Chapter – 3
Pair of Linear Equations in Two Variables

Exercise 3.4

Q. 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 . ..... (i)

2x - 3y = 4 .....(ii)

Multiplying equation (i) by 2 we get,

2x + 2y = 10 .....(iii)

Subtracting equation (ii) from equation (iii) we get,

5y = 6

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

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

$x = 5 - \frac{6}{5} = \frac{19}{5}$

By substitution method

x + y = 5 ..... (i)

2x - 3y = 4 ..... (ii)

from equation (i)

x = 5 – y .....(iii)

Putting value of x from equation (iii) to equation (ii) we get,

2(5 - y) - 3y = 4

= 10 - 2y - 3y = 4

= -5y = -6

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

Putting value of y in equation (iii) we get,

$x = 5 - \frac{6}{5} = \frac{19}{5}$

ii) By elimination method

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

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

Multiplying equation (ii) by 2 we get,

4x - 4y = 4 ..... (iii)

Adding equations (i) and (iii) we get,

7x = 14

$= x = \frac{14}{7} = 2$

Putting value of x in equation (i) we get,

3 (2) + 4y = 10

4y = 10 - 6 = 4

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

By substitution method

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

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

From equation (ii)

$2x = 2 + 2y$

Dividing both side by 2, we get$x = 1 + y$

putting value of x in equation (i) we get,

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

$3 + 3y + 4y = 107y = 7y = 1$

and

$x = 1 + y = 1 + 1 = 2$(iii) By elimination method

$3x - 5y = 4.$ .....(i)

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

Multiplying equation (i) by 3 we get,

$9x - 15y = 12$.....(iii)

Subtracting equation (ii) from (iii) we get,

$-13y = 5$

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

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

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

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

Taking LCM,

$3x = \frac{4}{1} - \frac{25}{13} = \frac{52-25}{13} = \frac{27}{13}$

or $x = \frac{27}{13\times3} = \frac{9}{13}$

By substitution method

$3x - 5y = 4$ ..... (i)

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

From equation (i)

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

Putting value of x in equation (ii) we get,

$= 9 \times \frac{4+5y}{3} - 2y = 7$

= 12 + 15y – 2y = 7

= 13y = -5

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

Putting value of y in equation (i) we get

$3x - 5 \times -\frac{5}{13} = 4$

$3x = 4 - \frac{25}{13} = \frac{27}{13}$

$= x = \frac{27}{39} = \frac{9}{13}$

iv) By elimination method

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

$= x - \frac{y}{3} = 3$ ….. (ii)

Multiplying equation (i) by 2, we get,

$x + \frac{4y}{3} = -2$ …. (iii)

Subtracting equation (ii) from equation (iii) we get,

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

$= y = -\frac{15}{3} = -3$

Putting value of y in equation (ii) we get,

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

= x - 4 = - 2

= x = 2

By substitution method

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

$= x - \frac{y}{3} = 3$ … (ii)

From equation (ii) we get,

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

Putting value of x in equation (i) we get,

$= \frac{9+y}{6} + \frac{2y}{3} = -1$

$= \frac{9+y+4y}{6} = -1$

= 5y = - 6 - 9 = - 15

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

Putting this value in (iii), we get x = 3 - 1 = 2.

Q. 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 a sold 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 a 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 is =

According condition (i)

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

$= x + 1 = y - 1$

$= x - y = -2$ …. (i)

According condition (ii)

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

= 2x = y + 1

= 2x - y = 1 …. (ii)

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

x = 3

Putting value of x in equation (i) we get,

3 - y = -2

= - y = - 5 and y = 5

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

ii) Let present age of Nuri = x

Let present age of Sonu = y

According to condition (i)

five years before Nuri's age is 3 times that of Sonu's age

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

$x – 3y = -10$ …. (i)

According to condition (ii)

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

$= x – 2y = 10$ … (ii)

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

$y = 20$

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

$x - 60 = -10$

$x = 50$

Hence,

Present age of Nuri = 50 years

Present age of Sonu = 20 years

iii) Let the unit digit of number = x

Let tens digit = y

so number = $10y + x$

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

According to the question,

$x + y = 9$ .....(i)

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

$= 90y + 9x = 20x + 2y$

$= 88y -11x = 0$

$= - x + 8y = 0$.....(ii)

Adding equations (i) and (ii). we get,

$9y = 9$

$= y = \frac{9}{9} = 1$

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

$x = 8$

Hence,

The required number is $= 10y + x = 10 \times 1 + 8 = 18$

iv) Let the number of Rs, 50 notes = x

Let the number of Rs, 100 notes = y

According to the question,

$x + y = 25$ ..... (i)

$50x + 100y = 2000$ ..... (ii)

Multiplying equation (i) by 50 we get,

$50x + 50y = 1250$ ..... (iii)

Subtracting equation (iii) from equation (ii). we get,

$50\ y = 750$

$= y = \frac{750}{50} = 15$

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

$x = 10$

Hence,

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

v) Let the fixed charge for first three days = Rs. x

Let each day charge there after = Rs. y

According to the question,

$x + 4y = 27$ ..... (i)

$x + 2y = 21$ ..... (ii)

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

$2y = 6$

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

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

$x + 12 = 27$

$= x = 27 - 12 = 15$

Hence,

Fixed charge = Rs. 15

Charge per day = Rs. 3