Chapter 5

Simultaneous Linear Equations

Exercise 5.1

1.

Solution

(i) x + y = 14

x – y = 4

∴ x + y = 14

x – y = 4

x = y + 4

x + y = 14

[y + 4] + y = 14

2y + 4 = 14

2y = 14 – 4

2y = 10

$Y = \frac{10}{2}$

x + y =14

x + 5 = 14

x = 14 -5

x = 9

x = 9 ; y = 5

(ii) s – t = 3 ....(1)

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

2s + 3t = 6

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

(1) s- t = 3

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

S – 6 = 3

S = 6 + 3

= 9

S – t = 3

9- t = 3

-t = 3 – 9

- t = - 6

t = 6

∴ s = 9 , t = 6

(iii) 2x + 3y = 9 ....(1)

3x + 4y = 5 ....(2)

4y = 5 – 3x

$Y = \frac{5-3x}{4}$

(1) 2x + 3y = 9

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

$8x + 15 - 9x = 36$

$-x = 36 - 15$

$-x = 21$

$X = -21$

$\therefore 2x + 3y = 9$

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

$-42 + 3y = 9$

$3y = 9 + 42$

$3y = 51$

$Y = \frac{51}{3} = 17$

$\therefore x = -21 , y = 17$

(iv) $3x - 5y = 4$....(1)

$9x - 2y = 7$ ....(2)

$9x - 2y = 7$

$9x = 7 + 2y$

$X = \frac{7+2y}{9}$

$3x - 5y = 4$

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

$21 + 6y - 45y = 36$

$-39y = 36 - 21$

$-39y = 15$

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

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

$Y = -\frac{5}{13}$

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

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

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

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

$X = \frac{27}{13}$

$X = \frac{9}{13}$

2.

Solution

(i) $a + 3b = 5$ ....(1)

$7a - 8b = 6$ .....(2)

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

$a + 3b = 5$

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

$6 + 8b + 21b = 35$

$6 + 29b = 35$

$29b = 35 - 6$

$b = \frac{29}{29}$

$b = 1$

$a + 3b = 5$

$a + 3(1) = 5$

$a = 5-3$

$a = 2$

$\therefore a = 2 , b = 1$

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

$X - 20 = 12y$

$\therefore x - 20 = 12y$

$Y = \frac{x-20}{12}$

$5x + 4y - 4 = 0$

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

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

$64x - 128 = 0$

$64x = 128$

$X = \frac{128}{64}$

$X = 2$

$5x + 4y - 4 = 0$

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

$10 + 4y - 4 = 0$

$6 + 4y = 0$

$4y = 6$

$Y = \frac{6}{4} = \frac{3}{2}$

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

3.

Solution

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

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

$8x = 12 + 3y$

$X = \frac{12+3y}{8}$

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

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

$-y = 56 - 60$

$Y = 4$

$Y = 4$

$6x - 2y - 7 = 0$

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

$5x - 8 - 7 = 0$

$5x - 15 = 0$

$5x = 15$

$X = \frac{15}{5}$

$X = 3$

$\therefore x = 3 , y = 4$

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

$5x - 20 = 8y$

$Y = \frac{5x-20}{8}$

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

$16x + 15x - 60 = 184$

$31x = 184 + 60$

$31x = 244$

$X = \frac{244}{31} = 7\frac{27}{31}$

$2x + 3y = 23$

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

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

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

$Y = \frac{225}{31} \div 3$

$Y = \frac{75}{31}$

$Y = 2\frac{13}{31}$

$\therefore x = 7\frac{27}{31} \quad y = \frac{2.13}{31}$

4.

Solution

(i) $mx - ny = m^2 + n^2$ .....(i)

$X + y = 2m$ .....(ii)

Substitute (ii) in (i)

$\therefore \ x = 2m - y$

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

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

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

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

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

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

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

$\therefore y = m - n$

$x = 3m - y$

$= 2m - m + n$

$x = m + n$

$\therefore x = m + n$

$Y = m - n$

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

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

$x + y = 2ab$

$x = 2ab - y$

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

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

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

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

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

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

$Y = ab$

$x = 2ab - y$

$x = 2ab - ab$

$= ab$

5.

Solution

$2x + y = 35$

$3x + 4y = 65$

$3x + 4y = 65$

$4y = 65 - 3x$

$Y = \frac{65-3x}{4}$

$2x + y = 35$

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

$8x + 65 - 3x = 140$

$8x - 3x = 140 - 65$

$5x = 75$

x = 15

2x + y = 35

2x + y = 35

2(15) + y = 35

30 + y = 35

Y = 35 – 30

= 5

∴ x = 15 , y = 5

∴ $\frac{x}{y} = \frac{15}{5} = 3$

6.

Solution

3x – y = 5

4x – 3y = -1

3x = 5y + y

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

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

20 + 4y - 9y = -3

-5y = - 3 – 20

- 5y = -23

$$Y = \frac{23}{5}$$

$$3x - y = 5$$

$$15x - \frac{23}{5} = 5$$

$$15x - 23 = 25$$

$$15x = 25 + 23$$

$$15x = 48$$

$$X = \frac{48}{15} = \frac{16}{15}$$

$$Y = px - 3$$

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

$$\frac{23}{5} = \left(\frac{16p}{5}\right) - 15$$

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

$$P = \frac{19}{8}$$

Exercise 5.2

1.

Solution

(i) $3x + 4y = 10$ .....(1)

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

$$X = \frac{2+2y}{2}$$

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

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

$$6 + 6y + 8y = 20$$

$$6 + 14y = 20$$

$$14y = 20 - 6$$

$$14y = 14$$

$$Y = 1$$

$$3x + 4y = 10$$

$$3x = 10 - 4$$

$$3x = 6$$

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

$$x = 2$$

$\therefore x = 2 , y = 1$

(ii) $2x = 5y + 4$

$3x – 2y + 16 = 0$

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

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

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

$15y + 12 – 4y + 32 = 0$

$11y + 44 = 0$

$11y = - 44$

$Y = -\frac{44}{11} = -4$

$Y = - 4$

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

$2x = -20 + 4$

$2x = -16$

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

$x = -8$

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

2.

Solution

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

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

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

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

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

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

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

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

$\therefore y = 3$

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

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

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

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

$X = 4$

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

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

$2x - 3y - 3 = 0$

$2x = 3y + 3$

$X = \frac{3y+3}{2}$

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

$\frac{2}{3} . \frac{3}{2}(y + 1) + 4y + \frac{1}{2} = 0$

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

$5y + \frac{3}{2} = 0$

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

$Y = -\frac{3}{10}$

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

$2x - 3\left(-\frac{3}{10}\right) - 3 = 0$

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

$2x = 3 - \frac{9}{10}$

$x = \frac{30-9}{10}$

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

3.

Solution

(i) $15x - 14y = 117$

$14x - 15y = 115$

$14x = 115 + 15y$

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

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

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

$1725 + 225y - 196y = 1638$

$29y = +1638 - 1725$

$29y = -87$

$Y = -\frac{87}{29}$

$Y = -3$

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

$15x + 42 = 117$

$15x = 117 - 42$

$15x = 75$

$X = \frac{75}{15}$

$X = 5$

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

$53x + 41y = 147$

$53x = 147 - 41y$

$X = \frac{147-41y}{53}$

$41x + 53y = 135$

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

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

$6027 - 1681y + 2809y = 7155$

$1128y = 1128$

$Y = \frac{1128}{1128}$

$Y = 1$

$\therefore 41x + 53y = 135$

$41x + 53(1) = 135$

$41x = 135 - 53$

$41x = 82$

$X = \frac{82}{41}$

$X = 2$

4.

Solution

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

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

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

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

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

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

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

$2x = 9x - 84$

$9x - 2x = 84$

$7x = 84$

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

$x = 12$

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

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

$Y = 2 + 6$

$Y = 8$

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

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

$Y = \frac{2x}{5} - \frac{7}{5}$

$Y = \frac{2x-7}{5}$

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

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

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

$11x + 14 = 40$

$11x = 40 - 14$

$11x = 26$

$X = \frac{26}{11}$

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

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

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

$Y = \frac{10}{33} \times \frac{3}{2} = \frac{5}{11}$

5.

Solution

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

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

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

$13 - x = y + 7$

$Y = 13 - x - 7$

$Y = 6 - x$

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

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

$12 = -14 + 3x$

$3x = 12 + 14$

$3x = 26$

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

$Y = 6 - x$

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

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

$Y = -\frac{8}{3}$

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

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

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

$X - y = 3$

$X = 3 + y$

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

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

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

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

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

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

$Y = -\frac{9}{4}$

$X = 3 + y$

$X = 3 - \frac{9}{4}$

$X = \frac{12-9}{4}$

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

6.

Solution

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

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

$3x - y = 136$ .....(i)

And

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

$Y + 3x - 2 = 6$

$Y + 3x = 6 + 2$

$Y + 3x = 8$

$Y = 8 - 3x$ .....(ii)

Equation (ii) in equation (i)

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

$36x = 136 + 8$

$36x = 144$

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

$X = 4$

$\therefore y = 8 - 3(4)$

$= 8 - 12$

= - 4

(ii) given x – 3y = 3x -1 = 2x – y

∴ x – 3y = 3x – 1

3x – x = 1 – 3y

2x = 1 -3y

2x = 1 – 3y

2x + 3y = 1 .....(i)

∴ 3x – 1 = 2x – y

3x – 2x = 1 + y

X = 1 + y .....(ii)

Equation (ii) in equation (i)

2(1 + y) = 3y = 1

2 + 2y + 3y = 1

5y = 1 – 2

5y = -1

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

X = y + 1

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

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

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

7.

Solution

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

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

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

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

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

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

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

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

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

$52x - 2 = 42x$

$52x - 42x = 2$

$10x = 2$

$X = \frac{2}{10}$

$X = \frac{1}{5}$

$Y = \frac{13\left(\frac{1}{5}\right) - 5}{6\left(\frac{1}{5}\right)}$

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

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

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

$Y = -2$

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

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

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

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

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

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

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

$6y - 5 = 1$

$6y = 1 + 5$

$6y = 6$

$Y = \frac{6}{6}$

$Y = 1$

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

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

$x = 2$

8 .

Solution

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

$qx - py = p + q$

$qx = p + q + py$

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

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

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

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

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

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

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

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

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

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

$Y = -1$

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

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

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

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

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

$x = 1$

$\therefore x = 1$

$Y = -1$

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

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

$\frac{x}{a} = \frac{y}{b}$

$x = \frac{a}{b} . y.$

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

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

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

$(a^2 + b^2)y = (a^2 + b^2) - b$

$Y = b$

$\therefore x = \frac{a}{b} \cdot b$

$x = a$

9.

Solution

Given $2x + y = 23$

$4x - y = 19$

$Y = 23 - 2x$

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

$6x = 19 + 23$

$6x = 42$

$X = \frac{42}{6}$

$X = 7$

$Y = 23 - 2x$

$Y = 23 - 2(7)$

Y = 23 – 14

Y = 9

∴ x – 3y = 7 -3(9) = 7 – 27

= - 20

∴ x- 3y = -20

5y – 2x = 5(9) – 2(7)

= 45 – 14

= 31

5y – 2x = 31

10.

Solution

Given expression ax + by

(i) ax + by = 7

When x = 2; y = 1

∴ 2a + b = 7.....(i)

(ii) ax + by = 1

When x = - 1, y = 1

-a + b = 1.....(ii)

$\therefore b = 1 + a$

$2a + 1 + a = 7$

$3a + 1 = 7$

$3a = 7 - 1$

$3a = 6$

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

$a = 2$

$\therefore b = 1 + a$

$b = 1 + 2$

$= 3$

11.

Solution

Let the number be xy[10x + y]

Reverse of that number yx [10y + x]

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

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

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

$= 33x - 66y\ 0$

$= x - 2y = 0$ .....(i)

And also given that $x + y = 12$....(ii)

On solving equation(1) and equation(2)

(2)- (1) = x + y – x + 2y = 12

3y = 12

Y = 4

Put y = 4 in equation (1)

= x – 8 = 0

= x = 8

The required number is 84

12.

Solution

Let the number be xy [10x + y] and reverse of number is yx[10y + x]

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

= 60x + 6y = 50 y + 5x

= 55x – 44y = 0

= 5x – 4y = 0 .....(i)

And also given that x – y = 1 ....(ii)

Put x = y in equation (i)

5y + 5 - 4y = 0

Y = - 5

Put y = -5 in equation 2

= x = -4

∴ the requires number is 45

13

Solution

Let the number be xyz [100x + 10y + 7]

Given that x = 42.....(i)

x + y + z = 14.....(ii)

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

and given that (100x + 10y + z) –(100z + 10y +x) = 594

= 99x – 99z = 594

= 99(x – z) = 594

= x – 7 = 6.....(3)

On solving equation (1) and (3)

4z – z = 6

3z = 6

Z = 2

Put z = 2 in equation (3) = x – 2 = 6

= x = 8

Put x = 8 and z =2 in equation(2) = 8 + y + 2 = 14

= y = 4

The required number is 842

14.

Solution

Let the age of marina and her daughter be ‘m’ and ‘o’

Given that

$m - 4 = 3(D-4)$ ....(1)

$m + 6 = 2(d +6)$ .....(2)

equation (1) = $m - 4 = 3d - 12$

$= m = 3d - 8$ .....(3)

Equation (2) = $m + 6 = 2d + 12$

$= m = 2d + 6$ .....(4)

From (3) and (4) $3d - 8 = 2d + 6$

$D = 14$

Put d = 14 in equation (4)

$m = 28 + 6 = 34$

$m = 34$

∴ the present age of marina and her daughter is 34 and 14

Equation (1) × 12 = $144x + 120y = 1560000$

Equation (2) ×10 = $100x + 120y = 1340000$

(-) (-) (-)

$44x = 22000$

$X = 5000$

Put x = 5000 in equation (1)

60000 + 10y = 130000

10y = 70000

Y= 7000

Thus the money invested at 12% is 5000/-

10% is 1000/-

15.

Solution

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. of table = $x + \frac{8x}{100} = \frac{108}{100}$

Chair is sold at a discount of 10%

$\therefore$ s.p. of chair = $y - \frac{10y}{100} = \frac{90y}{100}$

And given that $\frac{108}{100} + \frac{90}{100} = 1008$

$= 6x + 5y = 5600...(1)$

Case (ii)

Table is solid at a profit of 10%

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

Chair is sold at a discount of 8%

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

Given that

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

$= 110x + 92y = 102500$....(2)

On solving equation (1) and (2) x = 600 y= 400

∴ cost price of table is 600/- and list price of chair is 400/-

16.

Solution

Let the money had by A and B is x and y respectively

Case(i)

Given that

x + 100 = 75 % (y – 100)

= x + 100 = $\frac{375}{100}(y - 100)$

= 4x + 400 = 3y - 300

= 4x – 3y = - 700...(i)

Case 2

X – 100 = 40 % (y + 100)

= x – 100 = $\frac{40}{100}$(4 + 100)

= 5x – 500 = 2y + 200

= 5x – 2y = 700 ....(2)

Equation (i) × 2 = 8x – 6y = - 1400

Equation (ii) ×3 = 15x - 6y = 2100

$$7x = 3500$$

$$X = 500$$

Put x = 500 in equation (2) = 2500 – 2y = 700

$$2y = 1500$$

$$Y = 900$$

∴ A and B have 500/- and 900/- respectively

17.

Solution

Let the number of rows be x

Number of students in one row be y

∴ total no. of student = xy

Given (i) if one student is extra in a row , there will be 2 rows less

= (y + 1) (x- 2) = xy

= xy - 2y + x – 2 = xy

= x – 2y = 2 .....(i)

(ii) if one student is less in arrow there will be 3 rows more.

= (y -1) (x + 3) = xy

= 2y + 3y - x - 3 = xy

= x – 34 = -3.....(2)

Equation (i) and equation (2)

Y = 5

Put y = 5 in (i)

= x – 10 = 2

= x = 12

∴ no. of student in the class is 12 × 5 = 60

18.

Solution

Let x grams of 18 carat gold is added there the amonts

Of 12 carat gold added is (120 – 1) grams

Given purity of gold is 24 carat

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

= $18x + 12(120 - x) . \frac{12}{24} = 120 \times 16$

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

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

= $x = \frac{120 \times 4}{6} = 80$

∴ so grams is 18 carat gold added with 120 – 80 = 40 grams]

Of 12 carat gold .

19.

Solution

Given A and B both can do work in 5 days

(A + 8) one days more = $\frac{1}{15}$

$\frac{a's\ 1\ day's work}{b's\ 1 days\ work} = \frac{\frac{3}{2}}{1} = \frac{3}{2}$

Let A's 1 days work be 3x and b's 1day work is 2x

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

5x = $\frac{1}{15}$

X = $\frac{1}{75}$

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

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

∴ A and B can do that work in 25 and 37. 5 days

20.

Solution

Let a men's rate be 'm'

Women's rate be 'w'

Given 2m + 5w = $\frac{1}{4}$

m + w = $\frac{1}{12}$

= 8m + 20w = 1 .....(1)

= 12m + 12w = 1.....(2)

Equation (1) × 3 = 24m + 60w = 3

Equation (2) ×2 = 24m + 24w = 2

36w = 1

$W = \frac{1}{36}$

$W = \frac{1}{36}$ in (2)

$m = \frac{1}{18}$

1 man would take 18 days to complete the work .

21.

Solution

Let the speed of train be 'x' kmph and scheduled time by 'y'

Therefore length of the journey = xy m

Given (i) (x + 30)(y – 2) = xy (ii) (x – 16)(y +2) = xy

= xy – 2x + 30y - 60 = xy xy + 2x + 15y – 30 = xy

= 2x – 30y + 60 = 0 .....(i) 2x – 15y – 30 = 0 .....(2)

Equation (2) and equation(1)

15y – 90 = 0

= 15 y = 90

= y = 6

Put y = 6 in (1) = 2x – 180 + 60 = 0

= 2x = 120

x = 60

∴ the length of the journey is 60 × 6 = 360

22.

Solution

Let speed of boat in still water be x km/h

Speed current be ‘y’ km/h

Time to go with the current is 2hrs

$= \frac{40}{x+y} = 2$ time = $\frac{distance}{speed}$

= x + y = 20 ...(i)

Time to go against the current is 4 hrs

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

= x – y = 10 ...(2)

Equation (1) and (2) = 2x = 30

X = 15

Put x = 15 in (1) = 15 + y = 20

= y = 5

Speed of boat in still water and speed of current is 15km/h and 5 km/h .

23.

Solution

Let the speed of boat in still water be ‘x’ km/h

Speed of boat current ‘y’ km/h

Time to go with the current is 4 hr. 48mins

$= 28$ min

$= \frac{24}{5}\ hrs$

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

$= 6x - 6y = 55$ .....(2)

Eq(2) + eq(1) × 6 = $12x = 121$

$= x = \frac{121}{12}$ km/h - speed of boat in still water

Put $x = \frac{121}{12}$ in (i) $= y = 11 - \frac{121}{12}$

$Y = \frac{11}{12}$ km/h – speed of current

24.

Solution

Let the plane air speed be ‘x’ km/h and wind speed be ‘y’ km/h

And given that with a heed wind it to 3.5 hrs

$= \frac{1650}{x-y} = 450$.....(1)

On return it took 3hrs

$= \frac{1680}{x+y} = 3$

$= x + y = 560$ .....(2)

(1) + (2) = $22 = 1040$

$X = 520$

Put $x = 520$ in (2) = $520 + y = 560$

$= y = 40$

Plane air speed is 520 km/h and wind speed 40 km/h

25.

Solution

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

Given that bhawana paid 2600 for 20 days

$= x + 20y = 2600$...(1)

And divya paid 3020 for 26 days

$= x + 26y = 3020$ ...(2)

Equation (2) and equation(1) $= 6y = 420$

$Y = 70$

Put $y = 70$ in (1)

$= x + 1400 = 2600$

$= x = 1200$

Fixed charges = 1200/-

Cost of food per day – 70/-

Chapter test

Solve the following simultaneous linear equation (1 to 4):

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

$5x - 2y = 7$

Solution :

$2x - \left(\frac{3}{4}\right)y = 3$

$\frac{8x-3y}{4} = 3$

$8x - 3y = 12$ ...(i)

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

Multiply (i) by 5 and (ii) by 8 , we get

$40x - 15y = 60$ (iii)

$40x - 16y = 56$(iv)

Subtract (iv) from (iii) we get

$Y = 4$

Substitute y in (i)

$8x - 3 \times 4 = 12$

$8x = 12 + 12$

$8x = 24$

$X = \frac{24}{8}$

X = 3

Hence x = 3 and y = 4

(ii) 2(x -4) = 9y + 2

X – 6y = 2

Solution

2(x -4) = 9y + 2

2x – 8 = 9y + 2

2x- 9y = 2+ 8

2x – 9y = 10...(i)

X – 6y = 2....(ii)

Multiply (ii) by 2 , we get

2x – 12y = 4 ...(iii)

Subtract (iii) from (i) we get

2x – 9y = 10

-2x + 12y = -4

---

0 + 3y = 6

3y = 6

$Y = \frac{6}{3}$

$Y = 2$

Substitute the value of y in (i)

$2x - 9 \times 2 = 10$

$2x - 18 = 10$

$2x = 10 + 18$

$2x = 28$

$X = \frac{28}{2}$

$x = 14$

hence x = 14 and y = 2

2 . (i) 97x + 53y = 177

53x + 97y = 573

Solution :

Given equation are as follow

$97x + 53y = 177$ ...(i)

$53x + 97y = 573$ ...(ii)

Multiply (i) by 53 and (ii) by 97

$53(97x + 53y) = 53 \times 177$

$5141x + 2809y = 9381$ ....(iii)

$97(53x + 97y) = 97 \times 573$

$5141x + 9409y = 55581$...(iv)

Subtract (iv) from (iii)

$5141x + 2809y = 9381$....(iii)

$5141x + 9409y = 55581$....(iv)

$0x - 6600y = -46200$

$-6600y = -46200$

$Y = \frac{-46200}{-6600}$

$Y = 7$

Substitute the value of y in (i)

$97x + 53 \times 7 = 177$

$97x + 371 = 177$

$97x = 177 - 371$

$97x = -194$

$x = -\frac{194}{97}$

$x = -2$

hence $x = -2$ and $y = 7$

(ii) x + y = 5.5

X –y = 0.9

Solution

x + y = 5.5 .....(i)

x – y = 0.9 ......(ii)

Adding (i) and (ii) we get

2x = 5.5 + 0.9

2x = 6.4

$x = \frac{6.4}{2}$

x = 3.2

substituting value of x in (i)

3.2 + y = 5.5

Y = 5.5 – 3.2

Y = 2.3

Hence x = 3.2 and y = 2.3

3. (i) x + y = 7xy

2x – 3y + xy = 0

Solution :

X + y = 7xy .....(i)

2x – 3y + xy = 0 .....(ii)

Divide (i) by xy, we get

$\frac{x}{xy} + \frac{y}{xy} = \frac{7xy}{xy}$

$\frac{1}{y} + \frac{1}{x} = 7$

$\frac{1}{x} + \frac{1}{y} = 7$ .....(iii)

Divide (ii) by xy, we get

$\frac{2x}{xy} - \frac{3y}{xy} + \frac{xy}{xy} = 0$

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

$-\frac{3}{x} + \frac{2}{y} = -1$ .....(iv)

Multiplying (iii) by 3 , we get

$\frac{3}{x} + \frac{3}{y} = 3 \times 7$

$\frac{3}{x} + \frac{3}{y} = 21$ .....(v)

Adding (v) and (iv) we get

$\frac{5}{y} = 20$

$Y = \frac{5}{20}$

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

Substitute value of y in (iv)

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

$-\frac{3}{x} + 8 = -1$

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

$-\frac{3}{x} = -9$

$X = \frac{3}{9}$

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

Hence $x = \frac{1}{3}$ and $y = \frac{1}{4}$

(ii)

$$\frac{30}{x-y} + \frac{44}{x+y} = 10$$

$$\frac{40}{x-y} + \frac{55}{x+y} = 13$$

Solution :

$$\frac{30}{x-y} + \frac{44}{x+y} = 10 \text{ ....(i)}$$

$$\frac{40}{x-y} + \frac{55}{x+y} = 13 \text{ ....(ii)}$$

Multiply (i) by 4 and (ii) by 3, we get

$$\frac{120}{x-y} + \frac{176}{x+y} = 40 \text{ .....(iii)}$$

$$\frac{120}{x-y} + \frac{165}{x+y} = 39 \text{ .....(iv)}$$

Subtracting (iv) from (iii) we get

$$0 + \frac{11}{x+y} = 1$$

$$x + y = 11 \text{....(v)}$$

substituting (v) in (i) we get

$$\frac{30}{x-y} + \frac{44}{11} = 10$$

$\frac{30}{x-y} + 4 = 10$

$\frac{30}{x-y} = 10 - 4$

$\frac{30}{x-y} = 6$

$X - y = \frac{30}{6}$

$X - y = 5$ ....(vi)

Now solve for (v) and (vi)

$X + y = 11$

$X - y = 5$

Add (v) and (vi)

$2x = 16$

$X = \frac{16}{2} = 8$

Substitute x in (v)

$8 + y = 11$

$Y = 11 - 8$

$Y = 3$

Hence $x = 8$ and $y = 3$

4. (i) ax + by = a-b

bx – ay = a+ b

solution

ax + by = a – b ....(i)

bx – ay = a + b .....(ii)

multiplying (i) by a and (ii) by b , we get

a(ax + by) = a(a – b)

a^2 x + aby = a^2 – ab ....(iii)

b(bx – ay) = b(a + b)

b^2x – aby = ab + b^2.....(iv)

adding (iii) and (iv)

a^2x + aby = a^2 – ab

b^2 x – aby = ab + b^2

(a^2 + b^2) x = (a^2 + b^2)

$X = \frac{a^2+b^2}{a^2+b^2}$

X = 1

Substitute the value of x in (i) , we get

a × 1 + by = a – b

a + by = a- b

by = - b

$y = -\frac{b}{b}$

y = - 1

hence x = 1 and y = -1

(ii) 3x + 2y = 2xy

$\frac{1}{x} + \frac{2}{y} = 1\frac{1}{6}$

Solution

3x + 2y = 2xy

$\frac{1}{x} + \frac{2}{y} = 1\frac{1}{6}$

$\frac{1}{x} + \frac{2}{y} = \frac{7}{6}$ .....(ii)

Divide (i) by xy

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

$\frac{3}{y} + \frac{2}{x} = 2$ .....(iii)

Multiply (ii) by 2 , we get

$\frac{2}{x} + \frac{4}{y} = \frac{7}{3}$ ...(iv)

Subtract (iii) from (iv)

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

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

$0 + \frac{1}{y} = \frac{7}{3} - 2$

$\frac{1}{y} = \frac{7-6}{3}$

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

Y = 3

Substitute y in (iii)

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

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

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

X = 2

Hence x = 2 and y = 3

5 . solve $2x - \left(\frac{3}{y}\right) = 9$

$3x + \left(\frac{7}{y}\right) = 2$

Hence find the value of K if x = ky + 5

Solution

$2x - \left(\frac{3}{y}\right) = 9$ .....(i)

$3x + \left(\frac{7}{y}\right) = 2$ .... (ii)

Multiply (i) by 3 and (ii) by 2, we get

$6x - \left(\frac{9}{y}\right) = 27$ ....(iii)

$6x + \left(\frac{14}{y}\right) = 4$ .....(iv)

Subtracting (iv) from (iii) we get

$-\frac{23}{y} = 23$

$Y = \frac{23}{-23}$

Y = - 1

Substitute y in (i)

$2x - \left(\frac{3}{-1}\right) = 9$

2x + 3 = 9

2x = 9 -3

2x = 6

$X = \frac{6}{2}$

X= 3

Hence x = 3 and y = -1

Given x = ky + 5

Substitute x and y in above equation

$3 = k \times -1 + 5$

3 = - k + 5

K = 5 – 3

K = 2

Hence the value of k is 2

6. solve

$\frac{1}{x+y} - \frac{1}{2x} = \frac{1}{30}$

$\frac{5}{x+y} + \frac{1}{3} = \frac{4}{3}$

Hence find the value of $2x^2 - y^2$

Solution

$\frac{1}{x+y} - \frac{1}{2x} = \frac{1}{30}$ .....(i)

$\frac{5}{x+y} + \frac{1}{3} = \frac{4}{3}$ .....(ii)

Let (x +y) = a

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

$\frac{1}{a} - \frac{1}{2x} = \frac{1}{30}$ .....(iii)

$\frac{5}{a} + \frac{1}{x} = \frac{4}{3}$

Multiply (iii) by 5

$\frac{5}{a} - \frac{5}{2x} = \frac{1}{6}$ .....(iv)

$\frac{5}{a} + \frac{1}{x} = \frac{4}{3}$

Subtracting (ii) from (iv)

$-\frac{5}{2x} - \frac{1}{x} = \frac{1}{6} - \frac{4}{3}$

$\frac{-5-2}{2x} = \frac{1-8}{6}$

$-\frac{7}{2x} = -\frac{7}{6}$

2x = 6

X = 3

Substituting x in (iii)

$\frac{1}{a} - \frac{1}{2\times3} = \frac{1}{30}$

$\frac{1}{a} - \frac{1}{6} = \frac{1}{30}$

$\frac{1}{a} = \left(\frac{1}{30}\right) + \left(\frac{1}{6}\right)$

$\frac{1}{a} = \frac{1+5}{30}$

$\frac{1}{a} = \frac{6}{30}$

$a = \frac{30}{6}$

a = 5

substitute a in x + y = a

3 + y = 5

Y = 5 -3

Y = 2

Hence x = 3 , y = 2

$2x^2 - y^2 = 2 \times 3^2 - 2^2$

$= 2 \times 9 - 4$

$= 18 - 4$

$= 14$

Hence the value of $2x^2 - y^2$ is 14

7 . can x , y be found to satisfy the following equation simultaneously ?

$\frac{2}{y} + \frac{5}{x} = 19$

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

$3x + 8y = 5$

If so , find them

Solution

$\frac{2}{y} + \frac{5}{x} = 19$ ....(i)

$\frac{5}{y} - \frac{3}{x} = 1$ ....(ii)

$3x + 8y = 5$ ....(iii)

Multiply (i) by 5 and (ii) by 2 , we get

$\frac{10}{y} + \frac{25}{x} = 95$ .....(iv)

$\frac{10}{y} - \frac{6}{x} = 2$ .....(v)

Subtract (v) from (iv)

$\frac{31}{x} = 95 - 2$

$\frac{31}{x} = 93$

$x = \frac{31}{93}$

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

substitute x in (i)

$\left(\frac{2}{y}\right) + 5 \div \left(\frac{1}{3}\right) = 19$

$\left(\frac{2}{y}\right) + 5 \times 3 = 19$

$\left(\frac{2}{y}\right) = 19 - 15$

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

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

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

Substitute x and y in (iii)

$3 \times \left(\frac{1}{3}\right) + 8 \times \left(\frac{1}{2}\right) = 5$

$1 + 4 = 5$

The value of x and y satisfies (iii)

Hence the given equation are simultaneous .