Exercise – 3F

1.

Sol:
The given equations are
$x + 2y – 8 = 0$ ……(i)
$2x + 4y – 16 = 0$ ……(ii)
Which is of the form $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$, where
$a_1 = 1, b_1 = 2, c_1 = -8, a_2 = 2, b_2 = 4$ and $c_2 = -18$

Now

$\frac{a_1}{a_2} = \frac{1}{2}$

$\frac{b_1}{b_2} = \frac{2}{4} = \frac{1}{2}$

$\frac{c_1}{c_2} = \frac{-8}{-16} = \frac{1}{2}$

$\Rightarrow \frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2} = \frac{1}{2}$

Thus, the pair of linear equations are coincident and therefore has infinitely many solutions.

2.

Sol:

The given equations are

$2x + 3y – 7 = 0$ ……(i)

$(k – 1)x + (k + 2)y – 3k = 0$ ……(ii)

Which is of the form $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$, where

$a_1 = 2$, $b_1 = 3$, $c_1 = -7$, $a_2 = k – 1$, $b_2 = k + 2$ and $c_2 = -3k$

For the given pair of linear equations to have infinitely many solutions, we must have

$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

$\Rightarrow \frac{2}{k-1} = \frac{3}{k+2} = \frac{-7}{-3k}$

$\Rightarrow \frac{2}{k-1} = \frac{3}{k+2}, \frac{3}{k+2} = \frac{-7}{-3k}$ and $\frac{2}{k-1} = \frac{-7}{-3k}$

$\Rightarrow 2(k + 2) = 3(k – 1)$, $9k = 7k + 14$ and $6k = 7k – 7$

$\Rightarrow k = 7$, $k = 7$ and $k = 7$

Hence, $k = 7$.

3.

Sol:

The given pair of linear equations are

$10x + 5y – (k – 5) = 0$ ……(i)

$20x + 10y – k = 0$ ……(ii)

Which is of the form $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$, where

$a_1 = 10$, $b_1 = 5$, $c_1 = -(k – 5)$, $a_2 = 20$, $b_2 = 10$ and $c_2 = -k$

For the given pair of linear equations to have infinitely many solutions, we must have

$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

$\Rightarrow \frac{10}{20} = \frac{5}{10} = \frac{-(k-5)}{-k}$

$\Rightarrow \frac{1}{2} = \frac{k-5}{k}$

$\Rightarrow 2k - 10 = k \Rightarrow k = 10$

Hence, k = 10.

4.

Sol:

The given pair of linear equations are

$2x + 3y - 9 = 0$ ……(i)

$6x + (k-2)y - (3k-2) = 0$ ……(ii)

Which is of the form $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$, where

$a_1 = 2, b_1 = 3, c_1 = -9, a_2 = 6, b_2 = k - 2$ and $c_2 = -(3k - 2)$

For the given pair of linear equations to have infinitely many solutions, we must have

$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

$\Rightarrow \frac{2}{6} = \frac{3}{k-2} \neq \frac{-9}{-(3k-2)}$

$\Rightarrow \frac{2}{6} = \frac{3}{k-2}, \frac{3}{k-2} \neq \frac{-9}{-(3k-2)}$

$\Rightarrow k = 11, \frac{3}{k-2} \neq \frac{9}{(3k-2)}$

$\Rightarrow k = 11, 3(3k-2) \neq 9(k-2)$

$\Rightarrow k = 11, 1 \neq 3$ (true)

Hence, k = 11.

5.

Sol:

The given pair of linear equations are

$x + 3y - 4 = 0$ ……(i)

$2x + 6y - 7 = 0$ ……(ii)

Which is of the form $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$, where

$a_1 = 1, b_1 = 3, c_1 = -4, a_2 = 2, b_2 = 6$ and $c_2 = -7$

Now

$\frac{a_1}{a_2} = \frac{1}{2}$

$\frac{b_1}{b_2} = \frac{3}{6} = \frac{1}{2}$

$\frac{c_1}{c_2} = \frac{-4}{-7} = \frac{4}{7}$

$\Rightarrow \frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

Thus, the pair of the given linear equations has no solution.

6.

Sol:

The given pair of linear equations are

$3x + ky = 0$ ……(i)

$2x – y = 0$ ……(ii)

Which is of the form $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$, where

$a_1 = 3$, $b_1 = k$, $c_1 = 0$, $a_2 = 2$, $b_2 = -1$ and $c_2 = 0$

For the system to have a unique solution, we must have

$\frac{a_1}{a_2} = \frac{b_1}{b_2}$

$\Rightarrow \frac{3}{2} \neq \frac{k}{-1}$

$\Rightarrow k \neq -\frac{3}{2}$

Hence, $k \neq -\frac{3}{2}$.

7.

Sol:

Let the numbers be x and y, where x > y.

Then as per the question

$x – y = 5$ …….(i)

$x^2 – y^2 = 65$ …….(ii)

Dividing (ii) by (i), we get

$\frac{x^2 - y^2}{x - y} = \frac{65}{5}$

$\Rightarrow \frac{(x-y)(x+y)}{x-y} = 13$

$\Rightarrow x + y = 13$ ……….(iii)

Now, adding (i) and (ii), we have

$2x = 18 \Rightarrow x = 9$

Substituting x = 9 in (iii), we have

$9 + y = 13 \Rightarrow y = 4$

Hence, the numbers are 9 and 4.

8.

Sol:

Let the cost of 1 pen and 1 pencil are ₹x and ₹y respectively.

Then as per the question

$5x + 8y = 120$ …….(i)

$8x + 5y = 153$ …….(ii)

Adding (i) and (ii), we get

$13x + 13y = 273$

$\Rightarrow x + y = 21$ …….(iii)

Subtracting (i) from (ii), we get

$3x - 3y = 33$

$\Rightarrow x - y = 11$ ………(iv)

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

$2x = 32 \Rightarrow x = 16$

Substituting $x = 16$ in (iii), we have

$16 + y = 21 \Rightarrow y = 5$

Hence, the cost of 1 pen and 1 pencil are respectively ₹16 and ₹5.

9.

Sol:

Let the larger number be x and the smaller number be y.

Then as per the question

$x + y = 80$ …….(i)

$x = 4y + 5$

$x - 4y = 5$ …….(ii)

Subtracting (ii) from (i), we get

$5y = 75 \Rightarrow y = 15$

Now, putting $y = 15$ in (i), we have

$x + 15 = 80 \Rightarrow x = 65$

Hence, the numbers are 65 and 15.

10.

Sol:

Let the ones digit and tens digit be x and y respectively.

Then as per the question

$x + y = 10$ …….(i)
$(10y + x) - 18 = 10x + y$
$x - y = -2$ …….(ii)
Adding (i) and (ii), we get
$2x = 8 \Rightarrow x = 4$
Now, putting x = 4 in (i), we have
$4 + y = 10 \Rightarrow y = 6$
Hence, the number is 64.

11.

Sol:
Let the number of stamps of 20p and 25p be x and y respectively.
Then as per the question
$x + y = 47$ …….(i)
$0.20x + 0.25y = 10$
$4x + 5y = 200$ …….(ii)
From (i), we get
$y = 47 - x$
Now, substituting y = 47 – x in (ii), we have
$4x + 5(47 - x) = 200$
$\Rightarrow 4x - 5x + 235 = 200$
$\Rightarrow x = 235 - 200 = 35$
Putting x = 35 in (i), we get
$35 + y = 47$
$\Rightarrow y = 47 - 35 = 12$
Hence, the number of 20p stamps and 25p stamps are 35 and 12 respectively.

12.

Sol:
Let the number of hens and cow be x and y respectively.
As per the question
$x + y = 48$ …….(i)
$2x + 4y = 140$
$x + 2y = 70$ …….(ii)
Subtracting (i) from (ii), we have
$y = 22$

Hence, the number of cows is 22.

13.

Sol:
The given pair of equation is
$\frac{2}{x} + \frac{3}{y} = \frac{9}{xy}$ ………(i)
$\frac{4}{x} + \frac{9}{y} = \frac{21}{xy}$ ………(ii)
Multiplying (i) and (ii) by xy, we have
$3x + 2y = 9$ ……….(iii)
$9x + 4y = 21$ ………(iv)
Now, multiplying (iii) by 2 and subtracting from (iv), we get
$9x – 6x = 21 – 18 \Rightarrow x = \frac{3}{3} = 1$
Putting x = 1 in (iii), we have
$3 \times 1 + 2y = 9 \Rightarrow y = \frac{9-3}{2} = 3$
Hence, x = 1 and y = 3.

14.

Sol:
The given pair of equations is
$\frac{x}{4} + \frac{y}{3} = \frac{5}{12}$ ………(i)
$\frac{x}{2} + y = 1$ ………(ii)
Multiplying (i) by 12 and (ii) by 4, we have
$3x + 4y = 5$ ……….(iii)
$2x + 4y = 4$ ………(iv)
Now, subtracting (iv) from (iii), we get
$x = 1$
Putting x = 1 in (iv), we have
$2 + 4y = 4$
$\Rightarrow 4y = 2$
$\Rightarrow y = \frac{1}{2}$
$\therefore x + y = 1 + \frac{1}{2} = \frac{3}{2}$
Hence, the value of x + y is $\frac{3}{2}$.

15.

Sol:

The given pair of equations is

$12x + 17y = 53$ ……..(i)

$17x + 12y = 63$ …….(ii)

Adding (i) and (ii), we get

$29x + 29y = 116$

$\Rightarrow x + y = 4$ (Dividing by 4)

Hence, the value of x + y is 4.

16.

Sol:

The given system is

$3x + 5y = 0$ ……(i)

$kx + 10y = 0$ ……(ii)

This is a homogeneous system of linear differential equation, so it always has a zero solution i.e., x = y = 0.

But to have a non-zero solution, it must have infinitely many solutions.

For this, we have

$\frac{a_1}{a_2} = \frac{b_1}{b_2}$

$\Rightarrow \frac{3}{k} = \frac{5}{10} = \frac{1}{2}$

$\Rightarrow k = 6$

Hence, k = 6.

17.

Sol:

The given system is

$kx - y - 2 = 0$ ……(i)

$6x - 2y - 3 = 0$ ……(ii)

Here, $a_1 = k$, $b_1 = -1$, $c_1 = -2$, $a_2 = 6$, $b_2 = -2$ and $c_2 = -3$

For the system, to have a unique solution, we must have

$\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

$\Rightarrow \frac{k}{6} \neq \frac{-1}{-2} = \frac{1}{2}$

$\Rightarrow k \neq 3$

Hence, $k \neq 3$.

18.

Sol:
The given system is
2x + 3y – 5 = 0 ……(i)
4x + ky – 10 = 0 ……(ii)
Here, $a_1 = 2$, $b_1 = 3$, $c_1 = -5$, $a_2 = 4$, $b_2 = k$ and $c_2 = -10$
For the system, to have an infinite number of solutions, we must have
$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$
$\Rightarrow \frac{2}{4} = \frac{3}{k} = \frac{-5}{-10}$
$\Rightarrow \frac{1}{2} = \frac{3}{k} = \frac{1}{2}$
⇒ k = 6
Hence, k = 6.

19.

Sol:
The given system is
2x + 3y – 1 = 0 ……(i)
4x + 6y – 4 = 0 ……(ii)
Here, $a_1 = 2$, $b_1 = 3$, $c_1 = -1$, $a_2 = 4$, $b_2 = 6$ and $c_2 = -4$
Now,
$\frac{a_1}{a_2} = \frac{2}{4} = \frac{1}{2}$
$\frac{b_1}{b_2} = \frac{3}{6} = \frac{1}{2}$
$\frac{c_1}{c_2} = \frac{-1}{-4} = \frac{1}{4}$
Thus, $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$ and therefore the given system has no solution.

20.

Sol:
The given system is
x + 2y – 3 = 0 ……(i)
5x + ky + 7 = 0 ……(ii)
Here, $a_1 = 1$, $b_1 = 2$, $c_1 = -3$, $a_2 = 5$, $b_2 = k$ and $c_2 = 7$.
For the system, to be consistent, we must have
$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$
$\Rightarrow \frac{1}{5} = \frac{2}{k} \neq \frac{-3}{7}$

$\Rightarrow \frac{1}{5} = \frac{2}{k}$
$\Rightarrow$ k = 10
Hence, k = 10.

21.

Sol:
The given system of equations is
$\frac{3}{x+y} + \frac{2}{x-y} = 2$ ………..(i)
$\frac{9}{x+y} - \frac{4}{x-y} = 1$ ………..(ii)
Substituting $\frac{1}{x+y}$ = u and $\frac{1}{x-y}$ = v in (i) and (ii), the given equations are changed to
3u + 2v = 2 ………(iii)
9u – 4v = 1 ………(iv)
Multiplying (i) by 2 and adding it with (ii), we get
15u = 4 + 1 $\Rightarrow$ u = $\frac{1}{3}$
Multiplying (i) by 3 and subtracting (ii) from it, we get
6u + 4v = 6 – 1 $\Rightarrow$ u = $\frac{5}{10} = \frac{1}{2}$
Therefore
x + y = 3 ………….(v)
x – y = 2 …………(vi)
Now, adding (v) and (vi) we have
2x = 5 $\Rightarrow$ x = $\frac{5}{2}$
Substituting x = $\frac{5}{2}$ in (v), we have
$\frac{5}{2}$ + y = 3 $\Rightarrow$ y = 3 – $\frac{5}{2} = \frac{1}{2}$
Hence, x = $\frac{5}{2}$ and y = $\frac{1}{2}$.

Exercise – MCQ

1.

Answer: (c) x = 3, y = 2
Sol:
The given system of equations is
2x + 3y = 12 ……..(i)
3x – 2y = 5 ……..(ii)
Multiplying (i) by 2 and (ii) by 3 and then adding, we get

$4x + 9x = 24 + 15$

$\Rightarrow x = \frac{39}{13} = 3$

Now, putting x = 3 in (i), we have

$2 \times 3 + 3y = 12 \Rightarrow y = \frac{12-6}{3} = 2$

Thus, x = 3 and y = 2.

2.

Answer: (c) x = 6, y = 4

Sol:

The given system of equations is

$x - y = 2$ ……..(i)

$x + y = 10$ ……..(ii)

Adding (i) and (ii), we get

$2x = 12 \Rightarrow x = 6$

Now, putting x = 6 in (ii), we have

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

Thus, x = 6 and y = 4.

3.

Answer: (a) x = 2, y = 3

Sol:

The given system of equations is

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

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

Multiplying (i) and (ii) by 6, we get

$4x - 3y = -1$ ……..(iii)

$3x + 4y = 18$ ………(iv)

Multiplying (iii) by 4 and (iv) by 3 and adding, we get

$16x + 9x = -4 + 54$

$\Rightarrow x = \frac{50}{25} = 2$

Now, putting x = 2 in (iv), we have

$3 \times 2 + 4y = 18 \Rightarrow y = \frac{18-6}{4} = 3$

Thus, x = 2 and y = 3.

4.

Answer: (d) x = , y =

Sol:
The given system of equations is

$\frac{1}{x} + \frac{2}{y} = 4$ ……..(i)

$\frac{3}{y} - \frac{1}{x} = 11$ ……..(ii)

Adding (i) and (ii), we get

$\frac{2}{y} + \frac{3}{y} = 15$

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

Now, putting $y = \frac{1}{3}$ in (i), we have

$\frac{1}{x} + 2 \times 3 = 4 \Rightarrow \frac{1}{x} = 4 - 6 \Rightarrow x = -\frac{1}{2}$

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

5.

Answer: (a) x = 1, y = 1
Sol:
Consider $\frac{2x+y+2}{5} = \frac{3x-y+1}{3}$ and $\frac{3x-y+1}{3} = \frac{3x+2y+1}{3}$. Now, simplifying these equations, we get

3(2x + y + 2) = 5(3x – y + 1)

⇒ 6x + 3y + 6 = 15x – 5y + 5

⇒ 9x – 8y = 1 ……….(i)

And

6(3x – y + 1) = 3(3x + 2y + 1)

⇒18x – 6y + 6 = 9x + 6y + 3

⇒3x – 4y = -1 ……………(ii)

Multiplying (ii) by 2 and subtracting it from (i)

9x – 6x = 1 + 2 ⇒ x = 1

Now, putting x = 1 in (ii), we have

$3 \times 1 - 4y = -1 \Rightarrow y = \frac{3+1}{4} = 1$

Thus, x = 1, y = 1.

6.

Answer: (b)

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 in (i) and (ii), the new system becomes

3u + 2v = 2 ……..(iii)

9u – 4v = 1 …….(iv)

Now, multiplying (iii) by 2 and adding it with (iv), we get

$6u + 9u = 4 + 1 \Rightarrow u = \frac{5}{15} = \frac{1}{3}$

Again, multiplying (iii) by 2 and subtracting (iv) from , we get

$6v + 4v = 6 - 1 \Rightarrow v = \frac{5}{10} = \frac{1}{2}$

Therefore

x + y = 3 ……….(v)

x – y = 2 ……..(vi)

Adding (v) and (vi), we get

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

Substituting $x = \frac{5}{2}$, in (v), we have

$\frac{5}{2} + y = 3 \Rightarrow y = 3 - \frac{5}{2} = \frac{1}{2}$.

Thus, $x = \frac{5}{2}$ and $y = \frac{1}{2}$.

7.

Answer: (c) x = 3, y = 4

Sol:

The given equations are

4x + 6y = 3xy ……..(i)

8x + 9y = 5xy ……..(ii)

Dividing (i) and (ii) by xy, we get

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

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

Multiplying (iii) by 2 and subtracting (iv) from it, we get

$\frac{12}{x} - \frac{9}{x} = 6 - 5 \Rightarrow \frac{3}{x} = 1 \Rightarrow x = 3$

Substituting x = 3 in (iii), we get

$\frac{6}{3} + \frac{4}{y} = 3 \Rightarrow \frac{4}{y} = 1 \Rightarrow y = 4$

Thus, x = 3 and y = 4.

8.

Answer: (a) x = 1, y = 2

Sol:

The given system of equations is

$29x + 37y = 103$ ……..(i)

$37x + 29y = 95$ ……..(ii)

Adding (i) and (ii), we get

$66x + 66y = 198$

$\Rightarrow x + y = 3$ ………(iii)

$\Rightarrow$ Subtracting (i) from (ii), we get

$8x - 8y = -8$

$\Rightarrow x - y = -1$

Adding (iii) and (iv), we get

$2x = 2 \Rightarrow x = 1$

Substituting x = 1 in (iii), we have

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

Thus, x = 1 and y = 2.

9.

Answer: (c) 0

Sol:

$\because 2^{x+y} = 2^{x-y} = \sqrt{8}$

$\therefore x + y = x - y$

$\Rightarrow y = 0$

10.

Answer: (b) x = , y = 1

Sol:

The given equations are

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

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

Multiplying (ii) by 2 and subtracting it from (ii), we get

$\frac{3}{y} - \frac{1}{y} = 6 - 4$

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

Substituting y = 1 in (ii), we get

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

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

$\Rightarrow x = \frac{2}{3}$.

11.

Answer: (d) $\Rightarrow k \neq 3$

Sol:

The given equations are

$kx - y - 2 = 0$ ………(i)

$6x - 2y - 3 = 0$ ……..(ii)

Here, $a_1 = k$, $b_1 = -1$, $c_1 = -2$, $a_2 = 6$, $b_2 = -2$ and $c_2 = -3$.

For the given system to have a unique solution, we must have

$\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

$\Rightarrow \frac{k}{6} \neq \frac{-1}{-2}$

$\Rightarrow k \neq 3$

12.

Answer: (b) $k \neq -6$

Sol:

The correct option is (b).

The given system of equations can be written as follows:

x – 2y – 3 = 0 and 3x + ky – 1 = 0

The given equations are of the following form:

$a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$

Here, $a_1 = 1$, $b_1 = -2$, $c_1 = -3$, $a_2 = 3$, $b_2 = k$ and $c_2 = -1$.

$\therefore \frac{a_1}{a_2} = \frac{1}{3}, \frac{b_1}{b_2} = \frac{-2}{k}$ and $\frac{c_1}{c_2} = \frac{-3}{-1} = 3$

These graph lines will intersect at a unique point when we have:

$\frac{a_1}{a_2} \neq \frac{b_1}{b_2} \Rightarrow \frac{1}{3} \neq \frac{-2}{k} \Rightarrow k \neq -6$

Hence, k has all real values other than –6.

13.

Answer: (a) k = 10

Sol:

The correct option is (a).

The given system of equations can be written as follows:

x + 2y – 3 = 0 and 5x + ky + 7 = 0

The given equations are of the following form:

$a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$

Here, $a_1 = 1$, $b_1 = 2$, $c_1 = -3$, $a_2 = 5$, $b_2 = k$ and $c_2 = 7$.

$\therefore \frac{a_1}{a_2} = \frac{1}{5}, \frac{b_1}{b_2} = \frac{2}{k}$ and $\frac{c_1}{c_2} = \frac{-3}{7}$

For the system of equations to have no solution, we must have:

$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

$\therefore \frac{1}{5} = \frac{2}{k} \neq \frac{-3}{7} \Rightarrow k = 10$

14.

Answer: (d) $\frac{15}{4}$

Sol:

The given system of equations can be written as follows:

3x + 2ky – 2 = 0 and 2x + 5y + 1 = 0

The given equations are of the following form:

$a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$

Here, $a_1 = 3$, $b_1 = 2k$, $c_1 = -2$, $a_2 = 2$, $b_2 = 5$ and $c_2 = 1$

$\therefore \frac{a_1}{a_2} = \frac{3}{2}, \frac{b_1}{b_2} = \frac{2k}{5}$ and $\frac{c_1}{c_2} = \frac{-2}{1}$

For parallel lines, we have:

$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

$\therefore \frac{3}{2} = \frac{2k}{5} \neq \frac{-2}{1}$

$\Rightarrow$ k = $\frac{15}{4}$

15.

Answer: (d) all real values except -6

Sol:

The given system of equations can be written as follows:

kx – 2y – 3 = 0 and 3x + y – 5 = 0

The given equations are of the following form:

$a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$

Here, $a_1 = k$, $b_1 = -2$, $c_1 = -3$ and a2 = 3, $b_2 = 1$ and $c_2 =$ -5

$\therefore \frac{a_1}{a_2} = \frac{k}{3}, \frac{b_1}{b_2} = \frac{-2}{1}$ and $\frac{c_1}{c_2} = \frac{-3}{-5} = \frac{3}{5}$

Thus, for these graph lines to intersect at a unique point, we must have:

$\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

$\Rightarrow \frac{k}{3} \neq \frac{-2}{1} \Rightarrow k \neq -6$

Hence, the graph lines will intersect at all real values of k except –6.

16.

Answer: (d) no solution

Sol:

The given system of equations can be written as:

x + 2y + 5 = 0 and -3x - 6y + 1 = 0

The given equations are of the following form:

$a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$

Here, $a_1 = 1$, $b_1 = 2$, $c_1 = 5$, $a_2 = -3$, $b_2 = -6$ and $c_2 = 1$

$\therefore \frac{a_1}{a_2} = \frac{1}{-3}, \frac{b_1}{b_2} = \frac{2}{6} = \frac{1}{-3}$ and $\frac{c_1}{c_2} = \frac{5}{1}$

$\therefore \frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

Hence, the given system has no solution.

17.

Answer: (d) no solution

Sol:

The given system of equations can be written as:

2x + 3y - 5 = 0 and 4x + 6y - 15 = 0

The given equations are of the following form:

$a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$

Here, $a_1 = 2$, $b_1 = 3$, $c_1 = -5$, $a_2 = 4$, $b_2 = 6$ and $c_2 = -15$

$\therefore \frac{a_1}{a_2} = \frac{2}{4} = \frac{1}{2}, \frac{b_1}{b_2} = \frac{3}{6} = \frac{1}{2}$ and $\frac{c_1}{c_2} = \frac{-5}{-15} = \frac{1}{3}$

$\therefore \frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

Hence, the given system has no solution.

18.

Answer: (d) intersecting or coincident

Sol:

If a pair of linear equations is consistent, then the two graph lines either intersect at a point or coincidence.

19.

Answer: (a) parallel

Sol:

If a pair of linear equations in two variables is inconsistent, then no solution exists as they have no common point. And, since there is no common solution, their graph lines do not intersect. Hence, they are parallel.

20.

Answer: (b) 40^0

Sol:

Let $\angle A = x^0$ and $\angle B = y^0$

$\therefore \angle A = 3\angle B = (3y)^0$

Now, $\angle A + \angle B + \angle C = 180^0$

$\Rightarrow x + y + 3y = 180$

$\Rightarrow x + 4y = 180$ ……(i)

Also, $\angle C = 2(\angle A + \angle B)$

$\Rightarrow 3y = 2(x + y)$

$\Rightarrow 2x – y = 0$ ……..(ii)

On multiplying (ii) by 4, we get:

$8x - 4y = 0$ …….(iii)

On adding (i) and (iii) we get:

$9x = 180 \Rightarrow x = 20$

On substituting x = 20 in (i), we get:

$20 + 4y = 180 \Rightarrow 4y = (180 - 20) = 160 \Rightarrow y = 40$

$\therefore x = 20$ and $y = 40$

$\therefore \angle B = y^0 = 40^0$

21.

Answer: (b) 80^0

Sol:

The correct option is (b).

In a cyclic quadrilateral ABCD:

$\angle A = (x + y + 10)^0$

$\angle B = (y + 20)^0$

$\angle C = (x + y - 30)^0$

$\angle D = (x + y)^0$

We have:

$\angle A + \angle C = 180^0$ and $\angle B + \angle D = 180^0$ [Since ABCD is a cyclic quadrilateral]

Now, $\angle A + \angle C = (x + y + 10)^0 + (x + y - 30)^0 = 180^0$

$\Rightarrow 2x + 2y - 20 = 180$

$\Rightarrow x + y - 10 = 90$

$\Rightarrow x + y = 160$ ……(i)

Also, $\angle B + \angle D = (y + 20)^0 + (x + y)^0 = 180^0$

$\Rightarrow x + 2y + 20 = 180$

$\Rightarrow x + 2y = 160$

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

$y = (160 - 100) = 60$

On substituting y = 60 in (i), we get:

$x + 60 = 100 \Rightarrow x = (100 - 60) = 40$

$\therefore \angle B = (y + 20)^0 = (60 + 20)^0 = 80^0$

22.

Answer: (d) 40 years

Sol:

Let the man's present age be x years.
Let his son's present age be y years.
Five years later:
$(x + 5) = 3(y + 5)$
$\Rightarrow x + 5 = 3y + 15$
$\Rightarrow x - 3y = 10$ ………..(i)
Five years ago:
$(x - 5) = 7(y - 5)$
$\Rightarrow x - 5 = 7y - 35$
$\Rightarrow x - 7y = -30$ ………..(ii)
On subtracting (i) from (ii), we get:
$-4y = -40 \Rightarrow y = 10$
On substituting y = 10 in (i), we get:
$x - 3 \times 10 = 10 \Rightarrow x - 30 = 10 \Rightarrow x = (10 + 30) = 40$ years
Hence, the man's present age is 40 years.

23.

Answer: (c)
Sol:
Option (c) is the correct answer.
Clearly, Reason (R) is false.
On solving $x + y = 8$ and $x - y = 2$, we get:
$x = 5$ and $y = 3$
Thus, the given system has a unique solution. So, assertion (A) is true. ∴ Assertion (A) is true and Reason (R) is false.

24.
Answer: (b) parallel
Sol:

The given equations are as follows:

6x - 2y + 9 = 0 and 3x - y + 12 = 0

They are of the following form:

$a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$

Here, $a_1 = 6$, $b_1 = -2$, $c_1 = 9$ and $a_2 = 3$, $b_2 = -1$ and $c_2 = 12$

$\therefore \frac{a_1}{a_2} = \frac{6}{3} = \frac{2}{1}, \frac{b_1}{b_2} = \frac{-2}{-1} = \frac{2}{1}$ and $\frac{c_1}{c_2} = \frac{9}{12} = \frac{3}{4}$

$\therefore \frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

The given system has no solution.

Hence, the lines are parallel.

25.

Answer:

Sol:

The given equations are as follows:

2x + 3y – 2 = 0 and x – 2y – 8 = 0

They are of the following form:

$a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$

Here, $a_1 = 2$, $b_1 = 3$, $c_1 = -2$ and $a_2 = 1$, $b_2 = -2$ and $c_2 = -8$

$\therefore \frac{a_1}{a_2} = \frac{2}{1}, \frac{b_1}{b_2} = \frac{3}{-2}$ and $\frac{c_1}{c_2} = \frac{-2}{-8} = \frac{1}{4}$

$\therefore \frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

The given system has a unique solution.

Hence, the lines intersect exactly at one point.

26.

Answer: (a) coincident

Sol:

The correct option is (a).

The given system of equations can be written as follows:

$5x - 15y - 8 = 0$ and $3x - 9y - \frac{24}{5} = 0$

The given equations are of the following form:

$a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$

Here, $a_1 = 5$, $b_1 = -15$, $c_1 = -8$ and $a_2 = 3$, $b_2 = -9$ and $c_2 = -\frac{24}{5}$

$\therefore \frac{a_1}{a_2} = \frac{5}{3}, \frac{b_1}{b_2} = \frac{-15}{-9} = \frac{5}{3}$ and $\frac{c_1}{c_2} = -8 \times \frac{5}{-24} = \frac{5}{3}$

$\therefore \frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

The given system of equations will have an infinite number of solutions.

Hence, the lines are coincident.

27.

Answer: (a) 96

Sol:

Let the tens and the units digits of the required number be x and y, respectively.

Required number = (10x + y)

According to the question, we have:

x + y = 15 ……..(i)

Number obtained on reversing its digits = (10y + x)

∴ (10y + x) = (10x + y) + 9

⇒ 10y + x – 10x – y = 9

⇒ 9y – 9x = 9

⇒ y – x = 1 …….(ii)

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

2y = 16 ⇒ y = 8

On substituting y = 8 in (i), we get:

x + 8 = 15 ⇒ x = (15 – 8) = 7

Number = (10x + y) = 10 × 7 + 8 = 70 + 8 = 78

Hence, the required number is 78.

Exercise – Formative Assessment

1.

Answer: (a) parallel lines

Sol:

The given system of equations can be written as follows:

x + 2y – 3 = 0 and 2x + 4y + 7 = 0

The given equations are of the following form:

$a_1x + b_1x + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$

Here, $a_1 = 1$, $b_1 = 2$, $c_1 = -3$ and $a_2 = 2$, $b_2 = 4$ and $c_2 = 7$

$\therefore \frac{a_1}{a_2} = \frac{1}{2}, \frac{b_1}{b_2} = \frac{2}{4} = \frac{1}{2}$ and $\frac{c_1}{c_2} = \frac{-3}{7}$

$\therefore \frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

So, the given system has no solution.

Hence, the lines are parallel.

2.

Answer: (d) a = -5, b = -1

Sol:

The given system of equations can be written as follows:

$2x – 3y – 7 = 0$ and $(a + b)x – (a + b – 3)y – (4a + b) = 0$

The given equations are of the following form:

$a_1x + b_1x + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$

Here, $a_1 = 2$, $b_1 = -3$, $c_1 = -7$ and $a_2 = (a + b)$, $b_2 = –(a + b – 3)$ and $c_2 = –(4a + b)$

$\therefore \frac{a_1}{a_2} = \frac{2}{(a+b)}, \frac{b_1}{b_2} = \frac{-3}{-(a+b-3)} = \frac{3}{(a+b-3)}$ and $\frac{c_1}{c_2} = \frac{-7}{-(4a+b)} = \frac{7}{(4a+b)}$

For an infinite number of solutions, we must have:

$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

$\therefore \frac{2}{(a+b)} = \frac{3}{(a+b-3)} = \frac{7}{(4a+b)}$

Now, we have:

$\frac{2}{(a+b)} = \frac{3}{(a+b-3)} \Rightarrow 2a + 2b – 6 = 3a + 3b$

$\Rightarrow a + b + 6 = 0$ ……(i)

Again, we have:

$\frac{3}{(a+b-3)} = \frac{7}{(4a+b)} \Rightarrow 12a + 3b = 7a + 7b – 21$

$\Rightarrow 5a – 4b + 21 = 0$ …….(ii)

On multiplying (i) by 4, we get:

$4a + 4b + 24 = 0$ ……(iii)

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

$9a = -45 \Rightarrow a = -5$

On substituting a = -5 in (i), we get:

$-5 + b + 6 = 0 \Rightarrow b = -1$

$\therefore$a = -5 and b = -1.

3.

Answer: (a) a unique solution

Sol:

The given system of equations can be written as follows:

$2x + y – 5 = 0$ and $3x + 2y – 8 = 0$

The given equations are of the following form:

$a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$

Here, $a_1 = 2$, $b_1 = 1$, $c_1 = -5$ and $a_2 = 3$, $b_2 = 2$ and $c_2 = –8$

$\therefore \frac{a_1}{a_2} = \frac{2}{3}, \frac{b_1}{b_2} = \frac{1}{2}$ and $\frac{c_1}{c_2} = \frac{-5}{-8} = \frac{5}{8}$

$\therefore \frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

The given system has a unique solution.

Hence, the lines intersect at one point.

4.

Answer: (d) $\frac{1}{x} - \frac{1}{y} = 0$

Sol:

Given:

$x = -y$ and $y > 0$

Now, we have:

(i) x^2y

On substituting $x = -y$, we get:

$(-y)^2y = y^3 > 0$ ($\because y > 0$)

This is true.

(ii) $x + y$

On substituting $x = -y$, we get:

$(-y) + y = 0$

This is also true.

(iii) xy

On substituting $x = -y$, we get:

$(-y)y = -y^2$ ($\because y > 0$)

This is again true.

(iv) $\frac{1}{x} - \frac{1}{y} = 0$

$\Rightarrow \frac{y-x}{xy} = 0$

On substituting x = -y, we get:

$\frac{y-(-y)}{(-y)y} = 0 \Rightarrow \frac{2y}{-y^2} = 0 \Rightarrow 2y = 0 \Rightarrow y = 0.$

5.

Sol:

The given system of equations:

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

The given equations are of the following form:

$a_1x + b_1x + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$

Here, $a_1 = -1$, $b_1 = 2$, $c_1 = 2$ and $a_2 = \frac{1}{2}$, $b_2 = -\frac{1}{4}$ and $c_2 = -1$

$\therefore \frac{a_1}{a_2} = \frac{-1}{(1/2)} = -2, \frac{b_1}{b_2} = \frac{2}{(-1/4)} = -8$ and $\frac{c_1}{c_2} = \frac{2}{-1} = -2$

$\therefore \frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

The given system has a unique solution.

Hence, the lines intersect at one point.

6.

Sol:

The given system of equations can be written as follows:

$kx + 3y - (k - 2) = 0$ and $12x + ky - k = 0$

The given equations are of the following form:

$a_1x + b_1x + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$

Here, $a_1 = k$, $b_1 = 3$, $c_1 = -(k - 2)$ and $a_2 = 12$, $b_2 = k$ and $c_2 = -k$

$\therefore \frac{a_1}{a_2} = \frac{k}{12}, \frac{b_1}{b_2} = \frac{3}{k}$ and $\frac{c_1}{c_2} = \frac{-(k-2)}{-k} = \frac{(k-2)}{k}$

For inconsistency, we must have:

$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

$\Rightarrow \frac{k}{12} = \frac{3}{k} \neq \frac{(k-2)}{k} \Rightarrow k^2 = (3 \times 12) = 36$

$\Rightarrow k = \sqrt{36} = \pm 6$

Hence, the pair of equations is inconsistent if $k = \pm 6$.

7.

Sol:

The given system of equations can be written as follows:

$9x - 10y - 21 = 0$ and $\frac{3x}{2}x - \frac{5y}{3} - \frac{7}{2} = 0$

The given equations are of the following form:

$a_1x + b_1x + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$

Here, $a_1 = 9$, $b_1 = -10$, $c_1 = -21$ and $a_2 = \frac{3}{2}$, $b_2 = \frac{-5}{3}$ and $c_2 = \frac{-7}{2}$

$\therefore \frac{a_1}{a_2} = \frac{9}{3/2} = 6, \frac{b_1}{b_2} = \frac{-10}{(-5/3)} = 6$ and $\frac{c_1}{c_2} = -21 \times \frac{2}{-7} = 6$

$\therefore \frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

This shows that the given system of equations has an infinite number of solutions.

8.

Sol:

The given equations are as follows:

$x - 2y = 0$ …………(i)

$3x + 4y = 20$ …………(ii)

On multiplying (i) by 2, we get:

$2x - 4y = 0$ …………(iii)

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

$5x = 20 \Rightarrow x = 4$

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

$4 - 2y = 0 \Rightarrow 4 = 2y \Rightarrow y = 2$

Hence, the required solution is $x = 4$ and $y = 2$.

9. **Sol:**

The given system of equations can be written as follows:

$x - 3y - 2 = 0$ and $-2x + 6y - 5 = 0$

The given equations are of the following form:

$a_1x + b_{1y} + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$

Here, $a_1 = 1$, $b_1 = -3$, $c_1 = -2$ and $a_2 = -2$, $b_2 = 6$ and $c_2 = -5$

$\therefore \frac{a_1}{a_2} = \frac{1}{-2} = \frac{-1}{2}, \frac{b_1}{b_2} = \frac{-3}{6} = \frac{-1}{2}$ and $\frac{c_1}{c_2} = \frac{-2}{-5} = \frac{2}{5}$

$\therefore \frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

Thus, the given system of equations has no solution.

Hence, the paths represented by the equations are parallel.

10.

Sol:

Let the larger number be x and the smaller number be y.

Then, we have:

$x - y = 26$ ....(i)

$x = 3y$ ....(ii)

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

$3y - y = 26 \Rightarrow 2y = 26 \Rightarrow y = 13$

On substituting $y = 13$ in (i), we get:

$x - 13 = 26 \Rightarrow x = 26 + 13 = 39$

Hence, the required numbers are 39 and 13.

11.

Sol:

The given equations are as follows:

$23x + 29y = 98$ ....(i)

$29x + 23y = 110$ ....(ii)

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

$52x + 52y = 208$

$\Rightarrow x + y = 4$ ....(iii)

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

$6x - 6y = 12$

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

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

$2x = 6 \Rightarrow x = 3$

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

$3 + y = 4$

$\Rightarrow y = 4 - 3 = 1$

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

12.

Sol:

The given equations are as follows:

$6x + 3y = 7xy$ ....(i)

$3x + 9y = 11xy$ ....(ii)

For equation (i), we have:

$\frac{6x+3y}{xy} = 7$

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

For equation (ii), we have:

$\frac{3x+9y}{xy} = 11$

$\Rightarrow \frac{3x}{xy} + \frac{9y}{xy} = 11 \Rightarrow \frac{3}{y} + \frac{9}{x} = 11$ …….(iii)

On substituting $\frac{3}{y}$ = v and $\frac{1}{x}$ = u in (iii) and (iv), we get:

6v + 3u = 7 ………..(v)

3v + 9u = 11 ……….(vi)

On multiplying (v) by 3, we get:

18v + 9u = 21 ………(vii)

On substituting y = $\frac{3}{2}$ in (iii), we get:

$\frac{6}{(3/2)} + \frac{3}{x} = 7$

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

$\Rightarrow x = 1$

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

13.

Sol:

The given system of equations can be written as follows:

3x + y = 1

$\Rightarrow$ 3x + y – 1 = 0 ……….(i)

kx + 2y = 5

$\Rightarrow$ kx + 2y – 5 = 0 ……….(ii)

These equations are of the following form:

$a_1x + b_1x + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$

Here, $a_1 = 3$, $b_1 = 1$, $c_1 = –1$ and $a_2 = k$, $b_2 = 2$ and $c_2 = –5$

(i) For a unique solution, we must have:

$\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$ i.e. $\frac{3}{k} \neq \frac{1}{2}$ $\Rightarrow k \neq 6$

Thus, for all real values of k other than 6, the given system of equations will have a unique solution.

(ii) In order that the given equations have no solution, we must have:

$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

$\frac{3}{k} = \frac{1}{2} \neq \frac{-1}{-5}$

$\Rightarrow \frac{3}{k} = \frac{1}{2}$ and $\frac{3}{k} = \frac{-1}{-5}$

$\Rightarrow k = 6, k \neq 15$

Thus, for k = 6, the given system of equations will have no solution.

14.

Sol:

Let $\angle A = x^0$ and $\angle B = y^0$

Then, $\angle C = 3\angle B = 3y^0$

Now, we have:

$\angle A + \angle B + \angle C = 180^0$

$\Rightarrow x + y + 3y = 180$

$\Rightarrow x + 4y = 180$ ……..(i)

Also, $\angle C = 2(\angle A + \angle B)$

$\Rightarrow 3y = 2(x + y)$

$\Rightarrow 2x - y = 0$ ……..(ii)

On multiplying (ii) by 4, we get:

$8x - 4y = 0$ ………(iii)

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

$9x = 180 \Rightarrow x = 20$

On substituting x = 20 in (i), we get:

$20 + 4y = 180 \Rightarrow 4y = (180 - 20) = 160 \Rightarrow y = 40$

$\therefore x = 20$ and $y = 40$

$\therefore \angle A = 20^0, \angle B = 40^0, \angle C = (3 \times 40^0) = 120^0$.

15.

Sol:

Let the cost of each pencil be Rs. x and that of each pen be Rs. y.

Then, we have:

$5x + 7y = 195$ ………(i)

$7x + 5y = 153$ ………(ii)

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

$12x + 12y = 348$

$\Rightarrow 12(x + y) = 348$

$\Rightarrow x + y = 29$ ………(iii)

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

$2x - 2y = -42$

⇒ $2(x – y) = –42$

⇒ $x – y = –21$ ………(iv)

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

$4 + y = 29$ ⇒ $y = (29 – 4) = 25$

Hence, the cost of each pencil is Rs. 4 and the cost of each pen is Rs. 25.

16.

Sol:

On a graph paper, draw a horizontal line X'OX and a vertical line YOY' as the x-axis and the y-axis, respectively.

Graph of $2x – 3y = 1$

$2x – 3y = 1$

⇒ $3y = (2x – 1)$

∴ $y = \frac{2x-1}{3}$ ……..(i)

Putting x = -1, we get:

y = -1

Putting x = 2, we get:

y = 1

Putting x = 5, we get:

y = 3

Thus, we have the following table for the equation $2x – 3y = 1$.

x	-1	2	5
y	-1	1	3

Now, plots the points A(-1, -1), B(2, 1) and C(5, 3) on the graph paper.

Join AB and BC to get the graph line AC. Extend it on both the sides.

Thus, the line AC is the graph of $2x – 3y = 1$.

Graph of $4x – 3y + 1 = 0$

$4x – 3y + 1 = 0$

⇒ $3y = (4x + 1)$

∴ $y = \frac{4x+1}{3}$ ……..(ii)

Putting x = -1, we get:

y = -1

Putting x = 2, we get:

y = 3

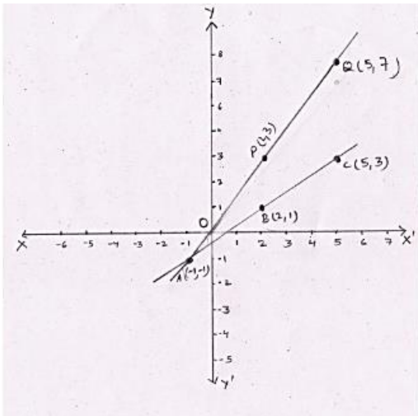
Putting x = 5, we get:

y = 7

Thus, we have the following table for the equation $4x – 3y + 1 = 0$.

x	-1	2	5
y	-1	3	7

Now, Plot the points P(2, 3) and Q(5, 7). The point A(-1, -1) has already been plotted. Join PA and QP to get the graph line AQ. Extend it on both sides.
Thus, the line AQ is the graph of the equation $4x - 3y + 1 = 0$.



The two lines intersect at A(-1. -1).
Thus, x = -1 and y = -1 is the solution of the given system of equations.

17.

Sol:
Given:
In a cyclic quadrilateral ABCD, we have:
$\angle A = (4x + 20)^0$
$\angle B = (3x - 5)^0$
$\angle C = 4y^0$
$\angle D = (7y + 5)^0$
$\angle A + \angle C = 180^0$ and $\angle B + \angle D = 180^0$ [Since ABCD is a cyclic quadrilateral] Now,
$\angle A + \angle C = (4x + 20)^0 + (4y^0) = 180^0$

$\Rightarrow 4x + 4y + 20 = 180$

$\Rightarrow 4x + 4y = 180 - 20 = 160$

$\Rightarrow x + y = 40$ …….(i)
Also, $\angle B + \angle D = (3x - 5)^0 + (7y + 5)^0 = 180^0$

$\Rightarrow 3x + 7y = 180$ …….(ii)
On multiplying (i) by 3, we get:
$3x + 3y = 120$ ……(iii)
On subtracting (iii) from (ii), we get:

$4y = 60 \Rightarrow y = 15$
On substituting y = 15 in (i), we get:

$x + 15 = 40 \Rightarrow x = (40 - 15) = 25$

Therefore, we have:

$\angle A = (4x + 20)^0 = (4 \times 25 + 20)^0 = 120°$

$\angle B = (3x - 5)^0 = (3 \times 25 - 5)^0 = 70°$

$\angle C = 4y^0 = (4 \times 15)^0 = 60^0$

$\angle D = (7y + 5)^0 = (7 \times 15 + 5)^0 = (105 + 5)^0 = 110^0$.

18.

Sol:

We have:

$\frac{35}{x+y} + \frac{14}{x-y} = 19$ and $\frac{14}{x+y} + \frac{35}{x-y} = 37$

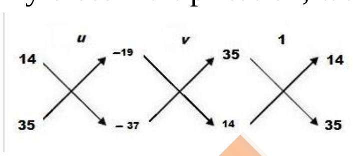
Taking $\frac{1}{x+y} = u$ and $\frac{1}{x-y} = v$.

$35u + 14v - 19 = 0$ ……….(i)

$14u + 35v - 37 = 0$ ……….(ii)

Here, $a_1 = 35$, $b_1 = 14$, $c_1 = -19$ and $a_2 = 14$, $b_2 = 35$ and $c_2 = -37$

By cross multiplication, we have:



$\therefore \frac{u}{[14 \times (-37) - 35 \times (-19)]} = \frac{v}{[(-19) \times 14 - (-37) \times (35)]} = \frac{1}{[35 \times 35 - 14 \times 14]}$

$\Rightarrow \frac{u}{-518+665} = \frac{v}{-266+1295} = \frac{1}{1225-196}$

$\Rightarrow \frac{u}{147} = \frac{v}{1029} = \frac{1}{1029}$

$\Rightarrow u = \frac{147}{1029} = \frac{1}{7}$, $v = \frac{1029}{1029} = 1$

$\Rightarrow \frac{1}{x+y} = \frac{1}{7}, \frac{1}{x-y} = 1$

$\therefore (x + y) = 7$ ………(iii)

And, $(x - y) = 1$ ……...(iv)

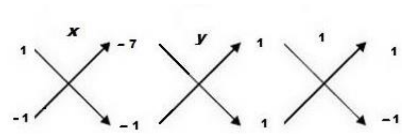
Again, the equations (iii) and (iv) can be written as follows:

$x + y - 7 = 0$ ……….(v)

$x - y - 1 = 0$ ………(vi)

Here, $a_1 = 1$, $b_1 = 1$, $c_1 = -7$ and $a_2 = 1$, $b_2 = -1$ and $c_2 = -1$

By cross multiplication, we have:



$\therefore \frac{x}{[1\times(-1)-(-1)\times(-7)]} = \frac{y}{[(-7)\times 1\ -(-1)\times 1]} = \frac{1}{[1\times(-1)-1\times 1]}$

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

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

$\Rightarrow x = \frac{-8}{-2} = 4$, $y = \frac{-6}{-2} = 3$

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

19.

Sol:

Let the required fraction be x/y

Then, we have:

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

$\Rightarrow 5(x + 1) = 4(y + 1)$

$\Rightarrow 5x + 5 = 4y + 4$

$\Rightarrow 5x - 4y = -1$ ………(i)

Again, we have:

$\frac{x-5}{y-5} = \frac{1}{2}$

$\Rightarrow 2(x - 5) = 1(y - 5)$

$\Rightarrow 2x - 10 = y - 5$

$\Rightarrow 2x - y = 5$ ………(ii)

On multiplying (ii) by 4, we get:

$8x - 4y = 20$ ……..(iii)

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

$3x = (20 - (-1)) = 20 + 1 = 21$

$\Rightarrow 3x = 21$

$\Rightarrow x = 7$

On substituting x = 7 in (i), we get

$5 \times 7 - 4y = -1$

$\Rightarrow 35 - 4y = -1$

$\Rightarrow 4y = 36$

$\Rightarrow y = 9$

$\therefore x = 7$ and $y = 9$

Hence, the required fraction is $\frac{7}{9}$.

20.

Sol:

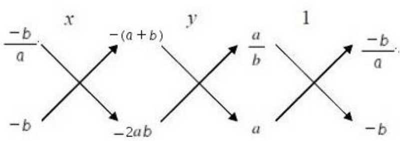
The given equations may be written as follows:

$\frac{ax}{b} - \frac{by}{a} - (a + b) = 0$ ………(i)

$ax - by - 2ab = 0$ ………(ii)

Here, $a_1 = \frac{a}{b}$, $b_1 = \frac{-b}{a}$, $c_1 = -(a + b)$ and $a_2 = a$, $b_2 = -b$ and $c_2 = -2ab$

By cross multiplication, we have:



$$\therefore \frac{x}{\left(-\frac{b}{a}\right)\times(-2ab)-(-b)\times(-(a+b))} = \frac{y}{-(a+b)\times a-(-2ab)\times\frac{a}{b}} = \frac{1}{\frac{a}{b}\times(-b)-a\times\left(-\frac{b}{a}\right)}$$

$$\Rightarrow \frac{x}{2b^2-b(a+b)} = \frac{y}{-a(a+b)+2a^2} = \frac{1}{-a+b}$$

$$\Rightarrow \frac{x}{2b^2-ab-b^2} = \frac{y}{-a^2-ab+2a^2} = \frac{1}{-a+b}$$

$$\Rightarrow \frac{x}{b^2-ab} = \frac{y}{a^2-ab} = \frac{1}{-(a-b)}$$

$$\Rightarrow \frac{x}{-b(a-b)} = \frac{y}{a(a-b)} = \frac{1}{-(a-b)}$$

$$\Rightarrow x = \frac{-b(a-b)}{-(a-b)} = b,\ y = \frac{a(a-b)}{-(a-b)} = -a$$

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