrac{6 + 8b}{7} + 3b = 5$

$6 + 8b + 21b = 35$

$6 + 29b = 35$

$29b = 35 - 6$

$\dfrac{29b}{29} = \dfrac{29}{29}$

$b = \dfrac{\overset{1}{\cancel{29}}}{\cancel{29}}$

$b = 1$

$a + 3b = 5$

$a + 3(1) = 5$

$a = 5 - 3$

$a = 2.$

$\therefore a = 2, \ b = 1$

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

$x - 20 = 12y$

$\therefore x - 20 = 12y$

$y = \dfrac{x - 20}{12}$

$5x + 4y - 4 = 0$

$5x + 4\left(\dfrac{x - 20}{12}\right) - 4 = 0$

$60x + 4x - 80 - 48 = 0$

$64x - 128 = 0$

$64x = 128$

$x = 128/4$

$x = 2$

$5x + 4y - 4 = 0$

$5(2) + 4y - 4 = 0$

$10 + 4y - 4 = 0$

$6 + 4y = 0$

$4y = 6$

$y = 6/4 = 3/2$

$\therefore x = 2, \ y = 3/2$

Solution-3

(i) $2x - \dfrac{3y}{4} = 3$ —①

$5x - 2y - 7 = 0$ —②

$8x = 12 + 3y$

$x = \dfrac{12 + 3y}{8}$

$5\left(\dfrac{12 + 3y}{8}\right) - 2y - 7 = 0$

$60 + 15y - 16y - 56 = 0$

$-y = 56 - 60$

$+y = +4$

$y = 4$

$\cancel{2x +} 5x - 2y - 7 = 0$

$5x - 2(4) - 7 = 0$

$5x - 8 - 7 = 0$

$5x - 15 = 0$

$5x = 15$

$x = 15/5$

$x = 3$

$\therefore x = 3, y = 4$

(ii) $2x + 3y = 23$

$5x - 20 = 8y$.

$y = \dfrac{5x - 20}{8}$

$2x + 3\left(\dfrac{5x - 20}{8}\right) = 23$

$16x + 15x - 60 = 184$

$31x = 184 + 60$

$31x = 244$

$x = \dfrac{244}{31} = 7\dfrac{27}{31}$

$2x + 3y = 23$

$2\left(\dfrac{244}{31}\right) + 3y = 23$

$\dfrac{488}{31} + 3y = 23$

$3y = 23 - \dfrac{488}{31}$

$3y = \dfrac{225}{31}$

$y = \dfrac{225}{31} \div 3$

$y = \dfrac{75}{31}$

$y = 2\dfrac{13}{31}$

$\therefore x = 7\dfrac{27}{31} \qquad y = 2\cdot\dfrac{13}{31}$.

Solution — 4

(i)

$$mx - ny = m^2 + n^2 \quad -(i)$$
$$x + y = 2m. \quad -(ii)$$

substitute (ii) in (i)

$$\therefore \quad x = 2m - y$$

$$\Rightarrow \quad m(2m-y) - ny = m^2 + n^2$$

$$2m^2 - my - ny = m^2 + n^2$$

$$2m^2 - y(m+n) = m^2 + n^2$$

$$2m^2 - m^2 - n^2 = y(m+n)$$

$$m^2 - n^2 = y(m+n)$$

$$(m+n)(m-n) = y(m+n)$$

$$\therefore \quad y = m - n \quad \text{//.}$$

$$\therefore \quad x = 2m - y$$
$$= 2m - m + n$$
$$x = m + n$$

$$\therefore \quad x = m + n$$
$$y = m - n.$$

(ii) $\frac{b}{a}x + \frac{a}{b}y = a^2 + b^2$

$x + y = 2ab$

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

$\therefore \quad \frac{b}{a}(2ab - y) + \frac{a}{b}y = a^2 + b^2$

$\frac{b}{a} \cdot 2ab - \frac{b}{a} \cdot y + \frac{a}{b}y = a^2 + b^2$

$2b^2 - y\left(\frac{b}{a} - \frac{a}{b}\right) = a^2 + b^2$

$2b^2 - a^2 - b^2 = y\left(\frac{b^2 - a^2}{ab}\right)$

$b^2 - a^2 = y\left(\frac{b^2 - a^2}{ab}\right)$

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

$y = ab$

$\therefore \quad x = 2ab - y$

$x = 2ab - ab$

$= ab$

⑤ $2x + y = 35$

$3x + 4y = 65$

$3x + 4y = 65$

$\quad 4y = 65 - 3x$

$\quad\quad y = \dfrac{65 - 3x}{4}$

$2x + y = 35$

$2x + \dfrac{65 - 3x}{4} = 35$

$8x + 65 - 3x = 140$

$8x - 3x = 140 - 65$

$5x = 75$

$\quad x = 15$

$2x + y = 35$

$2(15) + y = 35$

$30 + y = 35$

$\quad y = 35 - 30$

$\quad\quad = 5$

$\therefore x = 15, \; y = 5$

$\therefore x/y = \dfrac{15}{5} = 3$

(6) $3x - y = 5$

$4x - 3y = -1$

$3x = 5 + y$

$x = \dfrac{5 + y}{3}$

$4\left(\dfrac{5+y}{3}\right) - 3y = 1 - 1$

$20 + 4y - 9y = -3$

$-5y = -3 - 20$

$-5y = -23$

$y = \dfrac{23}{5}$

$3x - y = 5$

$3x - \dfrac{23}{5} = 5$

$15x - 23 = 25$

$15x = 25 + 23$

$15x = 48$

$x = \dfrac{48}{15} = 16/5$

$y = px - 3$

$\dfrac{23}{5} = p\left(\dfrac{16}{5}\right) - 3$

$\dfrac{23}{5} = \dfrac{16p}{5} - 15 \bigg/ 3$

$\dfrac{23}{5} - 15 = \dfrac{16p}{5}$

$p = \dfrac{19}{8}$

Solution - 1:-

① $3x + 4y = 10$ — ①

$2x - 2y = 2$ — ②

$x = \dfrac{2 + 2y}{2}$

①=) $3\left(\dfrac{2 + 2y}{2}\right) + 4y = 10$

$\dfrac{6 + 6y}{2} + 4y = 10$

$6 + 6y + 8y = 20$

$6 + 14y = 20$

$14y = 20 - 6$

$14y = 14$

$y = \underline{1}$

① =) $3x + 4y = 10$

$3x = 10 - 4$

$3x = 6$

$x = \dfrac{6}{3}^{2}$

$x = 2$

∴ $x = 2$, $y = \underline{1}$

Sol ② (ii)

$2x = 5y + 4$

$3x - 2y + 16 = 0$

$x = \dfrac{5y + 4}{2}$

$3\left(\dfrac{5y + 4}{2}\right) - 2y + 16 = 0$

$\dfrac{15y + 12}{2} - 2y + 16 = 0$

$15y + 12 - 4y + 32 = 0$

$11y + 44 = 0$

$11y = -44$

$y = \dfrac{-44}{11} = -4$

$y = -4$

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

$2x = -20 + 4$

$2x = -16$

$x = \dfrac{-16}{2}$

$x = -8$

$\therefore x = -8, \quad y = -4$

Solution -2

(i) $\frac{3}{4}x - \frac{2}{3}y = 1$

$\frac{3}{8}x - \frac{1}{6}y = 1$

$\Rightarrow \frac{3}{8}x = 1 + \frac{1}{6}y$

$x = \left(1 + \frac{1}{6}y\right)\frac{8}{3}$

$\therefore \frac{3}{4}\left(1 + \frac{1}{6}y\right)\frac{8}{3}^{2} - \frac{2}{3}y = 1$

$2 + \frac{2}{6}y - \frac{2}{3}y = 1$

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

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

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

$\therefore y = 3$

$\therefore \frac{3}{4}x - \frac{2}{3}\cdot(3) = 1$

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

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

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

$x = 4$

(ii) $2x - 3y - 3 = 0$

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

$\Rightarrow \quad 2x - 3y - 3 = 0$

$\qquad 2x = 3y + 3$

$\qquad x = \dfrac{3y + 3}{2}$

$\therefore \quad \dfrac{2}{3}\left(\dfrac{3y+3}{2}\right) + 4y + \dfrac{1}{2} = 0$

$\qquad \dfrac{2}{3} \cdot \dfrac{3(y+1)}{2} + 4y + \dfrac{1}{2} = 0$

$\qquad y + 1 + 4y + \dfrac{1}{2} = 0$

$\qquad 5y + \dfrac{3}{2} = 0$

$\qquad 5y = -\dfrac{3}{2}$

$\qquad y = -\dfrac{3}{10}$

$\therefore \quad 2x - 3y - 3 = 0$

$\qquad 2x - 3 \cdot \left(\dfrac{-3}{10}\right) - 3 = 0$

$\qquad 2x + \dfrac{9}{10} - 3 = 0$

$\qquad 2x = 3 - \dfrac{9}{10}$

$\qquad 2x = \dfrac{30 - 9}{10}$

$\qquad x = \dfrac{21}{20} \quad \|$

Solution- 3

i) $15x - 14y = 117$

$14x - 15y = 115$

$\Rightarrow 14x = 115 + 15y$

$x = \dfrac{115 + 15y}{14}$

$\therefore 15\left(\dfrac{115 + 15y}{14}\right) - 14y = 117$

$1725 + 225y - 196y = 117 \times 14$

$1725 + 225y - 196y = 1638$

$29y = +1638 - 1725$

$29y = -87$

$y = \dfrac{-87}{29}$

$y = -3$

$\therefore 15x - 14(-3) = 117$

$15x + 42 = 117$

$15x = 117 - 42$

$15x = 75$

$x = \dfrac{75}{15}$

$x = 5$

(ii) $41x + 53y = 135$

$53x + 41y = 147$

$53x = 147 - 41y$

$x = \dfrac{147 - 41y}{53}$

$41x + 53y = 135$

$41\left(\dfrac{147 - 41y}{53}\right) + 53y = 135$

$6027 - 1681y + 2809y = 135 \times 53$

$6027 - 1681y + 2809y = 7155$

$1128y = 1128$

$y = \dfrac{1128}{1128}$

$y = 1$

$\therefore$ $41x + 53y = 135$

$41x + 53(1) = 135$

$41x = 135 - 53$

$41x = 82$

$x = \dfrac{82}{41}$

$x = 2$

Solution - 4

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

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

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

$\therefore \frac{x}{6} = \frac{3x}{4} - 1 - 6$

$\frac{x}{6} = \frac{3x}{4} - 7$

$\frac{x}{6_3} = \frac{3x - 28}{4_2}$

$\frac{x}{\frac{6}{3}} = \frac{3x - 28}{2}$

$2x = 9x - 84$

$9x - 2x = 84$

$7x = 84$

$x = \frac{84}{7}$

$x = 12$

$\therefore \frac{x}{6} = y - 6$

$\frac{\overset{2}{12}}{6} = y - 6$

$y = 2 + 6$

$y = 8$

(ii) $x - \dfrac{2}{3}y = \dfrac{8}{3}$

$\dfrac{2x}{5} - y = \dfrac{7}{5}$

$y = \dfrac{2x}{5} - \dfrac{7}{5}$

$y = \dfrac{2x - 7}{5}$

$\therefore\quad x - \dfrac{2}{3}\left(\dfrac{2x - 7}{5}\right) = \dfrac{8}{3}$

$x - \dfrac{4x - 14}{15} = \dfrac{8}{3}$

$\dfrac{15x - 4x + 14}{15\;5} = \dfrac{8}{3}$

$15x - 4x + 14 = 8 \times 5$

$11x + 14 = 40$

$11x = 40 - 14$

$11x = 26$

$x = \dfrac{26}{11}.$

$\therefore\quad \dfrac{26}{11} - \dfrac{2}{3}y = \dfrac{8}{3}$

$\dfrac{2}{3}y = \dfrac{26}{11} - \dfrac{8}{3}$

$\dfrac{2}{3}y = \dfrac{78 - 88}{33}$

$y = \dfrac{\overset{5}{\cancel{10}}}{\underset{11}{\cancel{33}}} \times \dfrac{3}{2} = \dfrac{5}{11}$

Solution-5

(i)
$$9 - (x - 4) = y + 7$$
$$2(x + y) = 4 - 3y$$

$$\Rightarrow 9 - x + 4 = y + 7$$

$$\Rightarrow 13 - x = y + 7$$

$$y = 13 - x - 7$$

$$y = 6 - x$$

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

$$2x + 12 - 2x = 4 - 18 + 3x$$

$$12 = -14 + 3x$$

$$3x = 12 + 14$$

$$3x = 26$$

$$x = \frac{26}{3}$$

$$y = 6 - x$$

$$y = 6 - \frac{26}{3}$$

$$y = \frac{18 - 26}{3}$$

$$y = -8/3$$

(ii) $2x + \dfrac{x-y}{6} = 2$

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

$\Rightarrow \quad \dfrac{3x - 2x - y}{3} = 1$

$x - y = 3$.

$x = 3 + y$.

$\therefore \quad 2(3+y) + \dfrac{3+y-y}{6} = 2$

$6 + 2y + \dfrac{\cancel{3}}{\cancel{6}_2} = 2$

$6 + 2y + \dfrac{1}{2} = 2$

$2y = 2 - \dfrac{1}{2} - 6$

$2y = \dfrac{4 - 1 - 12}{2}$

$2y = \dfrac{-9}{2}$

$y = \dfrac{-9}{4}$

$x = 3 + y$

$x = 3 - \dfrac{9}{4}$

$x = \dfrac{12 - 9}{4}$

$x = \dfrac{3}{4}$.

Solution - 6 :

(i)

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

$$\Rightarrow \frac{32x + x - y}{8} = 17$$

$$33x - y = 136 \qquad --- (i)$$

and

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

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

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

$$y + 3x = 6 + 2$$

$$y + 3x = 8$$

$$y = 8 - 3x \qquad --- (ii)$$

Equ (ii) in equ (i)

$$\therefore \quad 33x - 8 + 3x = 136$$

$$36x = 136 + 8$$

$$36x = 144$$

$$x = \frac{144}{36}$$

$$x = 4.$$

$$y = 8 - 3.(4)$$

$$= 8 - 12$$

$$= -4.$$

(ii)   Given $x - 3y = 3x - 1 = 2x - y$

$\therefore$ $x - 3y = 3x - 1$

$3x - x = 1 - 3y$

$2x = 1 - 3y$

$2x + 3y = 1$ ——— (i)

$\therefore$ $3x - 1 = 2x - y$

$3x - 2x = 1 + y$

$x = 1 + y$ ——→ (ii)

Equ (ii) in equ (i)

$\therefore$ $2(1 + y) + 3y = 1$

$2 + 2y + 3y = 1$

$5y = 1 - 2$

$5y = -1$

$y = -\frac{1}{5}$

$\therefore$ $x = y + 1$

$x = -\frac{1}{5} + 1$

$x = \frac{-1 + 5}{5}$

$x = \frac{4}{5}$

Solution - 7

Given
$$\frac{3}{x} + 4y = 7$$

$$\frac{5}{x} + 6y = 13$$

$$\Rightarrow \quad \frac{5}{x} = 13 - 6y$$

(or)
$$6y = 13 - \frac{5}{x}$$

$$6y = \frac{13x - 5}{x}$$

$$y = \frac{13x - 5}{6x}$$

$$\therefore \quad \frac{3}{x} + 4y = 7$$

$$\frac{3}{x} + 4\left(\frac{13x - 5}{6x}\right) = 7$$

$$\frac{3}{x} + \frac{52x - 20}{6x} = 7$$

$$\frac{18 + 52x - 20}{6x} = 7$$

$$52x - 2 = 42x$$

$$52x - 42x = 2$$

$$10x = 2$$

$$x = 2/10$$

$$x = 1/5$$

$$\Rightarrow \quad y = \frac{13\left(\frac{1}{5}\right) - 5}{6\left(\frac{1}{5}\right)}$$

$$y = \frac{\frac{13}{5} - 5}{\frac{6}{5}}$$

$$y = \frac{\frac{13-25}{5}}{\frac{6}{5}}$$

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

$$y = -2$$

(ii) $\quad 5x - 9 = \frac{1}{4}$

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

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

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

② $\quad 5\left(\frac{3y-1}{y}\right) - 9 = \frac{1}{4}$

$$\frac{15y-5}{y} - 9 = \frac{1}{4}$$

$$\frac{15y-5-9y}{y} = \frac{1}{4}$$

$$6y - 5 = 1$$

$$6y = 1+5$$

$$6y = 6$$

$$y = \frac{6}{6}$$

$$y = 1.$$

$$\therefore \quad x = \frac{3y-1}{y}$$

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

$$x = 2$$

Solution - 8

(i)
$$px + qy = p - q$$

$$qx - py = p + q$$

$$qx = p + q + py$$

$$x = \frac{q + p(1+y)}{q}$$

$$\therefore \quad p\left(\frac{q + p(1+y)}{q}\right) + qy = p - q$$

$$\frac{pq + p^2(1+y)}{q} + qy = p - q$$

$$\frac{pq + p^2(1+y) + q^2 y}{q} = p - q$$

$$pq + p^2(1+y) + q^2 y = pq - q^2$$

$$p^2(1+y) = -q^2 - q^2 y$$

$$p^2(1+y) = -q^2(1+y)$$

$$p^2 + p^2 y = -q^2 - q^2 y$$

$$p^2 y + q^2 y = -q^2 - p^2$$

$$y(p^2 + q^2) = -(p^2 + q^2)$$

$$y = -1.$$

$$\therefore \quad x = \frac{q + P(1+y)}{q}$$

$$x = \frac{q + P(1-1)}{q}$$

$$x = \frac{q + P(0)}{q}$$

$$x = \frac{q + 0}{q}$$

$$x = \frac{q}{q}$$

$$x = 1$$

$$\therefore \quad x = 1$$
$$y = -1$$

(ii) $\quad \dfrac{x}{a} - \dfrac{y}{b} = 0$

$\quad\quad ax + by = a^2 + b^2$

$\quad\quad\quad \dfrac{x}{a} = \dfrac{y}{b}$

$\quad\quad\quad x = \dfrac{a}{b} \cdot y$

$\Rightarrow \quad a \cdot \dfrac{a}{b} \cdot y + by = a^2 + b^2$

$\quad\quad\quad \dfrac{a^2}{b} y + by = a^2 + b^2$

$\quad\quad\quad \dfrac{a^2 y + b^2 y}{b} = a^2 + b^2$

$\quad\quad\quad (a^2 + b^2) y = (a^2 + b^2)\, b$

$\quad\quad\quad y = b$

$\therefore \quad\quad x = \dfrac{a}{b} \cdot b$

$\therefore \quad x = a$

Solution – 9 :-

Given $2x + y = 23$

$4x - y = 19$

$\Rightarrow \quad y = 23 - 2x$

$\therefore \quad 4x - 23 + 2x = 19$

$6x = 19 + 23$

$6x = 42$

$x = \dfrac{42}{6}$

$x = 7$

$\therefore \quad y = 23 - 2x$

$y = 23 - 2(7)$

$y = 23 - 14$

$y = 9.$

$\therefore \quad x - 3y \Rightarrow 7 - 3(9) = 7 - 27$

$= -20$

$\therefore x - 3y = -20$

$\therefore \quad 5y - 2x \Rightarrow 5(9) - 2(7)$

$\Rightarrow 45 - 14$

$\Rightarrow 31$

$\therefore \quad 5y - 2x = 31.$

Solution – 10 :

Given expression $ax + by$

(i) $ax + by = 7$

When $x = 2; y = 1$

$\therefore 2a + b = 7$ ————— ①

(ii) $ax + by = 1$

when $x = -1, y = 1$

$-a + b = 1$ ————— ②

$b = 1 + a$

$\therefore 2a + 1 + a = 7$

$3a + 1 = 7$

$3a = 7 - 1$

$3a = 6$

$a = \dfrac{6}{3}$

$a = 2$

$b = 1 + a$

$b = 1 + 2$

$= 3.$

16)

Let the number be xy $(10x+y)$

Reverse of that number yx $(10y+x)$

And Given that $\dfrac{xy [10x+y]}{yx [10y+x]} = 1\frac{3}{4}$

$\Rightarrow \dfrac{10x+y}{10y+x} = \frac{7}{4}$

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

$\Rightarrow 33x-66y=0$

$\Rightarrow x-2y=0$ — ①

And also given that $x+y=12$ — ②

on Solving eq① and eq②

② - ① $\Rightarrow x+y-x+2y=12$

$\qquad 3y=12$

$\qquad \boxed{y=4}$

Put $y=4$ in ①

$\Rightarrow x-8=0$

$\Rightarrow \boxed{x=8}$

The required number is 84

17)

Let the number be xy $(10x+y)$ and reverse of number is yx $(10y+x)$

Given $\dfrac{10x+y}{10y+x} = \frac{5}{6}$

$\Rightarrow 60x+6y = 50y+5x$

$\Rightarrow 55x-44y=0$

$\Rightarrow 5x-4y=0$ — ①

And also given that $x-y=1$ — ②

Put $x=y+1$ in eq·①

$\qquad 5y+5-4y=0$

$\qquad y=-5$

Put $y=-5$ in eq·②

$\Rightarrow x=-4$

$\therefore$ The required number is 45

(8)

Let the number be xyz $[100x + 10y + z]$

Given that $x = 4z$ — ①

$x + y + z = 14$ — ②

And reverse of the number is zyx $[100z + 10y + x]$

And given that $(100x + 10y + z) - (100z + 10y + x) = 594$

$\Rightarrow 99x - 99z = 594$

$\Rightarrow \cancel{99}[x - z] = \underset{6}{\cancel{594}}$

$\Rightarrow x - z = 6$ — ③

on solving eq. ① & ③

$4z - z = 6$

$3z = 6$

$\Rightarrow z = 2$

Put $z = 2$ in eq. ③ $\Rightarrow x - 2 = 6$

$\Rightarrow x = 8$

Put $x = 8$ and $z = 2$ in eq. ② $\Rightarrow 8 + y + 2 = 14$

$\Rightarrow y = 4$

∴ The required number is 842

(9)

Let the age of marina and her daughter be 'm' and 'D'

Given that

$m - 4 = 3(D - 4)$ ①

$m + 6 = 2(D + 6)$ ②

eq. ① $\Rightarrow m - 4 = 3D - 12$

$\Rightarrow m = 3D - 8$ — ③

eq. ② $\Rightarrow m + 6 = 2D + 12$

$\Rightarrow m = 2D + 6$ — ④

from ③ & ④ $\quad 3D - 8 = 2D + 6$

$D = 14$

Put $D = 14$ in eq. ④

$m = 28 + 6 = 34$

$m = 34$

∴ The present age of marina and her daughter is 34 and 14.

$$eq.① \times 12 \Rightarrow 144x + 120y = 1560000$$
$$eq.② \times 10 \Rightarrow 100x + 120y = 1340000$$
$$\underline{\hphantom{eq.② \times 10 \Rightarrow 100x + 120y = 1340000}}$$
$$44x = 220000$$
$$x = 5000$$

Put $x = 5000$ in eq.②①
$$60000 + 10y = 130000$$
$$10y = 70000$$
$$y = 7000$$

Thus the money invested at 12% is **5000/-**

10% is **7000/-**

22)

Let the cost price of table be 'x' and list price of chair be 'y'

Case-(i)

Table is sold at a profit of 8%

$$\therefore S.P \text{ of table} = x + \frac{8x}{100} = \frac{108x}{100}$$

Chair is sold at a discount of 10%

$$\therefore S.P \text{ of chair} = y - \frac{10y}{100} = \frac{90y}{100}$$

and given that

$$\frac{6}{100}\frac{108x}{100} + \frac{5}{100}\frac{90y}{100} = \frac{56}{100}1008$$

$$\Rightarrow 6x + 5y = 5600 - ①$$

Case-(ii)

Table is sold at a profit of 10%

$$\therefore SP \text{ of table} = x + \frac{10x}{100} = \frac{110x}{100}$$

Chair is sold at a discount of 8%

$$\therefore SP \text{ of chair} = y - \frac{8y}{100} = \frac{92y}{100}$$

Given that

$$\frac{110x}{100} + \frac{92y}{100} = 1028$$

$$\Rightarrow 110x + 92y = 102800 - ②$$

on solving eq① & eq.② $\quad x = 600, \ y = 400$

$\therefore$ Cost price of table is 600/- and list price of chair is 400/-

eq.① − eq.② $y = 5$

Put $y = 5$ in ①

$\Rightarrow x - 10 = 2$

$\Rightarrow x = 12$

∴ No. of students in the class is $12 \times 5 = 60$.

25)

Let 'x' grams of 18 carat gold is added, thus the amount of 12 carat gold added is $(120 - x)$ grams

Given purity of gold is 24 carat

∴ $x \cdot \dfrac{18}{24} + (120 - x) \cdot \dfrac{12}{24} = 120 \times \dfrac{16}{24}$

$\Rightarrow 18x + 12(120 - x) = 120 \times 16$

$\Rightarrow 18x + 12 \times 120 - 12 \times x = 120 \times 16$

$\Rightarrow 6x = 120(16 - 12)$

$\Rightarrow x = \dfrac{120 \times 4}{6} = 80$

∴ 80 grams of 18 carat gold added with $120 - 80 = 40\,gms$ of 12 carat gold.

26)

Given A and B both can do work in 15 days.

(A+B) one day's work $= 1/15$

$\dfrac{\text{A's 1 day's work}}{\text{B's 1 day's work}} = \dfrac{\frac{3}{2}}{1} = \dfrac{3}{2}$

let A's 1 day's work be $3x$ and B's 1 day work is $2x$

Then $3x + 2x = \dfrac{1}{15}$

$5x = 1/15$

$\Rightarrow x = 1/75$

A's 1 day work $= 3 \times \dfrac{1}{75} = \dfrac{1}{25}$

B's 1 day work $= 2 \times \dfrac{1}{75} = \dfrac{1}{37.5}$

∴ A and B can do that work in 25 and 37.5 days respectively

27) Let a man's rate be 'm';
women's rate be 'w'

Given
$$2m + 5w = 1/4$$
$$m + w = 1/12$$

$$\Rightarrow \quad 8m + 20w = 1 \quad — ①$$
$$\Rightarrow \quad 12m + 12w = 1 \quad — ②$$

eq. ① × 3 ⇒ $24m + 60w = 3$
eq. ② × 2 ⇒ $24m + 24w = 2$

$$\overline{\qquad\qquad 36w = 1}$$
$$w = 1/36$$

$w = 1/36$ in ②

$$m = 1/18$$

1 man would take 18 days to complete the work.

28) Let the avg. speed of train be 'x' kmph and scheduled time by 'y' hrs
Therefore length. of the journey = xy km.

Given

(i) $(x+30)(y-2) = xy$

$\Rightarrow xy - 2x + 30y - 60 = xy$

$\Rightarrow 2x - 30y + 60 = 0 — ①$

(ii) $(x-15)(y+2) = xy$

$xy + 2x - 15y - 30 = xy$

$2x - 15y - 30 = 0 \quad ②$

eq. ② − eq ① ⇒ $15y - 90 = 0$
$\Rightarrow 15y = 90$
$\Rightarrow y = 6$ hrs

Put $y = 6$ in ① ⇒ $2x - 180 + 60 = 0$
$$2x = 120$$
$$x = 60 \text{ kmph}$$

∴ The length of the journey is $60 \times 6 = 360$ kms.

29)

Let speed of boat in still water be 'x' bmph

" current be 'y' bmph

Time to go with the current is 2 hrs

$$\Rightarrow \frac{40}{x+y} = 2 \qquad \boxed{Time = \frac{Distance}{speed}}$$

$$\Rightarrow x+y = 20 \quad —①$$

Time to go against the current is 4 hrs

$$\Rightarrow \frac{40}{x-y} = 4$$

$$\Rightarrow x-y = 10 \quad —②$$

$$eq ① + ② \Rightarrow 2x = 30$$
$$x = 15$$

Put $x = 15$ in ① $\Rightarrow 15 + y = 20$

$$\Rightarrow y = 5$$

speed of boat in still water and speed of current
is 15 bmph & 5 bmph

30)

Let the speed of boat in still water be 'x' bmph

" current be 'y' bmph

Time to go with the current is 4 hrs

$$\Rightarrow \frac{44}{x+y} = 4$$

$$\Rightarrow x+y = 11 \quad —①$$

Time to go against the current is 4 hrs. 48 mins

$$= 288 \text{ mins}$$
$$= \frac{24}{5} \text{ hrs} \qquad \left[\frac{288}{60} \text{ hrs}\right]$$

$$\Rightarrow \frac{44}{x-y} = \frac{24}{5}$$

$$\Rightarrow 6x - 6y = 55 \quad —②$$

$$eq ② + eq ① × 6 \Rightarrow 12x = 121$$

$$\Rightarrow x = \frac{121}{12} \text{ bmph.} \quad — \text{speed of boat in still water}$$

Put $x = \frac{121}{12}$ in ① $\Rightarrow y = 11 - \frac{121}{12}$

$$y = \frac{11}{12} \text{ bmph.} \quad — \text{speed of current}$$

31) Let the plane air speed be 'x' bmph and wind speed be 'y' bmph

And given that with a head wind ft took 3.5 hrs

$$\Rightarrow \frac{\overset{240}{\cancel{1680}}}{x-y} = 3.5 = \frac{7}{2}$$

$$\Rightarrow x-y = 480 \quad - ①$$

on return ft took 3hrs

$$\Rightarrow \frac{\overset{560}{\cancel{1680}}}{x+y} = 3$$

$$\Rightarrow x+y = 560 \quad - ②$$

① + ② $\Rightarrow$

$$2x = 1040$$
$$x = 520$$

PUt x = 520 in ② $\rightarrow 520+y = 560$

$$\Rightarrow y = 40$$

∴ plane air speed is 520 bmph and wind speed 40bmph.

32)

Let the fixed charges be 'x' and cost of food per day be 'y'

Given that Bhowana paid 2600 for 20days

$$\Rightarrow x + 20y = 2600 \quad - ①$$

and Divya paid 3020 for 26 days

$$\Rightarrow x + 26y = 3020 \quad - ②$$

eq. ② - eq. ① $\Rightarrow 6y = 420$
$$y = 70$$

Put y = 70 in ①

$$\Rightarrow x + 1400 = 2600$$
$$\Rightarrow x = 1200$$

∴ fixed charger − 1200/-

cost of food per day − 70/−.