CBSE Sample Questions

Pair of Linear Equations in Two Variables

MCQ

1. If the system of equations $3x + y = 1$ and $(2k - 1)x + (k - 1)y = 2k + 1$ is inconsistent, then k =
(a) -1 (b) 0 (c) 1 (d) 2
(2022-23) Ap

2. The value of k for which the lines $5x + 7y = 3$ and $15x + 21y = k$ coincide is
(a) 9 (b) 5 (c) 7 (d) 18
(Term I, 2021-22) R

3. The lines $x = a$ and $y = b$, are
(a) intersecting (b) parallel
(c) overlapping (d) none of these
(Term I, 2021-22) R

4. One equation of a pair of dependent linear equations is $-5x + 7y = 2$. The second equation can be
(a) $10x + 14y + 4 = 0$ (b) $-10x - 14y + 4 = 0$
(c) $-10x + 14y + 4 = 0$ (d) $10x - 14y = -4$
(Term I, 2021-22) Ev

VSA (1 mark)

5. If 3 chairs and 1 table costs Rs. 1500 and 6 chairs and 1 table costs Rs. 2400. Form linear equations to represent this situation. *(2020-21)*

3.3 Algebraic Methods of Solving a Pair of Linear Equations

MCQ

6. If $217x + 131y = 913$, $131x + 217y = 827$, then $x + y$ is
(a) 5 (b) 6 (c) 7 (d) 8
(Term I, 2021-22)

VSA (1 mark)

7. For what value of k, the pair of linear equations $3x + y = 3$ and $6x + ky = 8$ does not have a solution? *(2020-21)*

SA I (2 marks)

8. If $49x + 51y = 499$, $51x + 49y = 501$, then find the value of x and y. *(2022-23)* Ap

SA II (3 marks)

9. A train covered a certain distance at a uniform speed. If the train would have been 6 km/h faster, it would have taken 4 hours less than the scheduled time. And, if the train were slower by 6 km/hr ; it would have taken 6 hours more than the scheduled time. Find the length of the journey. *(2022-23)* Ev

Detailed SOLUTIONS

Previous Years' CBSE Board Questions

1. (c): The given pair of linear equations is $2x = 5y + 6$ and $15y = 6x - 18$
i.e., $2x - 5y - 6 = 0$ and $6x - 15y - 18 = 0$

As $\frac{2}{6} = \frac{-5}{-15} = \frac{-6}{-18}$

i.e., $1/3 = 1/3 = 1/3$

$\therefore$ Lines are coincident.

2. (b): The given pair of linear equations is

$\frac{3x}{2} + \frac{5y}{3} = 7$ or $\frac{3x}{2} + \frac{5y}{3} - 7 = 0$ ...(i)

and $9x + 10y = 14$ or $9x + 10y - 14 = 0$ ...(ii)

Here, $a_1 = \frac{3}{2}, b_1 = \frac{5}{3}, c_1 = -7;$

$a_2 = 9, b_2 = 10, c_2 = -14$

$\therefore \frac{a_1}{a_2} = \frac{3/2}{9} = \frac{1}{6}, \frac{b_1}{b_2} = \frac{5/3}{10} = \frac{1}{6}, \frac{c_1}{c_2} = \frac{-7}{-14} = \frac{1}{2}$

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

So, the given pair of equations is inconsistent.

3. The pair of linear equations are
$3x + y - 7 = 0$ and $6x + 2y - 8 = 0$

Here, $a_1 = 3, b_1 = 1, c_1 = -7; a_2 = 6, b_2 = 2, c_2 = -8$

$\therefore \frac{a_1}{a_2} = \frac{3}{6} = \frac{1}{2}, \frac{b_1}{b_2} = \frac{1}{2}, \frac{c_1}{c_2} = \frac{-7}{-8} = \frac{7}{8}$

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

Thus, the pair of linear equations are parallel.

4. The given pair of linear equations are

$\frac{3}{2}x + \frac{5}{3}y = 7$ or $\frac{3}{2}x + \frac{5}{3}y - 7 = 0$ ...(i) and $\frac{3}{2}x+\frac{2}{3}y=6$ or $\frac{3}{2}x+\frac{2}{3}y-6=0$ ...(ii)

Here $a_1=\frac{3}{2}, b_1=\frac{5}{3}, c_1=-7; a_2=\frac{3}{2}, b_2=\frac{2}{3}, c_2=-6$

$$\frac{a_1}{a_2}=\frac{3/2}{3/2}=1, \frac{b_1}{b_2}=\frac{5/3}{2/3}=\frac{5}{2}$$

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

So, the pair of linear equations intersect at a point.

Concept Applied

- When $\frac{a_1}{a_2}\neq\frac{b_1}{b_2}$, , then the pair of linear equations has a unique solution *i.e.*, intersect at a point.

5. We have, $2x+y+3=0$; $4x+2y+6=0$

Here, $a_1=2, b_1=1, c_1=3; a_2=4, b_2=2, c_2=6$

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

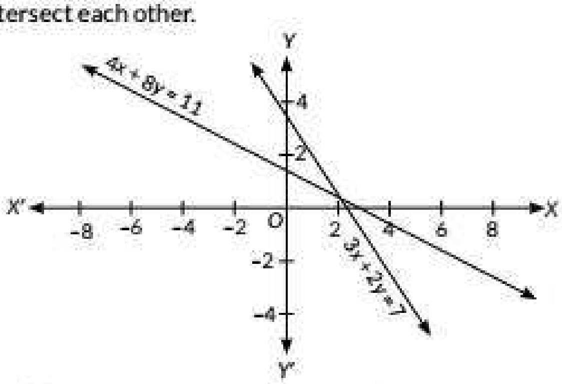
$\Rightarrow \quad \frac{a_1}{a_2}=\frac{b_1}{b_2}=\frac{c_1}{c_2}=\frac{1}{2}$

Hence, the given pair of linear equations is coincident.

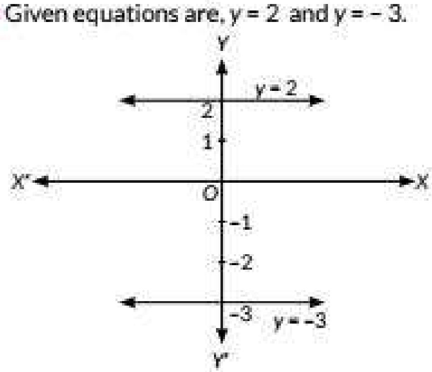
Commonly Made Mistake

- When $\frac{a_1}{a_2}=\frac{b_1}{b_2}=\frac{c_1}{c_2}$, then the given pair of linear equations have infinitely many solution *i.e.*, lines are dependent or consistent or coincident.

6. (c) : Clearly, from graph we can see that, both lines intersect each other.



7. (d): Given equations are, $y=2$ and $y=-3$.



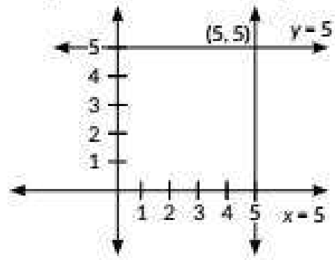
Clearly, from graph we can see that, both equations are parallel to each other.

So, there will be no solution.

Key Points

- Two lines has no solution, if they are parallel to each other.

8. (b) : Given equations are $x=5$ and $y=5$



Clearly, from graph we can see that both lines intersect each other at (5, 5).

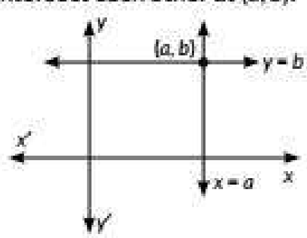
$\therefore$ The given pair of equations has a unique solution.

Key Points

- The line $x=c$ is parallel to y-axis and $y=c$ is parallel to x-axis.

9. (a): The pair of equations $x=a$ and $y=b$ graphically represents lines which are parallel to y-axis and x-axis respectively.

The lines will intersect each other at (a, b).



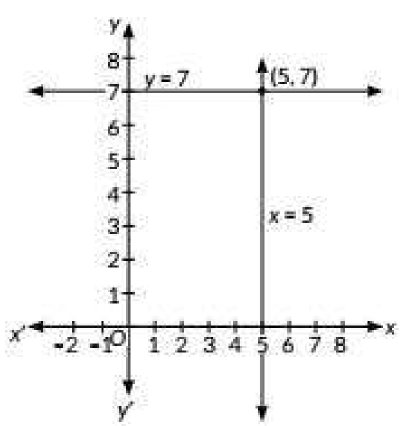
10. Given equations are

$x=5$ ... (i)

$y=7$ ... (ii)

Draw the line $x=5$ parallel to y-axis and $y=7$ parallel to x-axis .

$\therefore$ The graph of equation (i) and (ii) is as follows :



The lines $x=5$ and $y=7$ intersects each other at (5, 7).

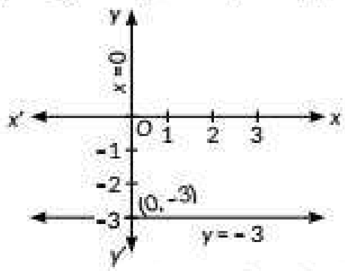
11. Given pair of equations are

$x = 0$ ...(i)

and $y = -3$ ...(ii)

$x = 0$ means y-axis and draw a line $y = -3$ parallel to x-axis.

$\therefore$ The graph of given equation (i) and (ii) is



The lines intersect each other at (0, −3). Therefore, the given pair of equations is consistent.

12. Solutions of linear equations

$2y - x = 8$ ...(i)

$5y - x = 14$ ...(ii)

and $y - 2x = 1$ ...(iii)

are given below :

x	−4	0	2
y	2	4	5

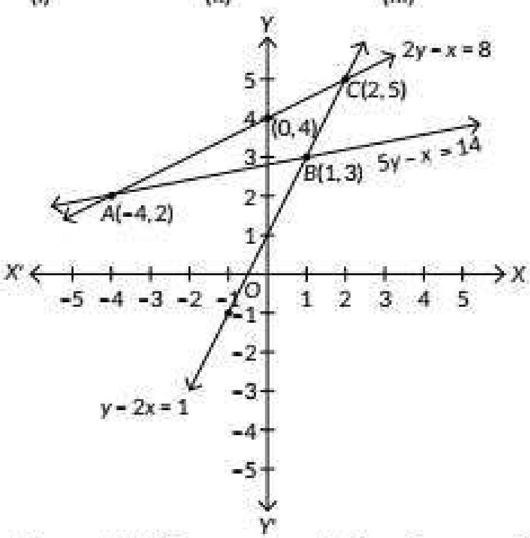
(i)

x	−4	1
y	2	3

(ii)

x	−1	1	2
y	−1	3	5

(iii)



From the graph of lines represented by given equations, we observe that

Lines (i) and (iii) intersect each other at $C(2, 5)$,

Lines (ii) and (iii) intersect each other at $B(1, 3)$ and

Lines (i) and (ii) intersect each other at $A(-4, 2)$.

$\therefore$ Coordinates of the vertices of the triangle are $A(-4, 2)$, $B(1, 3)$ and $C(2, 5)$.

13. Solution of linear equations

$x + 2y = 6$ ...(i)

and $2x - 5y = 12$ ...(ii)

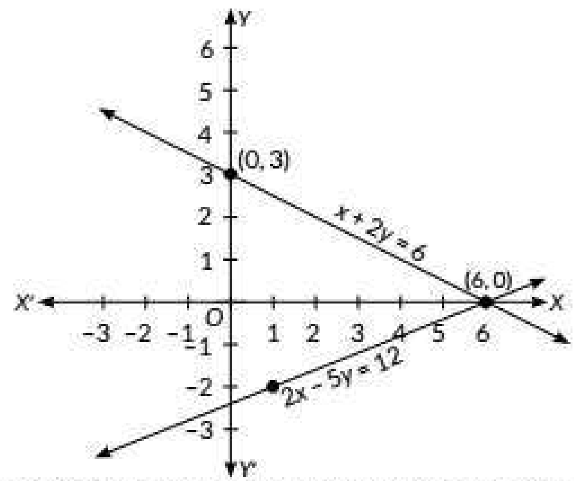
are given below

x	0	6
y	3	0

(i)

x	6	1
y	0	−2

(ii)



From the graph, the two lines intersect each other at point (6, 0)

$\therefore$ $x = 6$ and $y = 0$

14. Solutions of linear equations

$x - y + 1 = 0$ ...(i)

and $3x + 2y - 12 = 0$ ...(ii)

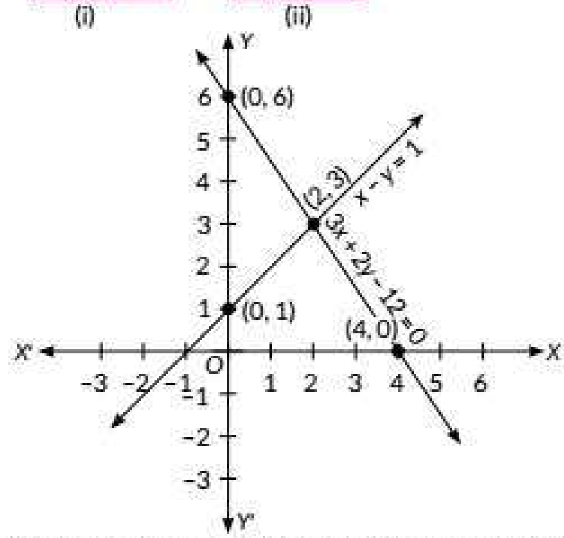
are given below :

x	0	−1
y	1	0

(i)

x	4	0
y	0	6

(ii)



From the graph, the two lines intersect each other at the point (2, 3). $\therefore$ $x = 2, y = 3$.

Key Points

- When the two lines will not intersect, then they are parallel.

15. Let ₹ x and ₹ y be the amount contributed by two sections A and B respectively.

According to question,

$x + y = 1500$ ...(i) and $x - y = -100$ ...(ii)

Two solutions of each linear equations are

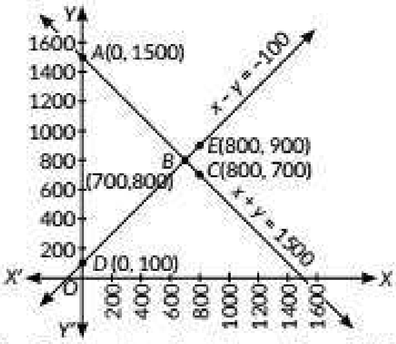
x	0	800
y	1500	700

(i)

x	0	800
y	100	900

(ii)

The graphical representation of the given pair of linear equations is given below :



The two lines intersect each other at the point (700, 800).
So, $x = 700$, $y = 800$.

∴ The amount contributed by section A is ₹ 700 and by section B is ₹ 800.

16. Two solutions of linear equations
$3x + 5y = 15$ ...(i)
and $6x - 5y = 30$ ...(ii)
are given below :

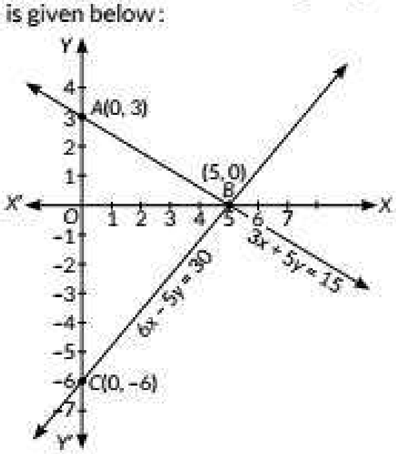
x	0	5
y	3	0

(i)

x	0	5
y	−6	0

(ii)

The graphical representation of the given pair of linear equations is given below :



Clearly, the lines intersect each other at the point (5, 0).
Area of park = Area of ΔABC

$= \frac{1}{2} \times AC \times OB = \frac{1}{2} \times 9 \times 5 = 22.5$ sq. km.

Public should keep the park clean.

Answer Tips

- Area of triangle $= \frac{1}{2} \times$ base × height

17. Two solutions of linear equations
$6x - y + 4 = 0$ ...(i) and $2x - 5y = 8$ ...(ii)
are given below :

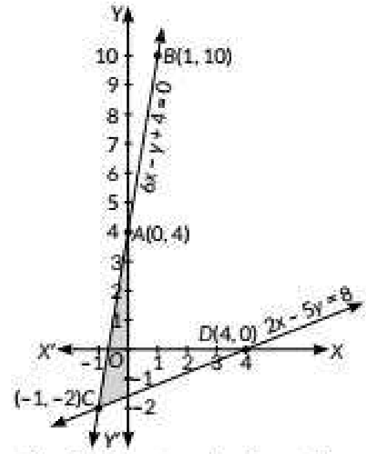
x	0	1
y	4	10

(i)

x	−1	4
y	−2	0

(ii)

The graphical representation is given below :



Thus, the two lines intersect each other at the point (−1, −2).

Concept Applied

- Intersection point of two lines is the solution of two lines.

18. Two solutions of linear equations
$x - 2y = 0$ ...(i) and $3x + 4y = 20$ ...(ii)
are given below :

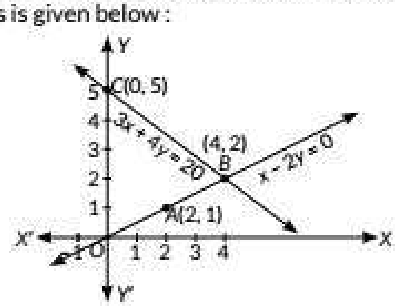
x	2	4
y	1	2

(i)

x	0	4
y	5	2

(ii)

The graphical representation of the given pair of linear equations is given below :



The two lines intersect each other at the point (4, 2).
So, $x = 4$, $y = 2$ is the required solution.

19. Two solutions of linear equations.
$2y - 3x = 14$ ...(i) and $2x + 3y = 8$ ...(ii)
are given below :

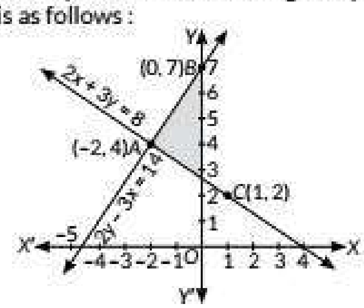
x	−2	0
y	4	7

(i)

x	−2	1
y	4	2

(ii)

The graphical representation of the given pair of linear equations is as follows :



The two lines intersect at the point (–2, 4).
So, $x = -2, y = 4$, is the required solution.

20. Two solutions of the given linear equations
$x + 3y = 6$ ...(i)
and $2x - 3y = 12$ ...(ii)
are given below :

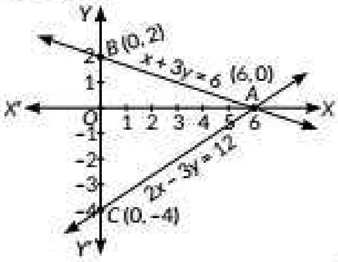
x	6	0
y	0	2

(i)

x	6	0
y	0	–4

(ii)

The graphical representation of the given pair of linear equations is as follows :



The line $x + 3y = 6$ intersects the y-axis at (0, 2) and the line $2x - 3y = 12$ intersects the y-axis at (0, –4) and the two lines intersect at the point (6, 0) on x-axis.

The area of the triangle formed by first line, $x = 0, y = 0$.

= Area of ΔABO

$= \frac{1}{2}$ (Base × height) $= \frac{1}{2} \times 2 \times 6 = 6$ sq. units.

And the area of the triangle formed by second line, $x = 0$, $y = 0$

= Area of ΔAOC

$= \frac{1}{2} \times 4 \times 6 = 12$ sq. units.

So, the ratio of areas of triangles $= \frac{\text{Area of } \Delta ABO}{\text{Area of } \Delta AOC}$

$= \frac{6}{12} = \frac{1}{2}$

Hence, the ratio of the areas of triangles is 1 : 2.

21. Two solutions of each linear equations
$2x + y = 4$ ...(i) and $2x - y = 4$ ...(ii)
are given below :

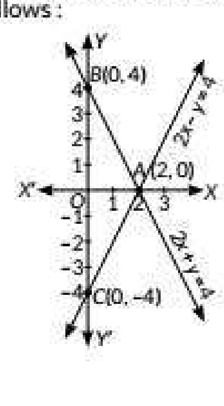
x	0	2
y	4	0

(i)

x	0	2
y	–4	0

(ii)

The graphical representation of the given pair of linear equations is as follows :



The coordinates of the vertices of ΔABC are $A(2, 0)$, $B(0, 4)$ and $C(0, -4)$.

Now, required area = Area of ΔABC

$= \frac{1}{2}$ (Base × Height)

$= \frac{1}{2} \times BC \times OA$

$= \frac{1}{2} \times 8 \times 2 = 8$ sq. units.

22. (b): Given equations are
$kx = y + 2 \Rightarrow kx - y - 2 = 0$
$6x = 2y + 3 \Rightarrow 6x - 2y - 3 = 0$

For infinitely many solutions $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

As, $\frac{k}{6} = \frac{1}{2} \neq \frac{2}{3}$

Hence, value of k does not exist.

23. (b): Let age of father be 'x' years and age of son be 'y' years.

According to the question, $x = 3y$ ...(i)
and $x + 12 = 2(y + 12) \Rightarrow x - 2y = 12$ ...(ii)
From (i) and (ii), we get $x = 36, y = 12$
$\therefore$ $x + y = 48$ years

24. (a): Given, $17x - 19y = 53$ ...(i)
and $19x - 17y = 55$ ...(ii)
Multiplying (i) by 19 and (ii) by 17, and by subtracting we get, $323x - 361y - (323x - 289y) = 1007 - 935$
$\Rightarrow$ $-72y = 72 \Rightarrow y = -1$
Putting $y = -1$ in (i), we get, $17x - 19(-1) = 53$
$\Rightarrow$ $17x = 53 - 19 \Rightarrow 17x = 34 \Rightarrow x = 2$
$\therefore$ $x + y = 2 - 1 = 1$

Concept Applied

- In elimination method, we multiply both the equations with some suitable non-zero constants to make the coefficients of one variable (either x or y) numerically equal.

25. Let the numerator be x and denominator be y of the fractions. Then, the fraction $= \frac{x}{y}$.
Given, $x + y = 18$ ...(i)
and $\frac{x}{y+2} = \frac{1}{3}$
$\Rightarrow$ $3x - y = 2$ ...(ii)
Adding (i) and (ii), we get
$4x = 20 \Rightarrow x = 5$
Put the value of x in (i), we get
$5 + y = 18 \Rightarrow y = 13$
$\therefore$ The required fraction is $\frac{5}{13}$.

26. Let the larger angle be $x°$ and smaller angle be $y°$. We know that the sum of two supplementary pair of angles is always 180°.
$\therefore$ We have $x° + y° = 180°$ ...(i)
and $x° - y° = 18°$ ...(ii) [Given]
By (i), we have $x° = 180° - y°$ ...(iii)

Put the value of x° in (ii), we get

$$180^\circ - y^\circ - y^\circ = 18^\circ$$

$\Rightarrow$ $162^\circ = 2y^\circ \Rightarrow y = 81$

From (3), we have $x^\circ = 180^\circ - 81^\circ = 99^\circ$

$\therefore$ The angles are 99° and 81°.

Concept Applied

- In substitution method, substitute the value of one variable by expressing it in terms of the other variable to solve the pair of linear equations.

27. Given pair of linear equations,

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

$2y + 7 = 9x$

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

Multiply (i) by 3 and subtract from (ii), as

$\Rightarrow$ $9x - 2y - (9x - 15y) = 7 - 12$

$\Rightarrow$ $9x - 2y - 9x + 15y = -5 \Rightarrow 13y = -5 \Rightarrow y = \frac{-5}{13}$

Put $y = \frac{-5}{13}$ in (i), we get

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

$\Rightarrow$ $3x + \frac{25}{13} = 4 \Rightarrow 3x = 4 - \frac{25}{13} \Rightarrow x = \frac{27}{13\times3} = \frac{9}{13}$

Hence, $x = \frac{9}{13}$ and $y = \frac{-5}{13}$

28. Here, *ABCD* is the rectangle

$\therefore$ $AB = DC$ and $DA = CB$

$\Rightarrow$ $x + y = 30$ ...(i)

and $x - y = 14$ ...(ii)

Adding (i) and (ii), we get

$2x = 44 \Rightarrow x = 22$

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

$22 + y = 30 \Rightarrow y = 30 - 22 = 8 \therefore x = 22, y = 8$

Key Points

- Opposite sides of a rectangle are equal.

29. Let x and y be two number such that $x > y$.

According to question,

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

and $x + 2y = 13$ ...(ii)

Subtracting (i) from (ii), we get

$3y = 9 \Rightarrow y = 3$

Substitute $y = 3$ in (i), we get

$x - 3 = 4 \Rightarrow x = 7$

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

According to question, we have

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

and $\frac{x}{y+8} = \frac{1}{4}$ ...(ii)

From (i), $3x - 3 = y$

$\Rightarrow$ $3x - y - 3 = 0$ ...(iii)

From (ii), $4x = y + 8$

$\Rightarrow$ $4x - y - 8 = 0$ ...(iv)

Subtracting (iii) from (iv), we get $x = 5$

Substituting the value of x in (iii), we get $y = 12$

Thus, the required fraction is $\frac{5}{12}$.

31. Let the present age of son be x years and that of father be y years.

According to question, we have

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

And $y + 3 = 2(x + 3) + 10$

$\Rightarrow$ $y + 3 = 2x + 6 + 10$

$\Rightarrow$ $2x - y + 13 = 0$ ...(ii)

Subtracting (ii) from (i), we get $x = 10$

Substituting the value of x in (ii), we get $y = 33$

So, the present age of son is 10 years and that of father is 33 years.

32. Let the age of two children be x and y respectively.

$\therefore$ Father's present age $= 3(x + y)$

After 5 years, sum of ages of children $= x + 5 + y + 5$

$= x + y + 10$

and age of father $= 3(x + y) + 5$

According to question,

$3(x + y) + 5 = 2(x + y + 10)$

$\Rightarrow$ $3x + 3y + 5 = 2x + 2y + 20 \Rightarrow x + y = 15$

Hence, present age of father $= 3(x + y)$

$= 3 \times 15 = 45$ years

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

Then, according to question,

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

$\Rightarrow$ $3x - 6 = y$ and $2x = y - 1$

$\Rightarrow$ $3x - y - 6 = 0$ ... (i) and $2x - y + 1 = 0$ ... (ii)

Subtracting (ii) from (i), we get

$x - 7 = 0 \Rightarrow x = 7$

From (i), $3(7) - y - 6 = 0 \Rightarrow 21 - 6 = y \Rightarrow y = 15$

$\therefore$ Required fraction $= \frac{7}{15}$

34. Let the monthly fixed charges be ₹ x and cost of food per day be ₹ y.

For student *A*, Fixed charges + cost of food for 25 days = ₹ 4500

i.e., $x + 25y = 4500$ ... (i)

For student *B*, Fixed charges + cost of food for 30 days = ₹ 5200

i.e., $x + 30y = 5200$ ...(ii)

Subtracting (i) from (ii), we get

$5y = 700 \Rightarrow y = 140$

From (i), $x + 25(140) = 4500 \Rightarrow x = 4500 - 3500 = 1000$

Hence, monthly fixed charges is ₹ 1000 and cost of food per day is ₹ 140.

35. Given pair of linear equations are

$3x - y = 5$ ...(i) and $5x - y = 11$ ...(ii)

Subtracting (ii) from (i), we get

$3x - y - (5x - y) = 5 - 11$

$\Rightarrow -2x = -6 \Rightarrow x = 3$

Substituting the value of x in (i), we get

$3 \times 3 - y = 5 \Rightarrow -y = 5 - 9 \Rightarrow y = 4$

Hence, $x = 3, y = 4$

36. Let the cost of a chair be ₹ x and the cost of a table be ₹ y.

Then, according to question,

$2x + 3y = 5650$ ...(i)

$3x + 2y = 7100$ ...(ii)

Multiply (i) by 2 and (ii) by 3, we get

$4x + 6y = 11300$ ...(iii)

$9x + 6y = 21300$ ...(iv)

Subtracting (iv) from (iii), we get

$5x = 10000 \Rightarrow x = 2000$

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

$2 \times 2000 + 3y = 5650$

$\Rightarrow 3y = 5650 - 4000 \Rightarrow 3y = 1650$

$\Rightarrow y = \frac{1650}{3} = 550$

Hence, the cost of a chair is ₹ 2000 and cost of a table is ₹ 550.

37. (i) For Hockey, the amount given to per student = ₹ x

For cricket, the amount given to per student = ₹ y

From the question,

$5x + 4y = 9500$ ...(1)

$4x + 3y = 7370$ ...(2)

(ii) (a) Multiply (1) by 3 and (2) by 4 and then subtracting, we get

$15x + 12y - (16x + 12y) = 28500 - 29480$

$\Rightarrow -x = -980 \Rightarrow x = 980$

The prize amount given for hockey is ₹ 980 per student

OR

(b) Multiply (1) by 4 and (2) by 5 and then subtracting, we get

$20x + 16y - 20x - 15y = 38000 - 36850$

$\Rightarrow y = 1150$

The prize amount given for cricket is more than hockey by ₹(1150 – 980) = ₹ 170.

(iii) Total prize amount = $2 \times 980 + 2 \times 1150$

= ₹ (1960 + 2300) = ₹ 4260

38. Let the income of first person be $9x$ and the income of second person be $7x$. Further, let the expenditures of first and second persons be $4y$ and $3y$ respectively. Then,

Saving of the first person = $9x - 4y$

Saving of the second person = $7x - 3y$

According to question,

$9x - 4y = 2000$ ...(i)

and $7x - 3y = 2000$ ...(ii)

Multiply (i) by 7 and (ii) by 9 and by subtracting, we get

$63x - 28y - (63x - 27y) = 14000 - 18000$

$\Rightarrow y = 4000$

From (i), $9x = 2000 + 4 \times 4000 = 18000 \Rightarrow x = 2000$

Thus, monthly income of first person = 9×2000

= ₹ 18000

Monthly income of second person = 7×4000 = ₹ 28000

39. Let the tens digit of a number be a and ones digit be b, then the number be $10a + b$.

On reversing the digits, the number is $10b + a$

According to question,

$a + b = 9$ ...(i)

and $9(10a + b) = 2(10b + a)$

$\Rightarrow 90a + 9b = 20b + 2a$

$\Rightarrow -11b + 88a = 0 \Rightarrow b - 8a = 0$ ...(ii)

Subtracting (i) from (ii), we get $a = 1$

Putting the value of a in (ii), we get $b = 8 \times 1 = 8$

Hence, required number = $10 \times 1 + 8 = 18$

40. Let the number of colours in the flag be x and number of lines in the blue colour wheel be y.

According to question,

$8x = y \Rightarrow 8x - y = 0$ ...(i)

and $x + y = 27$ ...(ii)

Adding (i) & (ii), we get

$9x = 27 \Rightarrow x = 27/9 = 3$

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

$y = 8 \times 3 \Rightarrow y = 24$

Thus, the number of colours in the flag is 3 and number of lines in the blue colour wheel is 24.

The wheel in flag signifies the law of dharma. This wheel denotes motion.

41. Let the speed of car at A be u km/h and car at B be v km/h.

Case 1 : When both cars travel in the same direction

Let both the cars meet at point C in 5 hours.

Car at A travels distance AC, whereas car at B travels distance BC.

$\therefore AC = 5 \times u$ and $BC = 5 \times v$

Now, $AC - BC = 100 \Rightarrow 5u - 5v = 100$

$\Rightarrow u - v = 20$ ...(i)

Case 2 : When both cars travel in opposite directions

Let both cars meet at point D.

Car at A will travel distance AD, whereas car at B will travel distance BD.

$\therefore \quad AD = 1 \times u$ and $BD = 1 \times v$

Now, $AD + BD = 100$

$\Rightarrow \quad u + v = 100$ ...(ii)

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

$2u = 120 \Rightarrow u = 60$

From (ii), we get

$60 + v = 100 \Rightarrow v = 40$

Steps to save petrol :

(i) Drive at a moderate speed, as higher the speed, the higher the fuel consumption.

(ii) Use public transport.

42. (d) : The given system of equation will have no solution.

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

$\because$ The given system of equations will have no solution.

$\therefore \quad \frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2} \Rightarrow \frac{1}{2} = \frac{1}{k} \neq \frac{-4}{-3}$

Now, $\frac{1}{2} = \frac{1}{k} \Rightarrow k = 2$

Clearly, $\frac{1}{k} \neq \frac{-4}{-3}$ for $k = 2$

Hence, the given system of equations will have no solution for $k = 2$.

43. Given, system of equations

$x + 2y = 5$

$3x + ky = -15$ has no solution.

$\therefore \quad \frac{1}{3} = \frac{2}{k} \neq \frac{5}{-15} \Rightarrow k = 6$

$\therefore$ For $k = 6$, the given system of equations has no solution.

44. The given pair of linear equations is

$x + 2y = 5$

$3x + ky = -15$

Since, the system of equations has a unique solution.

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

$\therefore$ For all values of k except $k = 6$, the given pair of linear equations will have unique solution.

45. Given pair of equations are

$x - 4y + p = 0$ ...(i)

and $2x + y - q - 2 = 0$ ...(ii)

It is given that $x = 3$ and $y = 1$ is the solution of (i) and (ii)

$\therefore \quad 3 - 4 \times 1 + p = 0 \Rightarrow p = 1$

and $2 \times 3 + 1 - q - 2 = 0 \Rightarrow q = 5 \therefore q = 5p$

46. Given system of equations

$cx + 3y + (3 - c) = 0$

and $12x + cy - c = 0$ has infinitely many solutions.

$\therefore \quad \frac{c}{12} = \frac{3}{c} = \frac{3-c}{-c}$

$\Rightarrow \quad \frac{c}{12} = \frac{3}{c}$ or $\frac{3}{c} = \frac{3-c}{-c}$

$\Rightarrow \quad c^2 = 36$ or $-3c = 3c - c^2$

$\Rightarrow \quad c = \pm 6$ or $c^2 - 6c = c(c - 6) = 0 \Rightarrow c = 0$ or 6

$\therefore$ The value of c, that satisfies both the condition is $c = 6$.

Concept Applied

- The given system equation will have infinitely many solution.

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

47. The given pair of linear equations is

$2x + 3y - 7 = 0$

$(k + 1)x + (2k - 1)y - (4k + 1) = 0$

Since, given equations have infinitely many solutions.

$\therefore \quad \frac{2}{k+1} = \frac{3}{2k-1} = \frac{-7}{-(4k+1)}$

Now, $\frac{2}{k+1} = \frac{3}{2k-1} \Rightarrow 4k - 2 = 3k + 3$

$\Rightarrow \quad 4k - 3k = 3 + 2 \Rightarrow k = 5$

48. The given pair of linear equations is

$2x + 3y - 7 = 0$

$(k - 1)x + (k + 2)y - 3k = 0$

Since, given equations have infinitely many solutions

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

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

$\Rightarrow \quad 6k = 7k - 7 \Rightarrow k = 7$

49. The given pair of linear equations is

$kx + 2y = 3$

$3x + 6y = 10$

Since, the system of equations has unique solution.

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

$\therefore$ For all values of k except $k = 1$, the given pair of linear equations will have unique solution.

50. The given system of equation will have no solution.

$\therefore \quad \frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2} \Rightarrow \frac{3}{2k-1} = \frac{1}{k-1} \neq \frac{1}{2k+1}$

Now, $\frac{3}{2k-1} = \frac{1}{k-1} \Rightarrow 3k - 3 = 2k - 1 \Rightarrow k = 2$

Clearly, $\frac{3}{2k-1} \neq \frac{1}{2k+1}$ for $k = 2$

Hence, the given system of equations will have no solution for $k = 2$.

51. (i) (c) : Given equations are :

$2x - 3y = 5$

$-6x + 9y = 7$

Hence, $a_1 = 2, b_1 = -3, c_1 = -5$

$a_2 = -6, b_2 = 9, c_2 = -7$

Now, $\frac{a_1}{a_2} = \frac{2}{-6} = \frac{-1}{3}$,

$\frac{b_1}{b_2} = \frac{-3}{9} = \frac{-1}{3}$ and $\frac{c_1}{c_2} = \frac{-5}{-7} = \frac{5}{7}$

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

∴ Equations are inconsistant and lines are parallel.

(ii) (c) : If any point lies on the line $ax + by = c$, then it must satisfy the equation of the line.

Here, (4, 1) satisfies the equation of line $2x - 3y = 5$.

As $2 \times 4 - 3 \times 1 = 5$

$\Rightarrow 8 - 3 = 5$

$\Rightarrow 5 = 5$

(iii) (a) : If a line $ax + by = c$ intersects the y-axis at a particular point, then $x = 0$ at that point.

In this case, if $x = 0$, then we have

$-6 \times 0 + 9y = 7 \Rightarrow y = \frac{7}{9}$

∴ The required coordinates are $\left(0, \frac{7}{9}\right)$

(iv) (b) : If a pair of equations $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ has a unique solution, then $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

(v) (b) : If $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$, then the two lines $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ are coincident and system of equations has infinite solutions.

CBSE Sample Questions

1. (d): The system of equation is inconsistent when,

$\frac{3}{2k-1} = \frac{1}{k-1} \neq \frac{1}{2k+1} \Rightarrow 3(k-1) = 2k - 1 \Rightarrow k = 2$ **(1)**

2. (a): For lines to coincide, $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

So, $\frac{5}{15} = \frac{7}{21} = \frac{-3}{-k} \Rightarrow \frac{1}{3} = \frac{3}{k} \Rightarrow k = 9$ **(1)**

3. (a): Lines $x = a$ is a line parallel to y-axis and $y = b$ is a line parallel to x-axis. So, they will intersect. **(1)**

4. (d): The given equation is $-5x + 7y = 2$

Multiplying both sides by -2, we get

$-2(-5x + 7y) = -4 \Rightarrow 10x - 14y = -4$

Here, $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2} = -2$ **(1)**

5. Let the cost of 1 chair = ₹ x

and the cost of 1 table = ₹ y

Then, according to given condition, we get

$3x + y = 1500, 6x + y = 2400$ **(1)**

6. (a): We have,

$217x + 131y = 913$ ...(i)

$131x + 217y = 827$ ...(ii)

Adding (i) and (ii), we get

$348x + 348y = 1740 \Rightarrow x + y = 5$ **(1)**

7. Since the given system of equations have no solution.

∴ $\frac{3}{6} = \frac{1}{k} \neq \frac{3}{8}$ **(1/2)**

Now, $\frac{3}{6} = \frac{1}{k} \Rightarrow k = 2$

Clearly, $\frac{1}{k} \neq \frac{3}{8}$ for $k = 2$. **(1/2)**

8. We have, $49x + 51y = 499$ ...(i)

$51x + 49y = 501$ ... (ii)

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

$100x + 100y = 1000$

Dividing both sides by 100, we get

$x + y = 10$ ...(iii) **(1/2)**

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

$2x - 2y = 2$

$\Rightarrow x - y = 1$ ...(iv) **(1/2)**

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

$2x = 11 \Rightarrow x = 11/2$ **(1/2)**

Substitute the value of x in equation (iii), we get

$\frac{11}{2} + y = 10 \Rightarrow y = 10 - \frac{11}{2} = \frac{9}{2}$ **(1/2)**

9. Let length of journey is d. If usual speed of train is s km/hr and it takes time to reach the destination is t.

So, $d = st$

When train is faster by 6 km/hr, then

$\Rightarrow t - 4 = \frac{d}{s+6} \Rightarrow t - 4 = \frac{st}{s+6}$

$\Rightarrow 6t - 4s = 24$ ...(i) **(1)**

when train is slower by 6 km/hr then,

$t + 6 = \frac{d}{s-6}$

$\Rightarrow t + 6 = \frac{st}{s-6}$

$\Rightarrow -6t + 6s = 36$ ...(ii) **(1)**

Adding (i) and (ii), we get

$6t - 4s - 6t + 6s = 24 + 36$

$\Rightarrow 2s = 60 \Rightarrow s = 30$

Put $s = 30$ in (i), we get

$\Rightarrow 6t - 4 \times 30 = 24$

$\Rightarrow 6t = 144 \Rightarrow t = 24$

So, length of journey, $d = st$

$= 30 \times 24$ km $= 720$ km **(1)**