Exercise – 3B

1.

Sol:

The given system of equation is:

$x + y = 3$…….(i)

$4x - 3y = 26$ ……(ii)

On multiplying (i) by 3, we get:

3x + 3y = 9 ….(iii)

On adding (ii) and (iii), we get:

7x = 35

⇒ x = 5

On substituting the value of x = 5 in (i), we get:

5 + y = 3

⇒ y = (3 – 5) = -2

Hence, the solution is x = 5 and y = -2

2.

Sol:

The given system of equations is

x – y = 3 …..(i)

$\frac{x}{3} + \frac{y}{2} = 6$ ……(ii)

From (i), write y in terms of x to get

y = x – 3

Substituting y = x – 3 in (ii), we get

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

⇒2x + 3(x – 3) = 36

⇒2x + 3x – 9 = 36

⇒x = $\frac{45}{5}$ = 9

Now, substituting x = 9 in (i), we have

9 – y = 3

⇒y = 9 – 3 = 6

Hence, x = 9 and y = 6.

3.

Sol:

The given system of equation is:

2x + 3y = 0 ……(i)

3x + 4y = 5 ……(ii)

On multiplying (i) by 4 and (ii) by 3, we get:

8x + 12y = 0 ……(iii)

9x + 12y = 15 …….(iv)

On subtracting (iii) from (iv) we get:

x = 15
On substituting the value of x = 15 in (i), we get:
30 + 3y = 0

$\Rightarrow$3y = -30

$\Rightarrow$y = -10

Hence, the solution is x = 15 and y = -10.

4.

Sol:
The given system of equation is:
2x - 3y = 13 ……(i)
7x - 2y = 20 ……(ii)
On multiplying (i) by 2 and (ii) by 3, we get:
4x - 6y = 26 ……(iii)
21x - 6y = 60 …….(iv)
On subtracting (iii) from (iv) we get:
17x = (60 – 26) = 34

$\Rightarrow$x = 2

On substituting the value of x = 2 in (i), we get:
4 – 3y = 13

$\Rightarrow$3y = (4 – 13) = -9

$\Rightarrow$y = -3

Hence, the solution is x = 2 and y = -3.

5.

Sol:
The given system of equation is:
3x - 5y - 19 = 0 ……(i)
-7x + 3y + 1 = 0 ……(ii)
On multiplying (i) by 3 and (ii) by 5, we get:
9x - 15y = 57 ……(iii)
-35x + 15y = -5 …….(iv)
On subtracting (iii) from (iv) we get:
-26x = (57 – 5) = 52

$\Rightarrow$x = -2

On substituting the value of x = -2 in (i), we get:

$-6 - 5y - 19 = 0$

$\Rightarrow 5y = (-6 - 19) = -25$

$\Rightarrow y = -5$

Hence, the solution is x = -2 and y = -5.

6.

Sol:

The given system of equation is:

$2x - y + 3 = 0$…….(i)

$3x - 7y + 10 = 0$ ……(ii)

From (i), write y in terms of x to get

$y=2x + 3$

Substituting $y = 2x + 3$ in (ii), we get

$3x - 7(2x + 3) + 10 = 0$

$\Rightarrow 3x - 14x - 21 + 10 = 0$

$\Rightarrow -7x = 21 - 10 = 11$

$x = -\frac{11}{7}$

Now substituting $x = -\frac{11}{7}$ in (i), we have

$-\frac{22}{7} - y + 3 = 0$

$y = 3 - \frac{22}{7} = -\frac{1}{7}$

Hence, $x = -\frac{11}{7}$ and $y = -\frac{1}{7}$.

7.

Sol:

The given system of equation can be written as:

$9x - 2y = 108$ ……(i)

$3x + 7y = 105$ ……(ii)

On multiplying (i) by 7 and (ii) by 2, we get:

$63x + 6x = 108 \times 7 + 105 \times 2$

$\Rightarrow 69x = 966$

$\Rightarrow x = \frac{966}{69} = 14$

Now, substituting x = 14 in (i), we get:

$9 \times 14 - 2y = 108$

$\Rightarrow 2y = 126 - 108$

$\Rightarrow y = \frac{18}{2} = 9$
Hence, x = 14 and y = 9.

8.

Sol:
The given equations are:
$\frac{x}{3} + \frac{y}{4} = 11$
$\Rightarrow 4x + 3y = 132$ …….(i)
and $\frac{5x}{6} - \frac{y}{3} + 7 = 0$
$\Rightarrow 5x – 2y = -42$ ……..(ii)
On multiplying (i) by 2 and (ii) by 3, we get:
$8x + 6y = 264$ …...(iii)
$15x – 6y = -126$ ….(iv)
On adding (iii) and (iv), we get:
$23x = 138$
$\Rightarrow x = 6$
On substituting x = 6 in (i), we get:
$24 + 3y = 132$
$\Rightarrow 3y = (132 – 24) = 108$
$\Rightarrow y = 36$
Hence, the solution is x = 6 and y = 36.

9.

Sol:
The given system of equation is:
$4x - 3y = 8$ ……(i)
$6x - y = \frac{29}{3}$ ……(ii)
On multiplying (ii) by 3, we get:
$18x – 3y = 29$ ….(iii)
On subtracting (iii) from (i) we get:
$-14x = -21$
$x = \frac{21}{14} = \frac{3}{2}$
Now, substituting the value of $x = \frac{3}{2}$ in (i), we get:

$4 \times \frac{3}{2} - 3y = 8$

$\Rightarrow 6 - 3y = 8$

$\Rightarrow 3y = 6 - 8 = -2$

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

Hence, the solution $x = \frac{3}{2}$ and $y = \frac{-2}{3}$.

10.

Sol:

The given equations are:

$2x - \frac{3y}{4} = 3$ …..(i)

$5x = 2y + 7$ ……..(ii)

On multiplying (i) by 2 and (ii) by $\frac{3}{4}$, we get:

$4x - \frac{3}{2}y = 6$ …...(iii)

$\frac{15}{4}x = \frac{3}{2}y + \frac{21}{4}$….(iv)

On subtracting (iii) and (iv), we get:

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

$\Rightarrow x = 3$

On substituting x = 3 in (i), we get:

$2 \times 3 - \frac{3y}{4} = 3$

$\Rightarrow \frac{3y}{4} = (6 - 3) = 3$

$\Rightarrow y = \frac{3 \times 4}{3} = 4$

Hence, the solution is x = 3 and y = 4.

11.

Sol:

The given equations are:

$2x - 5y = \frac{8}{3}$ …..(i)

$3x - 2y = \frac{5}{6}$ ……..(ii)

On multiplying (i) by 2 and (ii) by 5, we get:

$4x - 10y = \frac{16}{3}$ …...(iii)

$15x - 10y = \frac{25}{6}$……(iv)

On adding (iii) and (iv), we get:

$19x = \frac{57}{6}$

$\Rightarrow x = \frac{57}{6 \times 19} = \frac{3}{6} = \frac{1}{2}$

On substituting $x = \frac{1}{2}$ in (i), we get:

$2 \times \frac{1}{2} + 5y = \frac{8}{3}$

$\Rightarrow 5y = \left(\frac{8}{3} - 1\right) = \frac{5}{3}$

$\Rightarrow y = \frac{5}{3 \times 5} = \frac{1}{3}$

Hence, the solution is $x = \frac{1}{2}$ and $y = \frac{1}{3}$.

12.

Sol:

The given equations are:

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

$\Rightarrow 4x + 3y = 7$ ……..(i)

and $2x + 3y + 1 = 0$

$\Rightarrow 2x + 3y = -1$ ……….(ii)

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

$2x = 8$

$\Rightarrow x = 4$

On substituting x = 4 in (i), we get:

$16x + 3y = 7$

$\Rightarrow 3y = (7 - 16) = -9$

$\Rightarrow y = -3$

Hence, the solution is x = 4 and y = -3.

13.

Sol:

The given system of equations is

$0.4x + 0.3y = 1.7$ …….(i)

$0.7x - 0.2y = 0.8$ …….(ii)

Multiplying (i) by 0.2 and (ii) by 0.3 and adding them, we get
$0.8x + 2.1x = 3.4 + 2.4$

$\Rightarrow 2.9x = 5.8$

$\Rightarrow x = \frac{5.8}{2.9} = 2$

Now, substituting x = 2 in (i), we have

$0.4 \times 2 + 0.3y = 1.7$

$\Rightarrow 0.3y = 1.7 – 0.8$

$\Rightarrow y = \frac{0.9}{0.3} = 3$

Hence, x = 2 and y = 3.

14.

Sol:

The given system of equations is

$0.3x + 0.5y = 0.5$ …….(i)

$0.5x + 0.7y = 0.74$ …….(ii)

Multiplying (i) by 5 and (ii) by 3 and subtracting (ii) from (i), we get

$2.5y - 2.1y = 2.5 - 2.2$

$\Rightarrow 0.4y = 0.28$

$\Rightarrow y = \frac{0.28}{0.4} = 0.7$

Now, substituting y = 0.7 in (i), we have

$0.3x + 0.5 \times 0.7 = 0.5$

$\Rightarrow 0.3x = 0.50 – 0.35 = 0.15$

$\Rightarrow x = \frac{0.15}{0.3} = 0.5$

Hence, x = 0.5 and y = 0.7.

15.

Sol:

The given equations are:

$7(y + 3) – 2(x + 2) = 14$

$\Rightarrow$ $7y + 21 – 2x – 4 = 14$

$\Rightarrow -2x + 7y = -3$ ……..(i)

and $4(y – 2) + 3(x – 3) = 2$

$\Rightarrow 4y – 8 + 3x – 9 = 2$

$\Rightarrow 3x + 4y = 19$ ……….(ii)
On multiplying (i) by 4 and (ii) by 7, we get:
$-8x + 28y = -12$ ……(iii)
$21x + 28y = 133$ ……(iv)
On subtracting (iii) from (iv), we get:
$29x = 145$

$\Rightarrow x = 5$
On substituting x = 5 in (i), we get:
$-10 + 7y = -3$

$\Rightarrow 7y = (-3 + 10) = 7$

$\Rightarrow y = 1$
Hence, the solution is x = 5 and y = 1.

16.

Sol:
The given equations are:
$6x + 5y = 7x + 3y + 1 = 2(x + 6y – 1)$

$\Rightarrow 6x + 5y = 2(x + 6y – 1)$

$\Rightarrow 6x + 5y = 2x + 12y – 2$

$\Rightarrow 6x – 2x + 5y – 12y = -2$

$\Rightarrow 4x – 7y = -2$ …….(i)
and $7x + 3y + 1 = 2(x + 6y – 1)$

$\Rightarrow 7x + 3y + 1 = 2x + 12y – 2$

$\Rightarrow 7x – 2x + 3y – 12y = -2 – 1$

$\Rightarrow 5x – 9y = -3$ …….(ii)
On multiplying (i) by 9 and (ii) by 7, we get:
$36x - 63y = -18$ ……(iii)
$35x - 63y = -21$ ……(iv)
On subtracting (iv) from (iii), we get:
$x = (-18 + 21) = 3$
On substituting x = 3 in (i), we get:
$12 - 7y = -2$

$\Rightarrow 7y = (2 + 12) = 14$

$\Rightarrow y = 2$
Hence, the solution is x = 3 and y = 2.

17.

Sol:
The given equations are:
$\frac{x+y-8}{2} = \frac{x+2y-14}{3} = \frac{3x+y-12}{11}$
i.e., $\frac{x+y-8}{2} = \frac{3x+y-12}{11}$
By cross multiplication, we get:
11x + 11y – 88 = 6x + 2y – 24
⇒11x – 6x + 11y – 2y = -24 + 88
⇒5x + 9y = 64 …….(i)
and $\frac{x+2y-14}{3} = \frac{3x+y-12}{11}$
⇒11x + 22y – 154 = 9x + 3y – 36
⇒11x – 9x + 22y – 3y = -36 + 154
⇒2x + 19y = 118 …….(ii)
On multiplying (i) by 19 and (ii) by 9, we get:
95x + 171y = 1216 ……(iii)
18x + 171y = 1062 ……(iv)
On subtracting (iv) from (iii), we get:
77x = 154
⇒x = 2
On substituting x = 2 in (i), we get:
10 + 9y = 64
⇒9y = (64 – 10) = 54
⇒y = 6
Hence, the solution is x = 2 and y = 6.

18.

Sol:
The given equations are:
$\frac{5}{x}$ + 6y = 13 ……..(i)
$\frac{3}{x}$ + 4y = 7 ……..(ii)
Putting $\frac{1}{x}$ = u, we get:

5u + 6y = 13 …….(iii)

3u + 4y = 7 ……(iv)

On multiplying (iii) by 4 and (iv) by 6, we get:

20u + 24y = 52 ……..(v)

18u + 24y = 42 ……..(vi)

On subtracting (vi) from (v), we get:

2u = 10 ⇒ u = 5

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

On substituting x = $\frac{1}{5}$ in (i), we get:

$\frac{5}{1/3} + 6y = 13$

25 + 6y = 13

6y = (13 – 25) = -12

y = -2

Hence, the required solution is x = $\frac{1}{5}$ and y = -2.

19.

Sol:

The given equations are:

$x + \frac{6}{y} = 6$ ……..(i)

$3x - \frac{8}{y} = 5$ ……..(ii)

Putting $\frac{1}{y}$ = v, we get:

x + 6v = 6 …….(iii)

3x – 8v = 5 ……(iv)

On multiplying (iii) by 4 and (iv) by 3, we get:

4x + 24v = 24 ……..(v)

9x – 24v = 15 ……..(vi)

On adding (v) from (vi), we get:

13x = 39 ⇒ x = 3

On substituting x = 3 in (i), we get:

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

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

Hence, the required solution is x = 3 and y = 2.

20.

Sol:

The given equations are:

2x - $\frac{3}{y}$ = 9 ……..(i)

3x + $\frac{7}{y}$ = 2 ……..(ii)

Putting $\frac{1}{y}$ = v, we get:

2x - 3v = 6 …….(iii)

3x + 7v = 2 ……(iv)

On multiplying (iii) by 7 and (iv) by 3, we get:

14x - 21v = 63 ……..(v)

9x + 21v = 6 ……..(vi)

On adding (v) from (vi), we get:

23x = 69 ⇒ x = 3

On substituting x = 3 in (i), we get:

$2 \times 3 - \frac{3}{y} = 9$

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

Hence, the required solution is x = 3 and y = -1.

21.

Sol:

The given equations are:

$\frac{3}{x}$ - $\frac{1}{y}$ + 9 = 0,

⇒$\frac{3}{x}$ - $\frac{1}{y}$ = -9 ……..(i)

⇒$\frac{2}{x}$ - $\frac{3}{y}$ = 5……..(ii)

Putting $\frac{1}{x}$ = u and $\frac{1}{y}$ = v, we get:

3u – v = -9 …….(iii)

2u + 3v = 5 ……(iv)

On multiplying (iii) by 3, we get:

9u – 3v = -27 ……..(v)

On adding (iv) and (v), we get:

11u = -22 ⇒ u = -2

⇒$\frac{1}{x}$ = -2 ⇒ x = $\frac{-1}{2}$

On substituting x = $\frac{-1}{2}$ in (i), we get:

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

⇒−6 - $\frac{1}{y}$ = -9 ⇒ $\frac{1}{y}$ = (-6 + 9) = 3

⇒y = $\frac{1}{3}$

Hence, the required solution is x = $\frac{-1}{2}$ and y = $\frac{1}{3}$.

22.

Sol:

The given equations are:

$\frac{9}{x}$ - $\frac{4}{y}$ = 8 ……..(i)

$\frac{13}{x}$ + $\frac{7}{y}$ = 101 ……..(ii)

Putting $\frac{1}{x}$ = u and $\frac{1}{y}$ = v, we get:

9u - 4v = 8 …….(iii)

13u + 7v = 101 ……(iv)

On multiplying (iii) by 7 and (iv) by 4, we get:

63u - 28v = 56 ……..(v)

52u + 28v = 404 ……..(vi)

On adding (v) from (vi), we get:

115u = 460 ⇒ u = 4

⇒$\frac{1}{x}$ = 4 ⇒ x = $\frac{1}{4}$

On substituting x = $\frac{1}{4}$ in (i), we get:

$\frac{9}{1/4}$ - $\frac{4}{y}$ = 8

⇒36 - $\frac{4}{y}$ = 8 ⇒ $\frac{4}{y}$ = (36 – 8) = 28

y = $\frac{4}{28}$ = $\frac{1}{7}$

Hence, the required solution is x = $\frac{1}{4}$ and y = $\frac{1}{7}$.

23.

Sol:

The given equations are:

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

$\frac{3}{2x}$ + $\frac{2}{3y}$ = 5 ……..(ii)

Putting $\frac{1}{x}$ = u and $\frac{1}{y}$ = v, we get:

5u - 3v = 1 …….(iii)

$\Rightarrow \frac{3}{2}$ u + $\frac{2}{3}$ v = 5

$\Rightarrow \frac{9u+4v}{6}$ = 5

$\Rightarrow$9u + 4v = 30 …….(iv)

On multiplying (iii) by 4 and (iv) by 3, we get:

20u - 12v = 4 ……..(v)

27u + 12v = 90 ……..(vi)

On adding (iv) and (v), we get:

47u = 94 $\Rightarrow$ u = 2

$\Rightarrow \frac{1}{x}$ = 2 $\Rightarrow$ x = $\frac{1}{2}$

On substituting x = $\frac{1}{2}$ in (i), we get:

$\frac{5}{1/2}$ - $\frac{3}{y}$ = 1

$\Rightarrow$10 - $\frac{3}{y}$ = 1 $\Rightarrow$ $\frac{3}{y}$ = (10 – 1) = 9

y = $\frac{3}{9}$ = $\frac{1}{3}$

Hence, the required solution is x = $\frac{1}{2}$ and y = $\frac{1}{3}$.

24.

Sol:

The given equations are:

$\frac{3}{x}$ + $\frac{2}{y}$ = 12 ……..(i)

$\frac{2}{x}$ + $\frac{3}{y}$ = 13 ……..(ii)

Multiplying (i) by 3 and (ii) by 2 and subtracting (ii) from (i), we get:

$\frac{9}{x}$ - $\frac{4}{x}$ = 36 – 26

$\Rightarrow \frac{5}{x}$ = 10

$\Rightarrow$x = $\frac{5}{10}$ = $\frac{1}{2}$

Now, substituting x = $\frac{1}{2}$ in (i), we have

6 + $\frac{2}{y}$ = 12

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

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

Hence, x = $\frac{1}{2}$ and y = $\frac{1}{3}$.

25.

Sol:

The given equations are:

4x + 6y = 3xy …..(i)

8x + 9y = 5xy ……(ii)

From equation (i), we have:

$\frac{4x + 6y}{xy}$ = 3

⇒ $\frac{4}{y} + \frac{6}{x}$ = 3 ……(iii)

For equation (ii), we have:

$\frac{8x + 9y}{xy}$ = 5

⇒ $\frac{8}{y} + \frac{9}{x}$ = 5 ……(iv)

On substituting $\frac{1}{y}$ = v and $\frac{1}{x}$ = u, we get:

4v + 6u = 3 ……(v)

8v + 9u = 5 …….(vi)

On multiplying (v) by 9 and (vi) by 6, we get:

36v + 54u = 27 ….(vii)

48v + 54u = 30 ….(viii)

On subtracting (vii) from (viii), we get:

12v = 3 ⇒ v = $\frac{3}{12} = \frac{1}{4}$

⇒ $\frac{1}{y} = \frac{1}{4}$ ⇒ y = 4

On substituting y =4 in (iii), we get:

$\frac{4}{4} + \frac{6}{x}$ = 3

⇒ 1 + $\frac{6}{x}$ = 3 ⇒ $\frac{6}{x}$ = (3 – 1) = 2

⇒ 2x = 6 ⇒ x = $\frac{6}{2}$ = 3

Hence, the required solution is x = 3 and y = 4.

26.

Sol:

The given equations are:

x + y = 5xy …..(i)

3x + 2y = 13xy ……(ii)

From equation (i), we have:

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

$\Rightarrow \frac{1}{y} + \frac{1}{x} = 5$ ……(iii)

For equation (ii), we have:

$\frac{3x + 2y}{xy} = 13$

$\Rightarrow \frac{3}{y} + \frac{2}{x} = 13$ ……(iv)

On substituting $\frac{1}{y} = v$ and $\frac{1}{x} = u$, we get:

$v + u = 5$ ……(v)

$3v + 2u = 13$ …….(vi)

On multiplying (v) by 2, we get:

$2v + 2u = 10$ ….(vii)

On subtracting (vii) from (vi), we get:

$v = 3$

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

On substituting $y = \frac{1}{3}$ in (iii), we get:

$\frac{1}{1/3} + \frac{1}{x} = 5$

$\Rightarrow 3 + \frac{1}{x} = 5 \Rightarrow \frac{1}{x} = 2 \Rightarrow x = \frac{1}{2}$

Hence, the required solution is $x = \frac{1}{2}$ and $y = \frac{1}{3}$ or $x = 0$ and $y = 0$.

27.

Sol:

The given equations are

$\frac{5}{x+y} - \frac{2}{x-y} = -1$ ……(i)

$\frac{15}{x+y} - \frac{7}{x-y} = 10$ ……(ii)

Substituting $\frac{1}{x+y} = u$ and $\frac{1}{x-y} = v$ in (i) and (ii), we get

$5u – 2v = -1$ ……..(iii)

$15u + 7v = 10$ …….(iv)

Multiplying (iii) by 3 and subtracting it from (iv), we get

$7v + 6v = 10 + 3$

$\Rightarrow 13v = 13$

$\Rightarrow v = 1$

$\Rightarrow$x – y = 1 $\left(\because \frac{1}{x-y} = v\right)$ …..(v)

Now, substituting v = 1 in (iii), we get

5u – 2 = -1

$\Rightarrow$5u = 1

$\Rightarrow$u = $\frac{1}{5}$

x + y = 5 …….(vi)

Adding (v) and (vi), we get

2x = 6 $\Rightarrow$ x = 3

Substituting x = 3 in (vi), we have

3 + y = 5 $\Rightarrow$ y = 5 – 3 = 2

Hence, x = 3 and y = 2.

28.

Sol:

The given equations are

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

$\frac{9}{x+y} - \frac{4}{x-y} = 1$ ……(ii)

Substituting $\frac{1}{x+y}$ = u and $\frac{1}{x-y}$ = v, we get:

3u + 2v = 2 ……..(iii)

9u - 4v = 1 …….(iv)

On multiplying (iii) by 2, we get:

6u + 4v = 4 …..(v)

On adding (iv) and (v), we get:

15u = 5

$\Rightarrow$u = $\frac{5}{15} = \frac{1}{3}$

$\Rightarrow \frac{1}{x+y} = \frac{1}{3} \Rightarrow$ x + y = 3 …….(vi)

On substituting u = $\frac{1}{3}$ in (iii), we get

1 + 2v = 2

$\Rightarrow$2v = 1

$\Rightarrow$v = $\frac{1}{2}$

$\Rightarrow \frac{1}{x-y} = \frac{1}{2} \Rightarrow$ x – y = 2 …….(vii)

On adding (vi) and (vii), we get

2x = 5

$\Rightarrow$ x = $\frac{5}{2}$

On substituting x = $\frac{5}{2}$ in (vi), we have

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

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

Hence, the required solution is x = $\frac{5}{2}$ and y = $\frac{1}{2}$.

29.

Sol:

The given equations are

$\frac{5}{x+1} + \frac{2}{y-1} = \frac{1}{2}$ ……(i)

$\frac{10}{x+1} - \frac{2}{y-1} = \frac{5}{2}$ ……(ii)

Substituting $\frac{1}{x+1}$ = u and $\frac{1}{y-1}$ = v, we get:

5u - 2v = $\frac{1}{2}$ ……..(iii)

10u + 2v = $\frac{5}{2}$ …….(iv)

On adding (iii) and (iv), we get:

15u = 3

$\Rightarrow$u = $\frac{3}{15} = \frac{1}{5}$

$\Rightarrow \frac{1}{x+1} = \frac{1}{5} \Rightarrow$ x + 1 = 5 $\Rightarrow$ x = 4

On substituting u = $\frac{1}{5}$ in (iii), we get

$5 \times \frac{1}{5}$ - 2v = $\frac{1}{2} \Rightarrow$ 1 – 2v = $\frac{1}{2}$

$\Rightarrow$2v = $\frac{1}{2}$ $\Rightarrow$v = $\frac{1}{4}$

$\Rightarrow \frac{1}{y-1} = \frac{1}{4} \Rightarrow$ y – 1 = 4 $\Rightarrow$ y = 5

Hence, the required solution is x = 4 and y = 5.

30.

Sol:

The given equations are

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

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

Putting $\frac{1}{x+y}$ = u and $\frac{1}{x-y}$ = v, we get:
44u + 30v = 10 ……..(iii)
55u + 40v = 13 …….(iv)
On multiplying (iii) by 4 and (iv) by 3, we get:
176u + 120v = 40 …..(v)
165u + 120v = 39 …..(vi)
On subtracting (vi) and (v), we get:
11u = 1
$\Rightarrow$u = $\frac{1}{11}$
$\Rightarrow \frac{1}{x+y} = \frac{1}{11} \Rightarrow$ x + y = 11 …….(vii)
On substituting u = $\frac{1}{11}$ in (iii), we get:
4 + 30v = 10
$\Rightarrow$30v = 6
$\Rightarrow$v = $\frac{6}{30}$ = $\frac{1}{5}$
$\Rightarrow \frac{1}{x-y} = \frac{1}{5} \Rightarrow$ x – y = 5 …….(viii)
On adding (vii) and (viii), we get
2x = 16
$\Rightarrow$x = 8
On substituting x =8 in (vii), we get:
8 + y = 11
$\Rightarrow$ y = 11 – 8 = 3
Hence, the required solution is x = 8 and y =3.

31.

Sol:
The given equations are
$\frac{10}{x+y} + \frac{2}{x-y} = 4$ ……(i)
$\frac{15}{x+y} - \frac{9}{x-y} = -2$ ……(ii)
Substituting $\frac{1}{x+y}$ = u and $\frac{1}{x-y}$ = v in (i) and (ii), we get:
10u + 2v = 4 ……..(iii)
15u - 9v = -2 …….(iv)
Multiplying (iii) by 9 and (iv) by 2 and adding, we get:
90u + 30u = 36 – 4

$\Rightarrow 120u = 32$

$\Rightarrow u = \frac{32}{120} = \frac{4}{15}$

$\Rightarrow x + y = \frac{15}{4}$ $\left(\because \frac{1}{x+y} = u\right)$ .....(v)

On substituting $u = \frac{4}{15}$ in (iii), we get:

$10 \times \frac{4}{15} + 2v = 4$

$\frac{8}{3} + 2v = 4$

$\Rightarrow 2v = 4 - \frac{8}{3} = \frac{4}{3}$

$\Rightarrow v = \frac{2}{3}$

$\Rightarrow x - y = \frac{3}{2}$ $\left(\because \frac{1}{x-y} = v\right)$ .....(vi)

Adding (v) and (vi), we get

$2x = \frac{15}{4} + \frac{3}{2} \Rightarrow 2x = \frac{21}{4} \Rightarrow x = \frac{21}{8}$

Substituting $x = \frac{21}{8}$ in (v), we have

$\frac{21}{8} + y = \frac{15}{4} \Rightarrow y = \frac{15}{4} - \frac{21}{8} = \frac{9}{8}$

Hence, $x = \frac{21}{8}$ and $y = \frac{9}{8}$.

32.

Sol:

The given equations are:

$71x + 37y = 253$ .....(i)

$37x + 71y = 287$ ......(ii)

On adding (i) and (ii), we get:

$108x + 108y = 540$

$\Rightarrow 108(x + y) = 540$

$\Rightarrow (x + y) = 5$ ......(iii)

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

$34x - 34y = -34$

$\Rightarrow 34(x - y) = -34$

$\Rightarrow (x - y) = -1$ ......(iv)

On adding (iii) from (i), we get:

$2x = 5 - 1 = 4$

$\Rightarrow x = 2$

On subtracting (iv) from (iii), we get:

$2y = 5 + 1 = 6$

$\Rightarrow y = 3$

Hence, the required solution is x = 2 and y = 3.

33.

Sol:

The given equations are:

$217x + 131y = 913$ …..(i)

$131x + 217y = 827$ ……(ii)

On adding (i) and (ii), we get:

$348x + 348y = 1740$

$\Rightarrow 348(x + y) = 1740$

$\Rightarrow x + y = 5$ ……(iii)

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

$86x – 86y = 86$

$\Rightarrow 86(x – y) = 86$

$\Rightarrow x – y = 1$ ……(iv)

On adding (iii) from (i), we get:

$2x = 6$

$\Rightarrow x = 3$

On substituting x = 3 in (iii), we get:

$3 + y = 5$

$\Rightarrow y = 5 – 3 = 2$

Hence, the required solution is x = 3 and y = 2.

34.

Sol:

The given equations are:

$23x - 29y = 98$ …..(i)

$29x - 23y = 110$ ……(ii)

Adding (i) and (ii), we get: 52x

$– 52y = 208$

$\Rightarrow x – y = 4$ ……(iii)

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

$6x + 6y = 12$

$\Rightarrow x + y = 2$ ……(iv)

Now, adding equation (iii) and (iv), we get:

2x = 6

$\Rightarrow x = 3$

On substituting x = 3 in (iv), we have:

3 + y = 2

$\Rightarrow y = 2 – 3 = -1$

Hence, x = 3 and y = -1.

35.

Sol:

The given equations can be written as

$\frac{5}{x} + \frac{2}{y} = 6$ …….(i)

$\frac{-5}{x} + \frac{4}{y} = -3$ ……(ii)

Adding (i) and (ii), we get

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

Substituting y = 2 in (i), we have

$\frac{5}{x} + \frac{2}{2} = 6 \Rightarrow x = 1$

Hence, x = 1 and y = 2.

36.

Sol:

The given equations are

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

$\frac{1}{2(3x+y)} - \frac{1}{2(3x-y)} = -\frac{1}{8}$

$\frac{1}{3x+y} - \frac{1}{3x-y} = -\frac{1}{4}$ (Multiplying by 2) ……(ii)

Substituting $\frac{1}{3x+y}$ = u and $\frac{1}{3x-y}$ = v in (i) and (ii), we get:

$u + v = \frac{3}{4}$ ……..(iii)

$u – v = -\frac{1}{4}$ …….(iv)

Adding (iii) and (iv), we get:

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

$\Rightarrow$ u = $\frac{1}{4}$

$\Rightarrow$3x + y = 4 $\left(\because \frac{1}{3x+y} = u\right)$ …..(v)

Now, substituting u = $\frac{1}{4}$ in (iii), we get:

$\frac{1}{4}$ + v = $\frac{3}{4}$

v = $\frac{3}{4}$ - $\frac{1}{4}$

$\Rightarrow$v = $\frac{1}{2}$

$\Rightarrow$ 3x – y = 2 $\left(\because \frac{1}{3x-y} = v\right)$ …..(vi)

Adding (v) and (vi), we get

6x = 6 $\Rightarrow$x = 1

Substituting x = 1 in (v), we have

3 + y = 4 $\Rightarrow$y = 1

Hence, x = 1 and y = 1.

37.

Sol:

The given equations are

$\frac{1}{2(x+2y)} + \frac{5}{3(3x-2y)} = -\frac{3}{2}$ ……(i)

$\frac{1}{4(x+2y)} - \frac{3}{5(3x-2y)} = \frac{61}{60}$ ……(ii)

Putting $\frac{1}{x+2y}$ = u and $\frac{1}{3x-2y}$ = v, we get:

$\frac{1}{2}$u + $\frac{5}{3}$v = - $\frac{3}{2}$ ……..(iii)

$\frac{5}{4}$u – $\frac{3}{5}$v = $\frac{61}{60}$ …….(iv)

On multiplying (iii) by 6 and (iv) by 20, we get:

3u + 10v = -9 …..(v)

25u – 12v = $\frac{61}{3}$ …..(vi)

On multiplying (v) by 6 and (vi) by 5, we get

18u + 60v = -54 …….(vii)

125u – 60v = $\frac{305}{3}$ ……..(viii)

On adding(vii) and (viii), we get:

143u = $\frac{305}{3}$ – 54 = $\frac{305-162}{3}$ = $\frac{143}{3}$

$\Rightarrow$u = $\frac{1}{3}$ = $\frac{1}{x+2y}$

$\Rightarrow x + 2y = 3$ …….(ix)

On substituting u = $\frac{1}{3}$ in (v), we get:

1 + 10v = -9

$\Rightarrow$10v = -10

$\Rightarrow$v = -1

$\Rightarrow \frac{1}{3x-2y}$ = -1 $\Rightarrow$3x – 2y = -1 …….(x)

On adding (ix) and (x), we get:

4x = 2

$\Rightarrow$x = $\frac{1}{2}$

On substituting x = $\frac{1}{2}$ in (x), we get:

$\frac{3}{2}$ – 2y = -1

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

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

Hence, the required solution is x = $\frac{1}{2}$ and y = $\frac{5}{4}$.

38.

Sol:

The given equations are

$\frac{2}{3x+2y} + \frac{3}{3x-2y} = \frac{17}{5}$ ……(i)

$\frac{5}{3x+2y} + \frac{1}{3x-2y} = 2$ ……(ii)

Substituting $\frac{1}{3x+2y}$ = u and $\frac{1}{3x-2y}$ = v, in (i) and (ii), we get:

2u + 3v = $\frac{17}{5}$ ……..(iii)

5u + v = 2 …….(iv)

Multiplying (iv) by 3 and subtracting from (iii), we get:

2u – 15u = $\frac{17}{5}$ – 6

$\Rightarrow$ –13u = $\frac{-13}{5}$ $\Rightarrow$u = $\frac{1}{5}$

$\Rightarrow$3x + 2y = 5 $\left(\because \frac{1}{3x+2y} = u\right)$ …..(v)

Now, substituting u = $\frac{1}{5}$ in (iv), we get

1 + v = 2 $\Rightarrow$ v = 1

$\Rightarrow$ 3x – 2y = 1 $\left(\because \frac{1}{3x-2y} = v\right)$ …….(vi)

Adding(v) and (vi), we get:

$\Rightarrow 6x = 6 \Rightarrow x = 1$

Substituting x = 1 in (v), we get:

$3 + 2y = 5 \Rightarrow y = 1$

Hence, x = 1 and y =1.

39.

Sol:

The given equations can be written as

$\frac{3}{x} + \frac{6}{y} = 7$ …….(i)

$\frac{9}{x} + \frac{3}{y} = 11$ ……(ii)

Multiplying (i) by 3 and subtracting (ii) from it, we get

$\frac{18}{y} - \frac{3}{y} = 21 - 11$

$\Rightarrow \frac{15}{y} = 10$

$\Rightarrow y = \frac{15}{10} = \frac{3}{2}$

Substituting $y = \frac{3}{2}$ in (i), we have

$\frac{3}{x} + \frac{6 \times 2}{3} = 7$

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

Hence, x = 1 and $y = \frac{3}{2}$.

40.

Sol:

The given equations are

$x + y = a + b$ …….(i)

$ax - by = a^2 - b^2$ ……..(ii)

Multiplying (i) by b and adding it with (ii), we get

$bx + ax = ab + b^2 + a^2 - b^2$

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

Substituting x = a in (i), we have

$a + y = a + b$

$\Rightarrow y = b$

Hence, x = a and y = b.

41.

Sol:

The given equations are:

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

$\Rightarrow \frac{bx+ay}{ab} = 2$ [Taking LCM]

$\Rightarrow bx + ay = 2ab$ ....(i)

Again, $ax - by = (a^2 - b^2)$ .....(ii)

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

$b^2x + bay = 2ab^2$ ....(iii)

$a^2x - bay = a(a^2 - b^2)$ ....(iv)

On adding (iii) from (iv), we get:

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

$\Rightarrow (b^2 + a^2)x = 2ab^2 + a^3 - ab^2$

$\Rightarrow (b^2 + a^2)x = ab^2 + a^3$

$\Rightarrow (b^2 + a^2)x = a(b^2 + a^2)$

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

On substituting x = a in (i), we get:

$ba + ay = 2ab$

$\Rightarrow ay = ab$

$\Rightarrow y = b$

Hence, the solution is x = a and y = b.

42.

Sol:

The given equations are

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

$qx - py = p + q$ ....(ii)

Multiplying (i) by p and (ii) by q and adding them , we get

$p^2x + q^2x = p^2 - pq + pq + q^2$

$x = \frac{p^2 + q^2}{p^2 + q^2} = 1$

Substituting x = 1 in (i), we have

$p + qy = p - q$

$\Rightarrow qy = -p$

$\Rightarrow y = -1$
Hence, x = 1 and y = -1.

43.

Sol:
The given equations can be written as
$\frac{x}{a} - \frac{y}{b} = 0$ ....(i)
$ax + by = a^2 + b^2$ ......(ii)
From (i),
$y = \frac{bx}{a}$
Substituting $y = \frac{bx}{a}$ in (ii), we get
$ax + \frac{b \times bx}{a} = a^2 + b^2$
$\Rightarrow x = \frac{(a^2 + b^2) \times a}{a^2 + b^2} = a$
Now, substitute x = a in (ii) to get
$a^2 + by = a^2 + b^2$
$\Rightarrow by = b^2$
$\Rightarrow y = b$
Hence, x = a and y = b.

44.
Sol:
The given equations are
6(ax + by) = 3a + 2b
$\Rightarrow 6ax + 6by = 3a + 2b$ ....(i)
and 6(bx – ay) = 3b – 2a
$\Rightarrow 6bx - 6ay = 3b - 2a$ ....(ii)
On multiplying (i) by a and (ii) by b, we get
$6a^2x + 6aby = 3a^2 + 2ab$ ....(iii)
$6b^2x - 6aby = 3b^2 - 2ab$ ....(iv)
On adding (iii) and (iv), we get
$6(a^2 + b^2)x = 3(a^2 + b^2)$
$x = \frac{3(a^2 + b^2)}{6(a^2 + b^2)} = \frac{1}{2}$

On substituting x = $\frac{1}{2}$ in (i), we get:

$6a \times \frac{1}{2} + 6by = 3a + 2b$

$6by = 2b$

$y = \frac{2b}{6b} = \frac{1}{3}$

Hence, the required solution is x = $\frac{1}{2}$ and y = $\frac{1}{3}$.

45.

Sol:

The given equations are

$ax - by = a^2 + b^2$ ………(i)

$x + y = 2a$ ………(ii) From

(ii)

$y = 2a - x$

Substituting y = 2a – x in (i), we get

$ax – b(2a – x) = a^2 + b^2$

$\Rightarrow ax – 2ab + bx = a^2 + b^2$

$\Rightarrow x = \frac{a^2 + b^2 + 2ab}{a+b} = \frac{(a+b)^2}{a+b} = a + b$

Now, substitute x = a + b in (ii) to get

$a + b + y = 2a$

$\Rightarrow y = a – b$

Hence, x = a + b and y = a – b.

46.

Sol:

The given equations are:

$\frac{bx}{a} - \frac{ay}{b} + a + b = 0$

By taking LCM, we get:

$b^2x – a^2y = -a^2b – b^2a$ …..(i)

and $bx – ay + 2ab = 0$

$bx – ay = -2ab$ …….(ii)

On multiplying (ii) by a, we get:

$abx – a^2y = -2a^2b$ ……(iii)

On subtracting (i) from (iii), we get:

$abx – b^2x = 2a^2b + a^2b + b^2a = -a^2b + b^2a$

$\Rightarrow x(ab - b^2) = -ab(a - b)$

$\Rightarrow x(a - b)b = -ab(a - b)$

$\therefore x = \frac{-ab(a-b)}{(a-b)b} = -a$

On substituting x = -a in (i), we get:

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

$\Rightarrow -b^2a - a^2y = -a^2b - b^2a$

$\Rightarrow -a^2y = -a^2b$

$\Rightarrow y = b$

Hence, the solution is x = -a and y = b.

47.

Sol:

The given equations are:

$\frac{bx}{a} + \frac{ay}{b} = a^2 + b^2$

By taking LCM, we get:

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

$\Rightarrow b^2x + a^2y = (ab)a^2 + b^2$

$\Rightarrow b^2x + a^2y = a^3b + ab^3$ …..(i)

Also, $x + y = 2ab$ …….(ii)

On multiplying (ii) by a^2, we get:

$a^2x + a^2y = 2a^3b$ ……(iii)

On subtracting (iii) from (i), we get:

$(b^2 - a^2)x = a^3b + ab^3 - 2a^3b$

$\Rightarrow (b^2 - a^2)x = -a^3b + ab^3$

$\Rightarrow (b^2 - a^2)x = ab(b^2 - a^2)$

$\Rightarrow (b^2 - a^2)x = ab(b^2 - a^2)$

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

On substituting x = ab in (i), we get:

$b^2(ab) + a^2y = a^3b + ab^3$

$\Rightarrow a^2y = a^3b$

$\Rightarrow \frac{a^3b}{a^2} = ab$

Hence, the solution is x = ab and y = ab.

48.

Sol:
The given equations are
x + y = a + b ………(i)
ax - by = $a^2 - b^2$ ………(ii)
From (i)
y = a + b - x
Substituting y = a + b - x in (ii), we get
ax – b(a + b - x) = $a^2 - b^2$
$\Rightarrow$ax – ab - b^2 + bx = $a^2 - b^2$
$\Rightarrow x = \frac{a^2 + ab}{a+b} = a$
Now, substitute x = a in (i) to get
a + y = a + b
$\Rightarrow$y = b
Hence, x = a and y = b.

49.

Sol:
The given equations are
$a^2x + b^2y = c^2$ ………(i)
$b^2x + a^2y = d^2$ ………(ii)
Multiplying (i) by a^2 and (ii) by b^2 and subtracting, we get
$a^4x – b^4x = a^2c^2 - b^2 d^2$
$\Rightarrow x = \frac{a^2c^2 - b^2d^2}{a^4 - b^4}$
Now, multiplying (i) by b^2 and (ii) by a^2 and subtracting, we get
$b^4y – a^4y = b^2c^2 - a^2 d^2$
$\Rightarrow y = \frac{b^2c^2 - a^2d^2}{b^4 - a^4}$
Hence, $x = \frac{a^2c^2 - b^2d^2}{a^4 - b^4}$ and $y = \frac{b^2c^2 - a^2d^2}{b^4 - a^4}$.

50.

Sol:
The given equations are
$\frac{x}{a} + \frac{y}{b} = a + b$ …….(i)
$\frac{x}{a^2} + \frac{y}{b^2} = 2$ ……(ii)