CBSE Test Paper 01

Chapter 3 Pair of Linear Equation

1. Determine graphically the co-ordinates of the vertices of the triangle, the equations of whose sides are: $y = x,\ 3y = x,\ x + y = 8$ **(1)**
   a. 13 sq. units
   b. 21 sq. units
   c. 11 sq. units
   d. 12 sq. units
2. A system of two linear equations in two variables is consistent, if their graphs **(1)**
   a. do not intersect at any point
   b. coincide
   c. cut the x – axis
   d. intersect only at a point or they coincide with each other
3. The solution of px + qy = p – q and qx – py = p + q is **(1)**
   a. x = – 1 and y = 1
   b. x = 1 and y = 1
   c. x = 0 and y = 0
   d. x = 1 and y = – 1
4. The value of 'k' so that the system of equations 3x – y – 5 = 0 and 6x – 2y – k = 0 have infinitely many solutions is **(1)**
   a. k = – 10
   b. k = 10
   c. k = – 8
   d. k = 8
5. 5 pencils and 7 pens together cost Rs.50 whereas 7 pencils and 5 pens together cost Rs.46. The cost of 1 pen is **(1)**
   a. Rs. 5
   b. Rs. 6
   c. Rs. 3
   d. Rs. 4
6. Solve for x and y: $\frac{2x+5y}{xy} = 6;\ \frac{4x-5y}{xy} = -3$. **(1)**

7. Determine the values of m and n so that the following system of linear equations have infinite number of solutions: (2m - 1)x + 3y - 5 = 0: 3x + (n - 1)y - 2 = 0 **(1)**
8. Find whether the following pair of equations has no solution, unique solution or infinitely many solutions.
   5x - 8y + 1 = 0;
   3x - $\frac{24}{5}$y + $\frac{3}{5}$ = 0 **(1)**
9. For what value of k the following pair of linear equation has unique solution?
   kx + 3y = 3
   12x + ky = 6 **(1)**
10. If am = bl, then find whether the pair of linear equations ax + by = c and lx + my = n has no solution, unique solution or infinitely many solutions. **(1)**
11. For what value of k will the equations x + 2y + 7 = 0 , 2x + ky + 14 = 0 represent coincident lines? **(2)**
12. The expenses of a lunch are partly constant and partly proportional to the number of guests. The expenses amount to Rs. 65 for 7 guests and Rs. 97 for 11 guests. How much the expenses for 18 guests will amount to? **(2)**
13. Write the value of k for which the system of equations 3x + ky = 0, 2x - y = 0 has a unique solution. **(2)**
14. Solve the following pair of linear equations by the elimination method and the substitution method: 3x + 4y = 10 and 2x – 2y = 2. **(3)**
15. A person rowing at the rate of 5 km/h in still water, takes thrice as much time in going 40 km upstream as in going 40 km downstream. Find the speed of the stream. **(3)**
16. Solve the following system of equations in x and y
   ax + by = 1
   $bx + ay = \frac{(a+b)^2}{a^2+b^2} - 1$ or, $bx + ay = \frac{2ab}{a^2+b^2}$ **(3)**
17. Examine whether the solution set of the system of equations 3x – 4y = – 7; 3x – 4y = –9. Is consistent or inconsistent. **(3)**
18. Solve for x and y: $\frac{35}{x+y} + \frac{14}{x-y} = 19$ and $\frac{14}{x+y} + \frac{35}{x-y} = 37$. **(4)**
19. One says, "Give me a hundred rupee, friend! I shall then become twice as rich as you are." The other replies, "If you give me ten rupees, I shall be six times as rich as you are." Tell me how much money both have initially? **(4)**
20. Half the perimeter of a rectangular garden, whose length is 4 m more than its width, is 36 m. find the dimensions of the garden. **(4)**

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Solution

1. d. 12 sq. units

Explanation: y = x

x	-2	2	5
y	-2	2	5

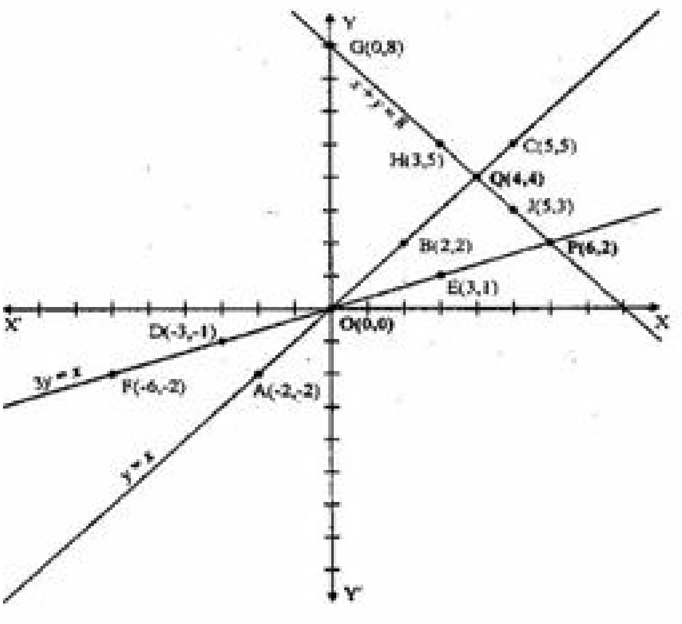
3y = x$\Rightarrow$ $y = \frac{x}{3}$

x	-3	3	-6
y	-1	1	-2

x + y = 8

$\Rightarrow$ y = (-x + 8)

x	0	3	5
y	8	5	3



ΔPOQ is formed by the given three lines.

$\therefore$ arΔPOQ = arΔROQ – arΔPOR = $\frac{1}{2} \times 8 \times 4 - \frac{1}{2} \times 4 \times 2$ = 16 – 4 = 12 sq.units

The lines intersect at point A(4,4),B(0,0),C(6,2)

2. d. intersect only at a point or they coincide with each other

Explanation: A system of two linear equations in two variables is consistent, if their graphs intersect only at a point, because it has a unique solution or they may coincide with each other giving infinite solutions.

3. d. x = 1 and y = – 1

Explanation: Given: $a_1 = p, a_2 = q, b_1 = q, b_2 = -p, c_1 = p - q$ and $c_2 = p + q$

Using the cross-multiplication method,

$\frac{x}{b_1c_2 - b_2c_1} = \frac{y}{c_1a_2 - c_2a_1} = \frac{-1}{a_1b_2 - a_2b_1}$

$\Rightarrow \frac{x}{q(p+q)-(-p)(p-q)} = \frac{y}{(p-q)q-(p+q)p} = \frac{-1}{p\times(-p)-q\times q}$

$\Rightarrow \frac{x}{pq+q^2+p^2-pq} = \frac{y}{pq-q^2-p^2-pq} = \frac{-1}{-p^2-q^2}$

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

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

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

$\Rightarrow \frac{y}{-(p^2+q^2)} = \frac{1}{p^2+q^2}$

$\Rightarrow x = 1$ and $\Rightarrow y = -1$

4. b. k = 10

Explanation: Given: $a_1 = 3, a_2 = 6, b_1 = -1, b_2 = -2, c_1 = -5$ and $c_2 = -k$

If there is infinitely many solutions, then $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$ = $\frac{3}{6} = \frac{-1}{-2} = \frac{-5}{-k}$

Taking $\frac{-1}{-2} = \frac{-5}{-k} \Rightarrow k = 5 \times 2 \Rightarrow k = 10$

5. a. Rs.5

Explanation: Let, cost(in RS) of one pencil = x

and cost (in RS) of one pen = y

Therefore , according to question

5x+7y = 50 .... (1)

7x + 5y = 46 ....(2)

Multiply equation (1) by 7 and equation (2) by 5 we get

7(5x+7y)= 7 $\times$ 50

35x +49y = 350 ....(3)

and 5(7x +5y) = 5 $\times$ 46

35x +25y = 230 .... (4)

Subtract equation (4) from equation 3 , we get

35x + 49y - 35x - 25y = 350 -230

49y -25y = 120

24y = 120

y = $\frac{120}{24}$

y= 5

Substitute y = 5 in equation 1 , we get

5x + 7 $\times$ 5 =50

5x + 35 = 50

5x = 50 - 35

5x = 15

x = $\frac{15}{5}$

x =3

Hence, Cost of One Pen = y =5

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

$\frac{4x-5y}{xy} = -3$.......(ii)

Adding (i) and (ii),

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

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

$\therefore$ x = 1 and y = 2

7. We have to determine the values of m and n so that the following system of linear equations have infinite number of solutions:

(2m - 1)x + 3y - 5 = 0

3x + (n - 1)y - 2 = 0

It is given that (2m - 1)x + 3y - 5 = 0 ...(i)

$a_1 = 2m - 1, b_1 = 3, c_1 = -5$

3x + (n - 1)y - 2 = 0 ...(ii)

$a_2 = 3, b_2 = n - 1, c_2 = 2$

On comparing with the general form of eqn.

For a pair of linear equations to have infinite number of solutions

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

or $\frac{2m-1}{3} = \frac{3}{n-1} = \frac{5}{2}$

$\frac{2m-1}{3} = \frac{5}{2}$

or 2(2m -1) = 15

or, 4m - 2 = 15

or, 4m = 17

$m = \frac{17}{4}$

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

or, 5(n - 1) = 6

or, 5n - 5 = 6

or, 5n = 11

or, $n = \frac{11}{5}$

Hence, $m = \frac{17}{4}, n = \frac{11}{5}$

8. $a_1 = 5,\ b_1 = -8,\ c_1 = 1$ and $a_2 = 3,\ b_2 = \frac{-24}{5}, c_2 = \frac{3}{5}$

   $\frac{a_1}{a_2} = \frac{5}{3}$ ...(i)

   $\frac{b_1}{b_2} = \frac{-8}{-24/5} = \frac{5}{3}$ ...(ii)

   and $\frac{c_1}{c_2} = \frac{1}{3/5} = \frac{5}{3}$ ...(iii)

   Form (i), (ii) and (iii)

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

   $\therefore$The pair of equations has infinitely many solutions.

9. Given pair of equations

   kx + 3y = 3, 12x + ky = 6

   For unique solutions $\frac{k}{12} \neq \frac{3}{k}$

   $\Rightarrow k^2 \neq 36$

   $\Rightarrow k \neq \pm 6.$

10. Since,

    $am = bl$

    $\therefore \frac{a}{l} = \frac{b}{m} \neq \frac{c}{n}$

    So, $ax + by = c$ and $lx + my = n$ has no solution.

11. The given equation are

    x + 2y + 7 = 0

    2x + ky + 14 = 0

    The given equations are of the form

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

    After comparing the given equation with standard equation

    We get, $a_1 = 1$, $b_1 = 2$, $c_1 = 7$ and $a_2 = 2$, $b_2 = k$, $c_2 = 14$

    The given equations will represent coincident lines if they have infinitely many solutions.

The condition for which is

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

$$\Rightarrow \frac{1}{2} = \frac{2}{k} = \frac{7}{14}$$

$\Rightarrow$ k = 4

Hence, the given system of equations will represent coincident lines, if k = 4.

12. Let the fixed expenses = Rs. x

and proportional charges = Rs. y

As per given condition

The expenses amount to Rs. 65 for 7 guests .

x + 7y = 65 ..(i)

And the expenses amount Rs. 97 for 11 guests.

So, x + 11y = 97 ..(ii)

Subtracting (i) from (ii), we get

4y = 32

$\Rightarrow$ y = 8

Put y = 8 eq. (i) , we get

x + 7(8) = 65

$\Rightarrow$ x = 9

Now, expenses for 18 guests

= x + 18y

= 9 + 18(8)

= 9 + 144 = Rs. 153

13. The given equations are

3x + ky = 0 .... (i)

2x - y = 0 .... (ii)

We know that,

The system of linear equations is in the form of

$a_1x + b_1y + c_1 = 0$

and $a_2x + b_2y + c_2 = 0$

Compare (i) and (ii), we get

$a_1 = 3$, $b_1 = k$ and $c_1 = 0$

$a_2 = 2$, $b_2 = -1$ and $c_2 = 0$

The equations has a unique solution if $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

So, $\frac{3}{2} \neq \frac{k}{-1}$

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

Thus, k can take any real values except -$\frac{3}{2}$.

14. 1. By Elimination method,

    The given system of equation is :

    3 x + 4 y = 10 ....(1)

    2 x - 2 y = 2 ....(2)

    Multiplying equation(2) by 2, we get

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

    Adding equation (1) and equation (3), we get 7 x = 14

    $\therefore \quad x = \frac{14}{7} = 2$

    Substituting this value of x in equation (2), we get 2(2) - 2y = 2

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

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

    $\Rightarrow \quad 2y = 2$

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

    So, the solution of the given system of equation is x = 2, y = 1

2. By Substitution method,

    The given system of equation is:

    3 x + 4 y = 10.................(1)

    2 x - 2 y = 2....................(2)

    From equation (2),

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

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

    Substituting this value of x in equation (3), we get y = 2 - 1

    $\Rightarrow \quad y = 1$

    So, the solution of the given system of equation is x = 2, y = 1

    Verification: Substituting x = 2, y = 1, we find that both the equation (1) and (2) are satisfied shown below:

    $3x + 4y = 3(2) + 4(1) = 6 + 4 = 10$

    $2x - 2y = 2(2) - 2(1) = 4 - 2 = 2$

    Hence, the solution is correct.

15. Let the speed of the stream = x km/hr

Speed of the boat in upstream = (5 - x) km/hr

Speed of the boat in downstream = (5 + x) km/hr

Distance = 40 km

Time taken in upstream = $\frac{40}{(5-x)} hr$

Time taken in downstream = $\frac{40}{(5+x)} hr$

According to the question,

$\frac{40}{5-x} = 3\left(\frac{40}{5+x}\right)$

⇒ (5 + x) = 3(5 - x)

⇒ 5 + x = 15 - 3x

⇒ 4x = 10 ⇒ x = 2.5

Therefore, speed of the stream = 2.5 km/hr.

16. The given system of equations are

ax + by - 1 = 0 .... (i)

$bx + ay = \frac{2ab}{a^2+b^2}$ .... (ii)

By cross-multiplication, of equations (i) and (ii) ,we have

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

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

$$\Rightarrow \frac{x}{\frac{-2ab^2+a^3+ab^2}{a^2+b^2}} = \frac{-y}{\frac{-2a^2b+a^2b+b^3}{a^2+b^2}} = \frac{1}{a^2-b^2}$$

$$\Rightarrow \frac{x}{\frac{a^3-ab^2}{a^2+b^2}} = \frac{-y}{\frac{-a^2b+b^3}{a^2+b^2}} = \frac{1}{a^2-b^2}$$

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

$$\Rightarrow \quad x = \frac{a\left(a^2-b^2\right)}{a^2+b^2} \times \frac{1}{a^2-b^2} \text{ and } y = \frac{b\left(a^2-b^2\right)}{a^2+b^2} \times \frac{1}{a^2-b^2}$$

$$\Rightarrow \quad x = \frac{a}{a^2+b^2} \text{ and } y = \frac{b}{a^2+b^2}$$

Hence, the solution of the given system of equations is $x = \frac{a}{a^2+b^2}$, $y = \frac{b}{a^2+b^2}$.

17. The given system of equation is :

3x - 4y = -7.........(1)

3x - 4y = -9..........(2)

Here, a_1 = 3, b_1 = -4, c_1 = 7

$a_2 = 3, b_2 = -4, c_2 = 9$

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

Hence, the lines represented by the given pair of linear equations are parallel.

Therefore, equation (1) and (2) have no common solution,i.e., the solution set of the given system equations is inconsistent.

18. $\frac{35}{x+y} + \frac{14}{x-y} = 19$

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

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

So, we get

$35u + 14v = 19$ ....(i)

and $14u + 35v = 37$ ....(ii)

Adding (i) and (ii), we get

$49u + 49v = 56$

$\Rightarrow 7u + 7v = 8$ ....(iii)

Subtract (i) from (ii), we get

$21u - 21v = -18$

$\Rightarrow 7u - 7v = -6$ ....(iv)

Adding (iii) and (iv), we get

$14u = 2$

$\Rightarrow u = \frac{1}{7}$

Substituting $u = \frac{1}{7}$ in (iii), we get v = 1,

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

$\Rightarrow x + y = 7$.........(iv)

and $x - y = 1$ ....(v)

Adding (iv) and (v), we get

2x = 8 $\Rightarrow$ x = 4

Substituting x = 4 in (iv), we get y = 3.

x=4 and y = 3

19. Suppose initially, they had Rs x and Rs. y with them respectively.

as per condition given in the question, we obtain

x + 100 = 2(y - 100)

$\Rightarrow$ x + 100 = 2y - 200

$\Rightarrow$ x - 2y = -300 ...(i)

and $6(x - 10) = (y + 10)$

$6x - 60 = y + 10$

$\Rightarrow 6x - y = 70$ .....(ii)

Multiplying equation (ii) by 2 & then subtracting eqeation (i) from it, we obtain:-

$(12x - 2y)-(x - 2y) = 140 - (- 300)$

$\Rightarrow 11x = 140 + 300$

$\Rightarrow 11x = 440$

$\Rightarrow x = 40$

Putting x = 40 in equation (i), we obtain

$40 - 2y = -300$

$\Rightarrow 40 + 300 = 2y$

$\Rightarrow 2y = 340$

$\Rightarrow y = 170$

Therefore, initially they had Rs 40 and Rs 170 with them respectively.

20. Let the dimensions (i.e., length and width) of the garden be x and y m respectively.

Then, $x = y + 4$ and $\frac{1}{2}(2x + 2y) = 36$

$\Rightarrow x - y = 4$ ...(1)

$x + y = 36$ ...(2)

Let us draw the graphs of equations (1) and (2) by finding two solutions for each of the equations. These two solution of the equations (1) and (2) are given below in table 1 and table 2 respectively.

For equation (1)

$x - y = 4$

$\Rightarrow y = x - 4$

Table 1 of solutions

x	4	2
y	0	-2

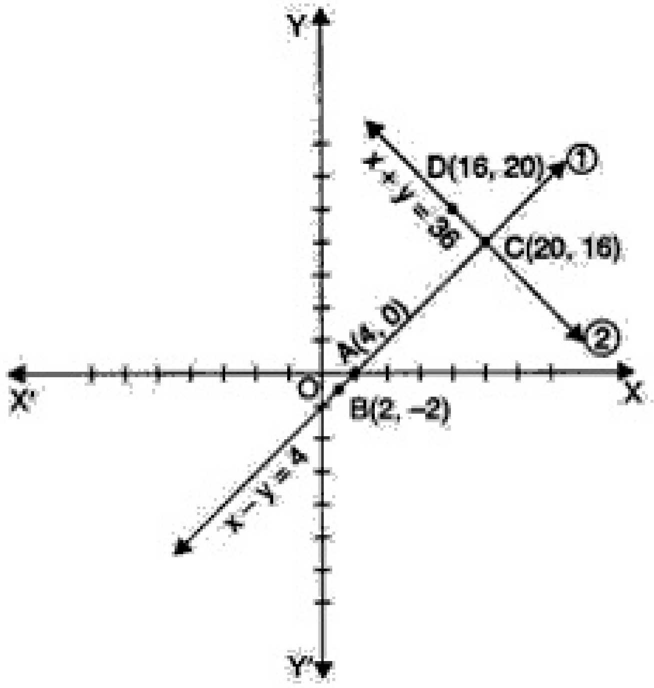
For equation (2) $x + y = 36$

$\Rightarrow y = 36 - x$

Table 2 of solutions

x	20	16
y	16	20

We plot the points A(4, 0) and B(2, -2) on a graph paper and join these points to form the line AB representing. The equation (1) as shown in the figure.
Also, we plot the points C(20, 16) and D(16, 20) on the same graph paper and join these points to form the line CD representing the equation (2) as shown in the same figure.



In the figure, we observe that the two lines intersect at the point C(20, 16) So x = 20, y = 16 is the required solution of the pair of linear equations formed. i.e., the dimensions of the garden are 20 m and 16 m.
Verification : substituting x = 20 and y = 16 in (1) and (2), we find that both the equations are satisfied as shown below:
20 - 16 = 4
20 + 16 = 36
This verifies the solution.