Let the actual price of the tea and lemon set be Rs.x and Rs.y respectively.
When gain is Rs.7, then
$\frac{y}{100} \times 15 - \frac{x}{100} \times 5 = 7$
$\Rightarrow 3y - x = 140$ ……..(i)
When gain is Rs.14, then
$\frac{y}{100} \times 5 + \frac{x}{100} \times 10 = 14$
$\Rightarrow y + 2x = 280$ ……..(ii)
Multiplying (i) by 2 and adding with (ii), we have
$7y = 280 + 280$
$\Rightarrow y = \frac{560}{7} = 80$
Putting y = 80 in (ii), we get
$80 + 2x = 280$
$\Rightarrow x = \frac{200}{2} = 100$
Hence, actual price of the tea set and lemon set are Rs.100 and Rs.80 respectively.

78. A lending library has fixed charge for the first three days and an additional charge for each day thereafter. Mona paid ₹27 for a book kept for 7 days, while Tanvy paid ₹21 for the book she kept for 5 days find the fixed charge and the charge for each extra day.

Sol:
Let the fixed charge be Rs.x and the charge for each extra day be Rs.y.
In case of Mona, as per the question
$x + 4y = 27$ ………(i)
In case of Tanvy, as per the question
$x + 2y = 21$ ………(ii)
Subtracting (ii) from (i), we get
$2y = 6 \Rightarrow y = 3$
Now, putting y = 3 in (ii), we have
$x + 2 \times 3 = 21$
$\Rightarrow x = 21 - 6 = 15$
Hence, the fixed charge be Rs.15 and the charge for each extra day is Rs.3.

79. A chemist has one solution containing 50% acid and a second one containing 25% acid. How much of each should be used to make 10 litres of a 40% acid solution?
Sol:
Let x litres and y litres be the amount of acids from 50% and 25% acid solutions respectively.
As per the question
50% of x + 25% of y = 40% of 10

$\Rightarrow 0.50x + 0.25y = 4$

$\Rightarrow 2x + y = 16$ ....(i)

Since, the total volume is 10 liters, so

$x + y = 10$

Subtracting (ii) from (i), we get

$x = 6$

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

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

Hence, volume of 50% acid solution = 6litres and volume of 25% acid solution = 4litres.

80. A jeweler has bars of 18-carat gold and 12-carat gold. How much of each must be melted together to obtain a bar of 16-carat gold, weighing 120gm? (Given: Pure gold is 24-carat).

Sol:

Let x g and y g be the weight of 18-carat and 12- carat gold respectively.

As per the given condition

$\frac{18x}{24} + \frac{12y}{24} = \frac{120 \times 16}{24}$

$\Rightarrow 3x + 2y = 320$ ....(i)

And

$x + y = 120$ ....(ii)

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

$x = 320 - 240 = 80$

Now, putting x = 80 in (ii), we have

$80 + y = 120 \Rightarrow y = 40$

Hence, the required weight of 18-carat and 12-carat gold bars are 80 g and 40 g respectively.

81. 90% and 97% pure acid solutions are mixed to obtain 21 litres of 95% pure acid solution. Find the quantity of each type of acid to be mixed to form the mixture.

Sol:

Let x litres and y litres be respectively the amount of 90% and 97% pure acid solutions.

As per the given condition

$0.90x + 0.97y = 21 \times 0.95$

$\Rightarrow 0.90x + 0.97y = 21 \times 0.95$ ....(i)

And

$x + y = 21$

From (ii), substitute y = 21 – x in (i) to get

$0.90x + 0.97(21 - x) = 21 \times 0.95$

$\Rightarrow 0.90x + 0.97 \times 21 - 0.97x = 21 \times 0.95$

$\Rightarrow 0.07x = 0.97\times 21 - 21\times 0.95$

$\Rightarrow x = \frac{21\times 0.02}{0.07} = 6$

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

$6 + y = 21 \Rightarrow y = 15$

Hence, the request quantities are 6 litres and 15 litres.

82. The larger of the two supplementary angles exceeds the smaller by 180^0. Find them.

Sol:

Let x and y be the supplementary angles, where x > y.

As per the given condition

$x + y = 180^0$ …….(i)

And

$x - y = 18^0$ ……..(ii)

Adding (i) and (ii), we get

$2x = 198^0 \Rightarrow x = 99^0$

Now, substituting $x = 99^0$ in (ii), we have

$99^0 - y = 18^0 \Rightarrow x = 99^0 - 18^0 = 81^0$

Hence, the required angles are 99^0 and 81^0.

83. In a $\Delta ABC, \angle A = x^\circ, \angle B = (3x-2)^\circ, \angle C = y^\circ$ and $\angle C - \angle B = 9^\circ$. Find the there angles.

Sol:

$\because \angle C - \angle B = 9^0$

$\therefore y^0 - (3x - 2)^0 = 9^0$

$\Rightarrow y^0 - 3x^0 + 2^0 = 9^0$

$\Rightarrow y^0 - 3x^0 = 7^0$

The sum of all the angles of a triangle is 180^0, therefore

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

$\Rightarrow x^0 + (3x - 2)^0 + y^0 = 180^0$

$\Rightarrow 4x^0 + y^0 = 182^0$

Subtracting (i) from (ii), we have

$7x^0 = 182^0 - 7^0 = 175^0$

$\Rightarrow x^0 = 25^0$

Now, substituting $x^0 = 25^0$ in (i), we have

$y^0 = 3x^0 + 7^0 = 3\times 25^0 + 7^0 = 82^0$

Thus

$\angle A = x^0 = 25^0$

$\angle B = (3x - 2)^0 = 75^0 - 2^0 = 73^0$
$\angle C = y^0 = 82^0$
Hence, the angles are 25^0, 73^0 and 82^0.

84. In a cyclic quadrilateral ABCD, it is given $\angle A = (2x + 4)^0$, $\angle B = (y + 3)^0$, $\angle C = (2y + 10)^0$ and $\angle D = (4x - 5)^0$. Find the four angles.
Sol:
The opposite angles of cyclic quadrilateral are supplementary, so
$\angle A + \angle C = 180^0$
$\Rightarrow (2x + 4)^0 + (2y + 10)^0 = 180^0$
$\Rightarrow x + y = 83^0$
And
$\angle B + \angle D = 180^0$
$\Rightarrow (y + 3)^0 + (4x - 5)^0 = 180^0$
$\Rightarrow 4x + y = 182^0$
Subtracting (i) from (ii), we have
$3x = 99 \Rightarrow x = 33^0$
Now, substituting $x = 33^0$ in (i), we have
$33^0 + y = 83^0 \Rightarrow y = 83^0 - 33^0 = 50^0$
Therefore
$\angle A = (2x + 4)^0 = (2 \times 33 + 4)^0 = 70^0$
$\angle B = (y + 3)^0 = (50 + 3)^0 = 53^0$
$\angle C = (2y + 10)^0 = (2 \times 50 + 10)^0 = 110^0$
$\angle D = (4x - 5)^0 = (4 \times 33 - 5)^0 = 132^0 - 5^0 = 127^0$
Hence, $\angle A = 70^0$, $\angle B = 53^0$, $\angle C = 110^0$ and $\angle D = 127^0$.

Exercise – 3F

1. Write the number of solutions of the following pair of linear equations:
$x + 2y - 8 = 0$,
$2x + 4y = 16$
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. Find the value of k for which the system of linear equations has an infinite number of solutions.

2x + 3y – 7 = 0,

(k – 1)x + (k + 2)y=3k

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

⇒ 2(k + 2) = 3(k – 1), 9k = 7k + 14 and 6k = 7k – 7

⇒ k = 7, k = 7 and k = 7

Hence, k = 7.

3. Find the value of k for which the system of linear equations has an infinite number of solutions.

10x + 5y – (k – 5) = 0,

20x + 10y – k = 0.

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. Find the value of k for which the system of linear equations has an infinite number of solutions.

2x + 3y=9,

6x + (k – 2)y =(3k – 2

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. Write the number of solutions of the following pair of linear equations:

x + 3y – 4 = 0, 2x + 6y – 7 = 0.

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. Find the values of k for which the system of equations 3x + ky = 0, 2x – y = 0 has a unique solution.

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. The difference of two numbers is 5 and the difference between their squares is 65. Find the numbers.

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. The cost of 5 pens and 8 pencils together cost Rs. 120 while 8 pens and 5 pencils together cost Rs. 153. Find the cost of a 1 pen and that of a 1pencil.

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. The sum of two numbers is 80. The larger number exceeds four times the smaller one by 5. Find the numbers.

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. A number consists of two digits whose sum is 10. If 18 is subtracted form the number, its digits are reversed. Find the number.

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. A man purchased 47 stamps of 20p and 25p for ₹10. Find the number of each type of stamps
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. A man has some hens and cows. If the number of heads be 48 and number of feet by 140. How many cows are there.
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. If $\frac{2}{x}+\frac{3}{y}=-\frac{9}{xy}$ *and* $\frac{4}{x}+\frac{9}{y}=\frac{21}{xy}$, find the values of x and y.

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. If $\frac{x}{4}+\frac{y}{3}=-\frac{15}{12}$ *and* $\frac{x}{2}+y=1$, then find the value of (x + y).

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. If 12x + 17y = 53 and 17x + 12y = 63 then find the value of (x + y)

Sol:

The given pair of equations is

12x + 17y = 53 ……..(i)

17x + 12y = 63 …….(ii)

Adding (i) and (ii), we get

29x + 29y = 116

⇒ x + y = 4 (Dividing by 4)

Hence, the value of x + y is 4.

16. Find the value of k for which the system of equations 3x + 5y = 0 and kx + 10y = 0 has infinite nonzero solutions.

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

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

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

⇒ k = 6

Hence, k = 6.

17. Find the value of k for which the system of equations kx – y = 2 and 6x – 2y = 3 has a unique solution.

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

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

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

⇒ k ≠ 3

Hence, k ≠ 3.

18. Find the value of k for which the system of equations 2x + 3y -5 = 0 and 4x + ky – 10 = 0 has infinite number of solutions.

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

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

$\Rightarrow \frac{2}{4} = \frac{3}{k} = \frac{-5}{-10}$

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

$\Rightarrow$ k = 6

Hence, k = 6.

19. Show that the system 2x + 3y -1= 0 and 4x + 6y - 4 = 0 has no solution.

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. Find the value of k for which the system of equations x + 2y – 3 = 0 and 5x + ky + 7 = 0 is inconsistent.

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. Solve for x and y: $\frac{3}{x+y} + \frac{2}{x-y} = 2, \frac{9}{x+y} - \frac{4}{x-y} = 1$

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. If 2x+ 3y =12 and 3x - 2y =5 then
(a) x = 2, y = 3 (b) x = 2, y = -3 (c) x = 3, y = 2 (d) x = 3, y = -2
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. If x - y = 2 and $\frac{2}{x+y} = \frac{1}{5}$ then

(a) x = 4, y = 2 (b) x = 5, y = 3 (c) x = 6, y = 4 (d) x = 7, y = 5

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. If $\frac{2x}{3} - \frac{y}{2} + \frac{1}{6} = 0$ and $\frac{x}{2} + \frac{2y}{3} = 3$ then

(a) x = 2, y = 3 (b) x = - 2, y = 3 (c) x = 2, y = - 3 (d) x = - 2, y = - 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. If $\frac{1}{x}+\frac{2}{y}=4$ and $\frac{3}{y}-\frac{1}{x}=11$ then

(a) x = 2, y = 3 (b) x = - 2, y = 3 (c) x = $\frac{-1}{2}$, y = 3 (d) x = $\frac{-1}{2}$, y = $\frac{1}{3}$

Answer: (d) x = $\frac{-1}{2}$, y = $\frac{1}{3}$

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. If $\frac{2x+y+2}{5}=\frac{3x-y+1}{3}=\frac{3x+2y+1}{6}$ then

(a) x = 1, y = 1 (b) x = -1, y = -1 (c) x = 1, y = 2 (d) x = 2, y = 1

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

$3(2x+y+2)=5(3x-y+1)$

$\Rightarrow 6x+3y+6=15x-5y+5$

$\Rightarrow 9x-8y=1$ ……….(i)

And

$6(3x-y+1)=3(3x+2y+1)$

$\Rightarrow 18x-6y+6=9x+6y+3$

$\Rightarrow 3x-4y=-1$ ……………(ii)

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

$9x-6x=1+2 \Rightarrow x=1$

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. If $\frac{3}{x+y}+\frac{2}{x-y}=2$ and $\frac{9}{x+y}-\frac{4}{x-y}=1$ then

(a) $x=\frac{1}{2}, y=\frac{3}{2}$ (b) $x=\frac{5}{2}, y=\frac{1}{2}$ (c) $x=\frac{3}{2}, y=\frac{1}{2}$ (d) $x=\frac{1}{2}, y=\frac{5}{2}$

Answer: (b) $x=\frac{5}{2}, y=\frac{1}{2}$

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 ⇒ u = $\frac{5}{15}=\frac{1}{3}$

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

6v + 4v = 6 – 1 ⇒ 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 ⇒ x = $\frac{5}{2}$

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

$\frac{5}{2}$ + y = 3 ⇒ y = 3 – $\frac{5}{2}=\frac{1}{2}$.

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

7. If 4x+6y=3xy and 8x +9y=5xy then

(a) x = 2, y = 3 (b) x = 1, y = 2 (c) x = 3, y = 4 (d) x = 1, y = - 1

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. If 29x + 37y = 103 and 37x + 29y = 95 then

(a) x = 1, y = 2 (b) x = 2, y = 1 (c) x = 3, y = 2 (d) x = 2, y = 3

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)

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. If $2^{x+y} = 2^{x-y} = \sqrt{8}$ then the value of y is

(a) $\frac{1}{2}$ (b) $\frac{3}{2}$ (c) 0 (d) none of these

Answer: (c) 0

Sol:

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

$\therefore x + y = x - y$

$\Rightarrow y = 0$

10. If $\frac{2}{x}+\frac{3}{y}=6$ and $\frac{1}{x}+\frac{1}{2y}=2$ then

(a) x = 1, y = $\frac{2}{3}$ (b) x = $\frac{2}{3}$, y = 1 (c) x = 1, y = $\frac{3}{2}$ (d) x= $\frac{3}{2}$, y = 1

Answer: (b) x = $\frac{2}{3}$, 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. The system of kx – y = 2 and 6x – 2y = 3 has a unique solution only when

(a) k = 0 (b) $k \neq 0$ (c) k = 3 (d) $k \neq 3$

Answer: (d) $k \neq 3$

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. The system x – 2y = 3 and 3x + ky = 1 have a unique solution only when ?

(a) k = -6 (b) k ≠ -6 (c) k = 0 (d) k ≠ 0

Answer: (b) k ≠ -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. The system x + 2y = 3 and 5x + ky + 7 = 0 have no solution when?
(a) k = 10 (b) k ≠ 10 (c) $k = \frac{-7}{3}$ (d) k = -21
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. If the lines given by 3x + 2ky = 2 and 2x + 5y + 1 = 0 are parallel, then the value of k is
(a) $\frac{-5}{4}$ (b) $\frac{2}{5}$ (c) $\frac{3}{2}$ (d) $\frac{15}{4}$
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. For what value of k do the equations kx – 2y = 3 and 3x + y = 5 represent two lines intersecting at a unique point?

(a) k = 3 (b) k = -3 (c) k = 6 (d) all real values except -6

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. The pair of equations x + 2y + 5 = 0 and–3x – 6y + 1 = 0 has

(a) a unique solution (b) exactly two solutions

(c) infinitely many solutions (d) no solution

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. The pair of equations 2x + 3y = 5 and 4x + 6y = 15 has

(a) a unique solution (b) exactly two solutions

(c) infinitely many solutions (d) no solution

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. If a pair of linear equations is consistent, then their graph lines will be
(a) parallel (b) always coincident
(c) always intersecting (d) intersecting or coincident
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. If a pair of linear equations is inconsistent, then their graph lines will be
(a) parallel (b) always coincident
(c) always intersecting (d) intersecting or coincident
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. In a ΔABC, $\angle C = 3\angle B = 2(\angle A + \angle B)$, then $\angle B = ?$
(a) 20^0 (b) 40^0 (c) 60^0 (d) 80^0
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. In a cyclic quadrilateral ABCD, it is being given that $\angle A = (x + y + 10)^0$, $\angle B = (y + 20)^0$, $\angle C = (x + y - 30)^0$ and $\angle D = (x + y)^0$. Then, $\angle B = ?$

(a) 70^0 (b) 80^0 (c) 100^0 (d) 110^0

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. 5 years hence, the age of a man shall be 3 times the age of his son while 5 years earlier the age of the man was 7 times the age of his son. The present age of the man is

(a) 45 years (b) 50 years (c) 47 years (d) 40 years

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.

Assertion (A)	Reason (R)
The system of equations $x + y - 8 = 0$ and $x - y - 2 = 0$ has a unique solutions.	The system of equations $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ has a unique solution when $\frac{a_1}{a_2} = \frac{b_1}{b_2}$.

The correct answer is: (a) / (b)/ (c)/ (d).
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. The graphs of the equations $6x - 2y + 9 = 0$ and $3x - y + 12 = 0$ are two lines which are
(a) coincident
(b) parallel
(c) intersecting exactly at one point
(d) perpendicular to each other
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. The graphs of the equations $2x + 3y – 2 = 0$ and $x – 2y – 8 = 0$ are two lines which are
(a) coincident
(b) parallel
(c) intersecting exactly at one point
(d) perpendicular to each other
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. The graphs of the equations $5x – 15y = 8$ and $3x – 9y = \frac{24}{5}$ are two lines which are
(a) coincident
(b) parallel
(c) intersecting exactly at one point
(d) perpendicular to each other
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. The sum of the digits of a two digit number is 15. The number obtained by interchanging the digits exceeds the given number by 9. The number is

(a) 96 (b) 69 (c) 87 (d) 78

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 = $(10y + x)$

$\therefore (10y + x) = (10x + y) + 9$

$\Rightarrow 10y + x - 10x - y = 9$

$\Rightarrow 9y - 9x = 9$

$\Rightarrow y - x = 1$ …….(ii)

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

$2y = 16 \Rightarrow y = 8$

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

$x + 8 = 15 \Rightarrow x = (15 - 8) = 7$

Number = $(10x + y) = 10 \times 7 + 8 = 70 + 8 = 78$

Hence, the required number is 78.

Exercise – Formative Assessment

1. The graphic representation of the equations $x + 2y = 3$ and $2x + 4y + 7 = 0$ gives a pair of

(a) parallel lines (b) intersecting lines

(c) coincident lines (d) none of these

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. If $2x – 3y = 7$ and $(a + b)x – (a + b – 3)y = (4a + b)$ have an infinite number of solutions, then

(a) a = 5, b = 1 (b) a = -5, b = 1

(c) a = 5, b = -1 (d) a = -5, b = -1

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. The pair of equations 2x + y = 5, 3x + 2y = 8 has
(a) a unique solution (b) two solutions
(c) no solution (d) infinitely many solutions
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. If x = -y and y > 0, which of the following is wrong?
(a) $x^2y > 0$ (b) $x + y = 0$ (c) $xy < 0$ (d) $\frac{1}{x} - \frac{1}{y} = 0$
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. Show that the system of equations $-x + 2y + 2 = 0$ and $\frac{1}{2}x - \frac{1}{4}y - 1 = 0$ has a unique solution.

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. For what values of k is the system of equations $kx + 3y = (k - 2)$, $12x + ky = k$ inconsistent?

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. Show that the equations $9x - 10y = 21, \frac{3x}{2} - \frac{5y}{3} = \frac{7}{2}$ have infinitely many solutions.

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. Solve the system of equations: $x - 2y = 0, 3x + 4y = 20$.

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. Show that the paths represented by the equations $x - 3y = 2$ and $-2x + 6y = 5$ are parallel.

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. The difference between two numbers is 26 and one number is three times the other. Find the numbers.

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. Solve: $23x + 29y = 98$, $29x + 23y = 110$.

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. Solve: $6x + 3y = 7xy$ and $3x + 9y = 11xy$

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. Find the value of k for which the system of equations $3x + y = 1$ and $kx + 2y = 5$ has (i) a unique solution, (ii) no solution.

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. In a ΔABC, $\angle C = 3\angle B = 2(\angle A + \angle B)$, find the measure of each one of $\angle A$, $\angle B$ and $\angle C$.
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. 5 pencils and 7 pens together cost Rs 195 while 7 pencils and 5 pens together cost Rs 153. Find the cost of each one of the pencil and pen.
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:
$2x - 2y = -42$

$\Rightarrow 2(x - y) = -42$

$\Rightarrow x - y = -21$ ………(iv)

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

$4 + y = 29 \Rightarrow y = (29 - 4) = 25$

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

16. Solve the following system of equations graphically:

$$2x - 3y = 1, 4x - 3y + 1 = 0$$

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 $2x - 3y = 1$

$2x - 3y = 1$

$\Rightarrow 3y = (2x - 1)$

$\therefore y = \frac{2x-1}{3}$ ……..(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 $4x - 3y + 1 = 0$

$4x - 3y + 1 = 0$

$\Rightarrow 3y = (4x + 1)$

$\therefore y = \frac{4x+1}{3}$ ……..(ii)

Putting x = -1, we get:

y = -1

Putting x = 2, we get:

y = 3

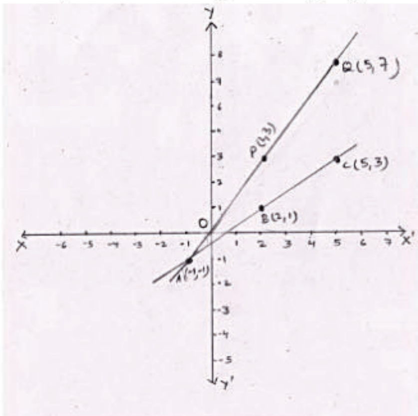
Putting x = 5, we get:

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. Find the angles of a cyclic quadrilateral ABCD in which $\angle A = (4x + 20)^0$, $\angle B = (3x - 5)^0$, $\angle C = 4y^0$ and $\angle D = (7y + 5)^0$.

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. Solve for x and y: $\frac{35}{x+y} + \frac{14}{x-y} = 19, \frac{14}{x+y} + \frac{35}{x-y} = 37$

Sol:

We have:

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

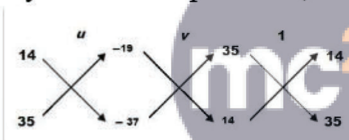
Taking $\frac{1}{x+y} = u$ and $\frac{1}{x-y} = v$.

$35u + 14v - 19 = 0$ ……….(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)

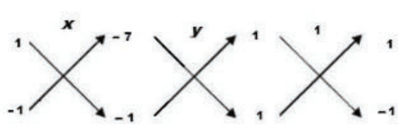
Again, the equations (iii) and (iv) can be written as follows:

$x + y - 7 = 0$ ……….(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:



$\therefore \frac{x}{[1\times(-1)-(-1)\times(-7)]} = \frac{y}{[(-7)\times1\ -(-1)\times 1]} = \frac{1}{[1\times(-1)-1\times 1]}$

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

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

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

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

19. If 1 is added to both of the numerator and denominator of a fraction, it becomes $\frac{4}{5}$. If however, 5 is subtracted from both numerator and denominator, the fraction becomes $\frac{1}{2}$. Find the fraction.

Sol:

Let the required fraction be $\frac{x}{y}$.

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. Solve: $\frac{ax}{b} - \frac{by}{a} = (a + b)$, $ax - by = 2ab$.

Sol:

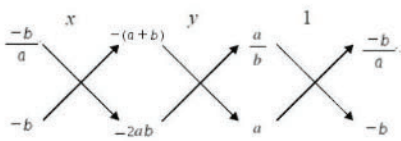
The given equations may be written as follows:

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