Linear Equations in Two Variables: Exercise - 3.4

Q.1 Solve the following pair of linear equation by the elimination method and the substitute 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 $x-\frac{y}{3}=3$

Sol. **(i) The given equations are:**

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

2x – 3y = 4..... (ii)

Multiplying (i) by 3,

We get

3x + 3y = 15..... (iii)

By adding (ii) and (iii),

we get

5x = 19

⇒ x = 19/5

Putting x = 19/5 in (i),

We get

(19/5) + y = 5

⇒ $y = 5 - (19/5) = \frac{25-19}{5} = 6/5$

Hence, x = 19/5, y = 6/5

By substitution method:

The given equations are:

x + y = 5 ... (i) and 2x – 3y = 4 ... (ii)

From (i), y = 5 – x Putting in (ii),

We get

2x – 3 (5 – x) = 4

⇒ 2x – 15 + 3x = 4

⇒ 5x = 4 + 15

⇒ 5x = 19

⇒ x=19/5

Putting x = 19/5 in (i),

We get

(19/5) + y = 5

⇒ y = 5 – (19/5) = (25–19) / 5 = 6/5

Hence, x = 19/5, y = 6/5

(ii) By elimination method:

The given equations are:

3x + 4y = 10 ... (i) and 2x – 2y = 2 ... (ii)

Multiplying (ii) by 2

We get

4x – 4y = 4..... (iii)

Now adding (i) and (iii)

3x + 4y + 4x – 4y = 10 + 4

⇒ 7x = 14

⇒ x = 2

Putting x = 2 in (i),

we get

3(2) + 4y = 10

⇒ 4y = 10 – 6 = 4

⇒ y = 1

Hence, x = 2 y = 1

By substitution method:

The given equations are:

$3x + 4y = 10$ ... (i) and $2x - 2y = 2 \Rightarrow x - y = 1$ ... (ii)

from (ii), $y = x - 1$ put this in (i)

We get

$3x + 4(x - 1) = 10$

$\Rightarrow 3x + 4x - 4 = 10$

$\Rightarrow 7x = 14$

$\Rightarrow x = 14/7 = 2$

Putting $x = 2$ in (i),

We get

$3(2) + 4y = 10$

$\Rightarrow 4y = 10 - 6 = 4$

$\Rightarrow y = 4/4 = 1$

Thus, $x = 2, y = 1$

(iii) By elimination method:

The given equations are:

$3x - 5y - 4 = 0 \Rightarrow 3x - 5y = 4$ ....(i)

and $9x = 2y + 7 \Rightarrow 9x - 2y = 7$ ...(ii)

Multiplying (i) by 3,

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

Subtracting (ii) from (iii),

We get,

$-13y = 5$

$\Rightarrow y = -(5/13)$

Putting $y = -(5/13)$ in (i),

We get

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

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

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

$\Rightarrow 3x = \frac{52 - 25}{13}$

$\Rightarrow x = 9/13$

Thus, $x = 9/13, y = -5/13$

By substitution method:

The given equations are:

$3x - 5y - 4 = 0 \Rightarrow 3x - 5y = 4$ ... (i)

and, $9x = 2y + 7 \Rightarrow 9x - 2y = 7$.... (ii)

From (ii), $2y = 9x - 7$

$\Rightarrow y = \frac{9x - 7}{2}$

Substituting $y = \frac{9x - 7}{2}$ in (i),

We get

$3x - 5(\frac{9x - 7}{2}) = 4$

$\Rightarrow -39x = 8 - 35$

$\Rightarrow -39x = -27$

$\Rightarrow x = \frac{-27}{-39} = 9/13$

Putting x = 9/13 in (ii),

We get

$3\times\frac{9}{13}-5y=4$

$\Rightarrow 5y=\frac{27}{13}-4$

$\Rightarrow 5y = -25/13$

$\Rightarrow y = -5/13$

Thus, x = 9/13; y = −5/13

(iv) By elimination method:

The given system of equations are:

$\frac{x}{2}+\frac{2y}{3} = -1 \Rightarrow 3x + 4y = -6$ ... (i)

$x-\frac{y}{3} = 3 \Rightarrow 3x - y = 9$... (ii)

Multiplying (ii) by 4 and adding to (i),

We get

15x = 30

$\Rightarrow x = 30/15 = 2$

Putting x = 2 in (ii),

We get

3(2) − y = 9

$\Rightarrow -y = 9 - 6 = 3$

$\Rightarrow y = -3$

Hence, x = 2, y = − 3

By substitution method:

$\frac{x}{2}+\frac{2y}{3} = -1 \Rightarrow 3x + 4y = -6$ ... (i)

$x-\frac{y}{3} = 3 \Rightarrow 3x - y = 9$ ... (ii)

From (ii), y = 3x − 9

Putting y = 3x − 9 in (i),

We get

3x + 4(3x − 9) = − 6

$\Rightarrow 3x + 12x - 36 = -6$

$\Rightarrow 15x = 30$

$\Rightarrow x = 30/15 = 2$

Putting x = 2 in (ii),

We get

3(2) − y = 9

$\Rightarrow -y = 9 - 6 = 3$

$\Rightarrow y = -3$

Thus, x = 2, y = − 3

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 year 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 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 man notes of Rs. 50 and RS 100 she received.
(v) A lending library has a fixed charge for first three days and an additional charge for each day thereafter. Saritha paid Rs. 27 for a book she kept for seven days, while Susy paid Rs. 21 for book she kept for five days. Find the fixed charge and the charge for each extra day.

Sol. **(i)** Let x be the numerator and y be the denominator of the fraction, then the fraction will be $\frac{x}{y}$.

By given conditions: If we add 1 to the numerator and subtract 1 from the denominator, a fraction reduces to 1

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

$\Rightarrow x+1=y-1$

$\Rightarrow x - y = -2$... (i)

If we only add 1 to the denominator, it becomes $\frac{1}{2}$:

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

$\Rightarrow 2x = y + 1$

$\Rightarrow 2x - y = 1$------(ii)

Subtracting (ii) from (i), we get

$(x - y) - (2x - y) = -2 - 1$

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

$\Rightarrow -x = -3$

$\Rightarrow x = 3$

putting the value of x = 3 in (i), we get

$3 - y = -2$

$\Rightarrow y = 5$

Hence, the required fraction is 3/5.

(ii) Let x be the present age of Nuri and y be the present age of Sonu.

Five years ago,

Nuri's age = (x – 5) years

Sonu's age = (y – 5) years

Nuri was thrice as old as Sonu

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

$\Rightarrow x - 5 = 3y - 15$

$\Rightarrow x - 3y = -15 + 5$

$\Rightarrow x - 3y = -10$ ... (i)

Ten years later,

Nuri's age = (x + 10) years

Sonu's age = (y + 10) years

Nuri will be twice as old as Sonu

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

$\Rightarrow x + 10 = 2y + 20$

$\Rightarrow x - 2y = 20 - 10$

$\Rightarrow x - 2y = 10$ ...(ii)

Subtracting (ii) from (i), we get

$-y = -20$

$\Rightarrow y = 20$

Putting y = 20 in (ii), we get

$x - 2(20) = 10$

$\Rightarrow x = 10 + 40 = 50$

Thus, Nuri's present age = 50 years and Sonu's present age = 20 years

(iii) Let x be the digits in the unit's place and y be the digit of ten's place.

So, Number will be = $10y + x$

If the digits age reversed, then the new number will be = $10x + y$

The sum of the digits of a two - digit number 9

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

Nine times this number is twice the number obtained by reversing the order of the digits

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

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

$\Rightarrow 20x - 9x + 2y - 90y = 0$

$\Rightarrow 11x - 88y = 0$ ... (ii)

From (i), $y = 9 - x$ put this value in (ii)

We get

$11x - 88(9 - x) = 0$

$\Rightarrow 11x - 88 \times 9 + 88x = 0$

$\Rightarrow 99x = 88 \times 9$

$\Rightarrow x = \frac{88x9}{99} = 8$

Putting $x = 8$ in (i), we get

$8 + y = 9$

$\Rightarrow y = 1$

Thus, the number = $10y + x$

$= 10 \times 1 + 8$

$= 18$

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

Since Total number of notes: $x + y = 25$..... (i)

Withdraw amount: $50x + 100y = 2000 \Rightarrow x + 2y = 40$.....(ii)

On subtracting (i), from (ii), we get

$y = 15$

Putting $y = 15$ in (i), we get

$x + 15 = 25$

$\Rightarrow x = 10$

Hence, number of Rs. 50 notes = 10 and, number of Rs. 100 notes = 15

(v) Let Rs. x be the fixed charge for 3 days and Rs. y be the charge each day thereafter**.**

Saritha paid Rs.27 for a book kept for seven days:

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

Susy paid Rs.21 for the book she kept for five days:

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

Subtracting (ii) form (i), we get

$2y = 6$

$\Rightarrow y = 3$ put in (i)

We get

$x + 4 \times 3 = 27$

$\Rightarrow x = 27 - 12 = 15$

Fixed charges x = Rs. 15

and, charges per day y = Rs. 3