CBSE Test Paper 02

Chapter 3 Pair of Linear Equation

1. Half the perimeter of a rectangular garden, whose length is 4m more than its width is 36m. The area of the garden is **(1)**

   a. 320 m^2
   b. 300 m^2
   c. 400 m^2
   d. 360 m^2

2. A fraction becomes $\frac{9}{11}$, if 2 is added to both the numerator and denominator. If 3 is added to both the numerator and denominator it becomes $\frac{5}{6}$, then the fraction is **(1)**

   a. $\frac{9}{7}$
   b. $\frac{-9}{7}$
   c. $\frac{7}{9}$
   d. $\frac{-7}{9}$

3. If a pair of linear equation is consistent, then the lines will be **(1)**

   a. always intersecting
   b. intersecting or coincident
   c. always coincident
   d. parallel

4. The system of equations 6x + 3y = 6xy and 2x + 4y = 5xy has **(1)**

   a. one solution
   b. one unique solution
   c. many solutions
   d. no solution

5. The sum of the numerator and denominator of a fraction is 18. If the denominator is increased by 2, the fraction reduces to $\frac{1}{3}$. The fraction is **(1)**

a. $\frac{-7}{11}$
b. $\frac{5}{13}$
c. $\frac{-5}{13}$
d. $\frac{7}{11}$

6. If ad ≠ bc, then find whether the pair of linear equations ax + by = p and cx + dy = q has no solution, unique solution or infinitely many. **(1)**

7. For what value of a the following pair of linear equation has infinitely many solutions?
   2x + ay = 8
   ax + 8y = a **(1)**

8. Find whether the following pair of linear equations is consistent or inconsistent:
   x + 3y = 5; 2x + 6y = 8 **(1)**

9. If 12x + 17y = 53 and 17x + 12y = 63 then find the value of (x + y). **(1)**

10. For what value of k, the following system of equations represent parallel lines?
    kx - 3y + 6 = 0, 4x - 6y + 15 = 0 **(1)**

11. Is the system of linear equations$2x + 3y - 9 = 0$ and $4x + 6y - 18 = 0$ is consistent ? Justify your answer **(2)**

12. Find two numbers such that the sum of thrice the first and the second is 142, and four times the first exceeds the second by 138. **(2)**

13. Solve the following systems of equations by using the method of substitution:
    3x - 5y=-1
    x - y =-1 **(2)**

14. Solve for x and y : $\frac{6}{x+y}$ = $\frac{7}{x-y}$ + 3, $\frac{1}{2(x+y)}$ = $\frac{1}{3(x-y)}$ where x + y$\neq$ 0 and x -y $\neq$0. **(3)**

15. The cost of 2 kg of apples and 1 kg of grapes in a day was found to be Rs.160. After a month, the cost of 4 kg of apples and 2 kg of grapes in Rs.300. Represent the situation algebraically and geometrically. **(3)**

16. The sum of a two digit number and the number formed by interchanging the digit is

132. If 12 is added to the number, the new number becomes 5 times the sum of the digits. Find the number. **(3)**

17. The coach of the cricket team buys 3 bat and 6 balls for Rs.3900. Later, she buys another bat and 3 more balls of the same kind for Rs.1300. Representing this situation algebraically and geometrically. **(3)**
18. On selling a T.V. at 5% gain and a fridge at 10% gain. A shopkeeper gains Rs. 2000. But if he sells the T.V. at 10% gain and the fridge at 5% loss. He gains Rs. 1500 on the transaction. Find the actual price of the T.V. and the fridge. **(4)**
19. Write the number of solutions of the following pair of linear equations: $x + 2y - 8 = 0$, $2x + 4y = 16$. **(4)**
20. Five years hence, father's age will be three times the age of his son. Five years ago, father was seven times as old as his son. Find their present ages. **(4)**

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Solution

1. a. 320 m^2

   Explanation: Let the width be x.

   then length be x+4

   According to the question,

   l+b=36

   x+(x+4)=36

   2x+4=36

   2x=36-4

   2x=32

   x=16.

   Hence, The length of the garden will be 20 m and width will be 16 m.

   Area = length $\times$ breath= 20 $\times$ 16 = 320 m^2

2. c. $\frac{7}{9}$

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

   According to question

   $\frac{x+2}{y+2}=\frac{9}{11}$

   $\Rightarrow 11x+22=9y+18$

   $\Rightarrow 11x-9y=-4$ ....(i)

   And $\frac{x+3}{y+3}=\frac{5}{6}$

   $\Rightarrow 6x+18=5y+15$

   $\Rightarrow 6x-5y=-3$ ....(ii)

   On solving eq. (i) and eq. (ii), we get

   $x=7, y=9$

   Therefore, the fraction is $\frac{7}{9}$

3. b. intersecting or coincident

   Explanation: If a consistent system has an infinite number of solutions, it is dependent. When you graph; the equations, both equations represent the same line. So for consistent line it has to be parallel or even they intersect at one point. If a system has no solution, it is said to be inconsistent. The graphs of the lines do not intersect, so the graphs are parallel and there is no solution.

4. b. one unique solution

Explanation: Given:

$6x + 3y = 6xy \Rightarrow \frac{3}{x} + \frac{6}{y} = 6$ And $2x + 4y = 5xy \Rightarrow \frac{4}{x} + \frac{2}{y} = 5$

Let $\frac{1}{x} = u$ and $\frac{1}{y} = v$

$\therefore$ The equations are $3u + 6v = 6$ and $4u + 2v = 5$

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

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

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

Therefore, the system of given equations has a unique solution.

5. b. $\frac{5}{13}$

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

According to question

$x + y = 18$ ....(i)

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

$\Rightarrow 3x = y + 2$

$\Rightarrow 3x - y = 2$ ....(ii)

On solving eq. (i) and eq. (ii), we get

$x = 5, y = 13$

Therefore, the fraction is $\frac{5}{13}$.

6. Pair of linear equations $ax + by = p$ and $cx + dy = q$

$ad \neq bc$ or

$\frac{a}{c} \neq \frac{b}{d}$

Hence, the pair of given linear equations has unique solution

7. For infinite numbers of solution

$\frac{2}{a} = \frac{a}{8} = \frac{8}{a} \Rightarrow \frac{2}{a} = \frac{a}{8}$ and $\frac{a}{8} = \frac{8}{a}$

$a^2 = 16 \ and \ a^2 = 64$

$\therefore$ The system do not have infinite solutions for any value of a.

8. Given equations are

$x + 3y = 5$ .....(i)

$2x + 6y = 8$ ..(ii)

$\frac{a_1}{a_2} = \frac{1}{2}; \frac{b_1}{b_2} = \frac{1}{2}; \frac{c_1}{c_2} = \frac{5}{8}$

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

$\therefore$ the pair of linear equations is inconsistent.

9. $12x + 17y = 53$............(i)

and $17x + 12y = 63$.....(ii)

Adding (i) and (ii), we get

$29x + 29y = 116$

$\Rightarrow$ x + y = 4

10. For no solution, $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

then, $\frac{k}{4} = \frac{-3}{-6} \neq \frac{6}{15} \Rightarrow \frac{k}{4} = \frac{1}{2} \Rightarrow$ k = $\frac{4}{2}$ = 2

11. We have, for the equation

$2x + 3y - 9 = 0$

$a_1 = 2, b_1 = 3$ and $c_1 = -9$

and for the equation, 4x + 6y - 18 = 0

$a_2 = 4, b_2 = 6$ and $c_2 = -18$

Here $\frac{a_1}{a_2} = \frac{2}{4} = \frac{1}{2} \ldots\ldots\ldots (i)$

$\frac{b_1}{b_2} = \frac{3}{6} = \frac{1}{2} \ldots\ldots\ldots (ii)$

and $\frac{c_1}{c_2} = \frac{-9}{-18} = \frac{1}{2} \ldots\ldots\ldots (iii)$

From (i), (ii) and (iii)

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

Hence, the system is consistent and dependent.

12. Let the first and second numbers be x and y respectively.

According to the given condition,

The sum of thrice the first and the second is 142.

3x + y = 142 ....(i)

And as per second condition

Four times the first exceeds the second by 138

4x - y = 138.............(ii)

Adding (i) and (ii), we get

7x = 280

$\Rightarrow x = \frac{280}{7} = 40$

Putting x = 40 in (i), we get

$3 \times 40 + y = 142$

y = 142 - 120

y = 22

Hence, the first and second numbers are 40 and 22.

13. $3x - 5y = -1$.........(i)

$x - y = -1$..........(ii)

From (ii), we get

$y = x + 1$

Substituting, $y = x + 1$ in (i), we get

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

$\Rightarrow -2x - 5 = -1 \Rightarrow x = -2$

Putting x = -2 in y = x + 1 we get y = -1.

Hence, the solution of the given system of equations is x = -2, y = -1.

14. $\frac{6}{x+y} = \frac{7}{x-y} + 3$ ...(i) and $\frac{1}{2(x+y)} = \frac{1}{3(x-y)}$ ...(ii)

put $\frac{1}{x+y}$ = A and $\frac{1}{x-y}$ = B

Equation (i) and (ii) becomes,

$6A = 7B + 3 \Rightarrow 6A - 7B = 3$

and $\frac{1}{2}$ A = $\frac{1}{3}$ B $\Rightarrow 3A = 2B \Rightarrow 3A - 2B = 0$

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

$$\begin{array}{r} 6A - 7B = 3 \\ 6A - 4B = 0 \\ - \quad + \quad\quad - \\ \hline -3B = 3 \end{array}$$

$\Rightarrow B = -1$

Putting $B = -1$ in eq. (ii), we get

$3A - 2 \times (-1) = 0 \Rightarrow$ A = -$\frac{2}{3}$

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

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

On solving both equations, we get

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

15. Let the cost of 1 kg of apples be Rs. x and of 1 kg of grapes be Rs. y.

Then the algebraic representation is given by the following

Equations:

$2x + y = 160$ ...(1)

$4x + 2y = 300$

$\Rightarrow 2x + y = 150$ ...(2)

To represent these equation graphically, we find two solutions for each equations are given below:

For Equation (1) $2x + y = 160$

$\Rightarrow y = 160 - 2x$

Table (1) of solutions

x	50	40
y	60	80

For Equation (2) $2x + y = 150$

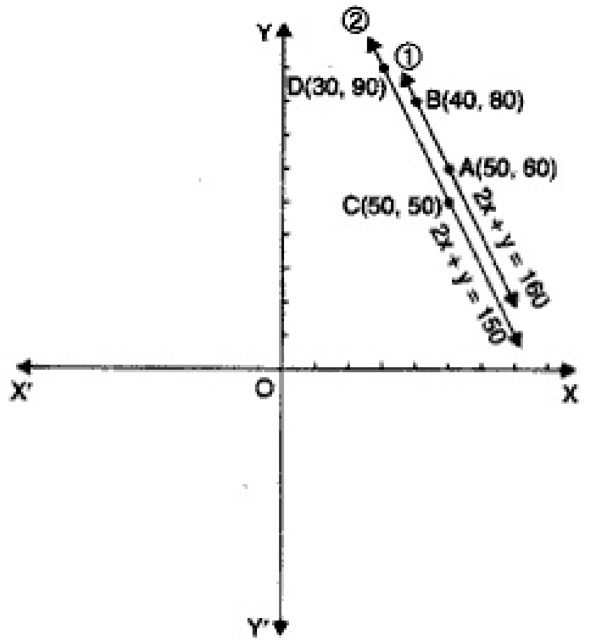
$\Rightarrow y = 150 - 2x$

Table 2 of solutions

x	50	30
y	50	90

We plot the points A(50, 60) and B(40, 80) corresponding to the solutions in table 1 on a graph paper for get the line.

AB representing the equation (1) and the points C(50, 50) and D(30, 90) corresponding the equation (2) as shown in figure given below.



We observe in figure that, the two lines do not intersect anywhere i.e., they are parallel.

16. Let the digits at units and tens place in the given number be x and y respectively. Then,

Number =$10y + x$ ....(i)

Number formed by interchanging the digits = $10x + y$

According to the given conditions, we have

$(10y + x) + (10x + y) = 132$

and, $(10y + x) + 12 = 5(x + y)$

$\Rightarrow 11x + 11y = 132$ and, $4x - 5y = 12$

$\Rightarrow x + y - 12 = 0$ and, $4x - 5y - 12 = 0$

Solving these two equations by cross-multiplication, we have

$\frac{x}{-12-60} = \frac{y}{-48+12} = \frac{1}{-5-4}$

$\Rightarrow \frac{x}{-72} = \frac{y}{-36} = \frac{1}{-9}$

$\Rightarrow x = \frac{-72}{-9}$ and $y = \frac{-36}{-9}$

$\Rightarrow x = 8 \ and \ y = 4$

Substituting the values of x and y in equation (i), we have

Number =$10 \times 4 + 8 = 48$

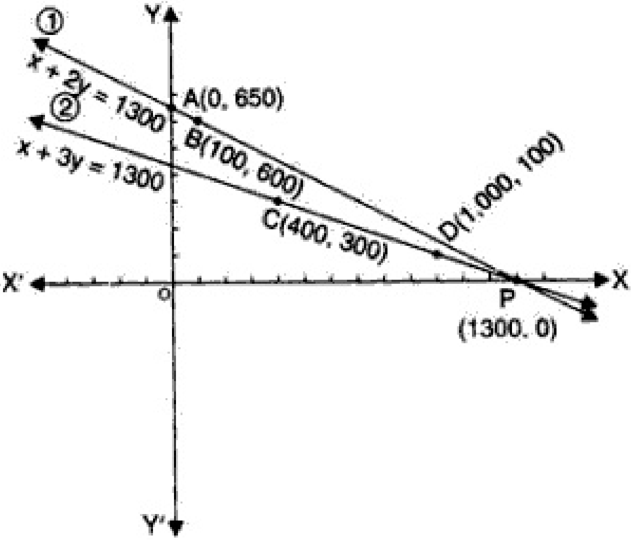
17. Let us denote the cost of 1 bat by Rs. x and one ball by Rs. y.

Then the algebraic representation is given by the following Equations:

3x + 6y = 3900 and x + 3y = 1300

$\Rightarrow$ x + 2y = 1300 ...(1)

And x + 3y = 1300 ...(2)



To represents these equations graphically, We find two solutions for each equation, These solution are given below:

For equation (1)x + 2y = 1300

$\Rightarrow$ 2y = 1300 - x $\Rightarrow y = \frac{1300-x}{2}$

Table 1 of solutions

x	0	100
y	650	600

For equation (2) x + 3y = 1300

$\Rightarrow$ 3y = 1300 - x $\Rightarrow y = \frac{1300-x}{3}$

Table 2 of solutions

x	400	1000
y	300	100

We plots the points A(0,650) and B (100,600) corresponding to the solutions in table 1 on the graph paper to get the line AB representing the equation (1) and the points C(400, 300) and D(1000, 100) corresponding to the solution in table 2 on the same graph paper to get the line CD representing the equation (2), as shown in figure.

We observe in the figure that the two lines representing the two equations are intersecting at the point P(13000)

18. Let the actual price of the T.V. and the fridge be Rs. x and Rs. y respectively.

Then, according to the question,

$\left(\frac{5}{100}x\right)+\left(\frac{10}{100}y\right)=2000$

$\Rightarrow \frac{x}{20}+\frac{y}{10}=2000$

⇒ x + 2y = 40000 ....(1)

And, $\left(\frac{10}{100}x\right)-\left(\frac{5}{100}y\right)=1500$

$\Rightarrow \frac{x}{10}-\frac{y}{20}=1500$

⇒ 2x - y = 30000 .....(2)

Multiplying equation (2) by 2, we get

4x - 2y = 60000 .....(3)

Adding equation (1) from equation (3), we get

5x = 100000

$\Rightarrow x=\frac{100000}{5}=20000$

Substituting x = 20000 in equation (1), we get

20000 + 2y = 40000

⇒ 2y = 40000 - 20000 = 20000

$\Rightarrow y=\frac{20000}{2}=10000$

So, the solution of the given equations is x = 20000 and y = 10000.

Hence, the actual price of the T.V. and fridge are ₹ 20000 and ₹10000 respectively.

Verification. Substituting x = 20000, y = 10000,

We find that both the equation (1) and (2) are satisfied as shown below:

x + 2y = 20000 + 2(10000) = 40000

2x - y = 2(20000) - 10000 = 30000

Hence, the solution we have got is correct.

19. $x+2y-8=0, 2x+4y=16$

$\Rightarrow x+2y-8=0, 2x+4y-16=0$

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

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

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

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

We know that,

the system of linear equations $a_1x+b_1y+c_1=0, a_2x+b_2y+c_2=0$

has infinite number of solutions if $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

So, the pair of equations has infinite number of solutions.

20. Suppose, the present age of father be x years and the present age of son be y years.

According to the question,

Five years hence,

Father's age = $(x + 5) years$

Using the given information, we have

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

$\Rightarrow x - 3y - 10 = 0$ ....(i)

Five years ago,

Father's age = $(x - 5) years$

Son's age =$(y - 5) years$

Using the given information, we get

$(x - 5) = 7(y - 5)$

$\Rightarrow x - 7y + 30 = 0$ ....(ii)

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

$4y - 40 = 0$

$\Rightarrow y = 10$

Putting y = 10 in equation (i), we get

$x - 30 - 10 = 0$

$\Rightarrow x = 40$

Hence, present age of father is 40 years and present age of son is 10 years.