

Exercise 3.3

Question 1:

Solve the following pair of linear equations by the elimination method and the substitution method:

(i) $x + y = 5$ and $2x - 3y = 4$ (ii) $3x + 4y = 10$ and $2x - 2y = 2$

(iii) $3x - 5y - 4 = 0$ and $9x = 2y + 7$ (iv) $\frac{x}{2} + \frac{2y}{3} = -1$ and $x - \frac{y}{3} = 3$

Answer :

(i) *By elimination method*

$$x + y = 5 \quad (1)$$

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

Multiplying equation (1) by 2, we obtain

$$2x + 2y = 10 \quad (3)$$

Subtracting equation (2) from equation (3), we obtain

$$\begin{aligned} 5y &= 6 \\ y &= \frac{6}{5} \quad (4) \end{aligned}$$

Substituting the value in equation (1), we obtain

$$\begin{aligned} x &= 5 - \frac{6}{5} = \frac{19}{5} \\ \therefore x &= \frac{19}{5}, y = \frac{6}{5} \end{aligned}$$

By substitution method

From equation (1), we obtain

$$x = 5 - y \quad (5)$$

Putting this value in equation (2), we obtain

$$2(5 - y) - 3y = 4$$

$$-5y = -6$$

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

Substituting the value in equation (5), we obtain

$$x = 5 - \frac{6}{5} = \frac{19}{5}$$
$$\therefore x = \frac{19}{5}, y = \frac{6}{5}$$

(ii) By elimination method

$$3x + 4y = 10 \quad (1)$$

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

Multiplying equation (2) by 2, we obtain

$$4x - 4y = 4 \quad (3)$$

Adding equation (1) and (3), we obtain

$$7x = 14$$
$$x = 2 \quad (4)$$

Substituting in equation (1), we obtain

$$6 + 4y = 10$$
$$4y = 4$$
$$y = 1$$

Hence, $x = 2, y = 1$

By substitution method

From equation (2), we obtain

$$x = 1 + y \quad (5)$$

Putting this value in equation (1), we obtain

$$3(1 + y) + 4y = 10$$

$$7y = 7$$

$$y = 1$$

Substituting the value in equation (5), we obtain

$$x = 1 + 1 = 2$$
$$\therefore x = 2, y = 1$$

(iii) By Elimination Method:

Equations are

$$3x - 5y = 4 \quad \dots(i)$$

$$\text{and } 9x - 2y = 7 \quad \dots(ii)$$

Multiplying equation (i) by 3 and subtracting from equation (ii),

$$\begin{array}{r} 9x - 2y = 7 \\ 9x - 15y = 12 \\ \hline - \quad + \quad - \\ \hline 13y = -5 \end{array}$$

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

Putting this value of y in equation (i), we get

$$3x - 5\left(\frac{-5}{13}\right) = 4 \Rightarrow 3x + \frac{25}{13} = 4 \Rightarrow 3x = 4 - \frac{25}{13} = \frac{52 - 25}{13}$$

$$\Rightarrow 3x = \frac{27}{13} \Rightarrow \boxed{x = \frac{9}{13}}$$

By Substitution Method:

$$\text{We have } 3x - 5y = 4 \quad \dots(i)$$

$$\text{and } 9x - 2y = 7 \quad \dots(ii)$$

$$\text{From equation (i), } x = \frac{4 + 5y}{3}$$

Putting this value in equation (ii), we get

$$9\left[\frac{4 + 5y}{3}\right] - 2y = 7 \Rightarrow 3[4 + 5y] - 2y = 7$$

$$\Rightarrow 12 + 15y - 2y = 7 \Rightarrow 12 + 13y = 7$$

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

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

$$\Rightarrow 3x + 4y = -6 \quad \dots (1)$$

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

$$\Rightarrow 3x - y = 9 \quad \dots (2)$$

Subtracting equation (1) from equation (2), we get

$$\begin{array}{r} 3x + 4y = -6 \\ 3x - y = 9 \\ \hline - \quad + \quad - \\ \hline 5y = -15 \\ \Rightarrow y = -3 \end{array}$$

Putting the value of y in equation (1), we get

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

Hence, $x = 2$ and $y = -3$.

Question 2 :

Form the pair of linear equations in the following problems, and find their solutions (if they exist) by the elimination method:

- (i) If we add 1 to the numerator and subtract 1 from the denominator, a fraction reduces to 1. It

becomes $\frac{1}{2}$ if we only add 1 to the denominator. What is the fraction?

- (ii) Five years ago, Nuri was thrice as old as Sonu. Ten years later, Nuri will be twice as old as Sonu. How old are Nuri and Sonu?

- (iii) The sum of the digits of a two-digit number is 9. Also, nine times this number is twice the number obtained by reversing the order of the digits. Find the number.

- (iv) Meena went to bank to withdraw Rs 2000. She asked the cashier to give her Rs 50 and Rs 100 notes only. Meena got 25 notes in all. Find how many notes of Rs 50 and Rs 100 she received.

- (v) A lending library has a fixed charge for the first three days and an additional charge for each day thereafter. Saritha paid Rs 27 for a book kept for seven days, while Susy paid Rs 21 for the book she kept for five days. Find the fixed charge and the charge for each extra day.

Answer :

- (i) Let the fraction be $\frac{x}{y}$.

According to the given information,

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

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

Subtracting equation (1) from equation (2), we obtain

$$x = 3 \quad (3)$$

Substituting this value in equation (1), we obtain

$$3 - y = -2$$

$$-y = -5$$

$$y = 5$$

Hence, the fraction is $\frac{3}{5}$.

- (ii) Let present age of Nuri = x

and present age of Sonu = y

According to the given information,

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

$$x - 3y = -10 \quad (1)$$

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

$$x - 2y = 10 \quad (2)$$

Subtracting equation (1) from equation (2), we obtain

$$y = 20 \quad (3)$$

Substituting it in equation (1), we obtain

$$x - 60 = -10$$

$$x = 50$$

Hence, age of Nuri = 50 years

And, age of Sonu = 20 years

(iii) Let the unit digit and tens digits of the number be x and y respectively. Then, number = $10y + x$

Number after reversing the digits = $10x + y$

According to the given information, $x + y$

$$= 9 \quad (1)$$

$$9(10y + x) = 2(10x + y)$$

$$88y - 11x = 0$$

$$-x + 8y = 0 \quad (2)$$

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

$$9y = 9y$$

$$= 1 \quad (3)$$

Substituting the value in equation (1), we obtain

$$x = 8$$

Hence, the number is $10y + x = 10 \times 1 + 8 = 18$

(iv) Let the number of Rs 50 notes and Rs 100 notes be x and y respectively.

According to the given information,

$$x + y = 25 \quad (1)$$

$$50x + 100y = 2000 \quad (2)$$

Multiplying equation (1) by 50, we obtain

$$50x + 50y = 1250 \quad (3)$$

Subtracting equation (3) from equation (2), we obtain

$$50y = 750$$

$$y = 15$$

Substituting in equation (1), we have $x = 10$

Hence, Meena has 10 notes of Rs 50 and 15 notes of Rs 100.

(v) Let the fixed charge for first three days and each day charge thereafter be Rs x and Rs y respectively.

According to the given information,

$$x + 4y = 27 \quad (1)$$

$$x + 2y = 21 \quad (2)$$

Subtracting equation (2) from equation (1), we obtain

$$2y = 6$$

$$y = 3 \quad (3)$$

Substituting in equation (1), we obtain

$$x + 12 = 27$$

$$x = 15$$

Hence, fixed charge = Rs 15

And Charge per day = Rs 3

