Chapter 3: Pair of Linear Equations

NCERT Solutions & Important Q&A (English Medium)

Exercise 3.1

Q1: Form the pair of linear equations and find their solutions graphically.
(i) 10 students of Class X took part in a Mathematics quiz. If the number of girls is 4 more than the number of boys, find the number of boys and girls.

Solution:

Let the number of girls = x

Let the number of boys = y

Total students: $x + y = 10$ .....(1)

Girls are 4 more than boys: $x - y = 4$ .....(2)

Graphical Solution:

From (1), $y = 10 - x$. Points: $(5, 5), (6, 4), (4, 6)$
From (2), $y = x - 4$. Points: $(5, 1), (6, 2), (7, 3)$

Plotting these on a graph, the lines intersect at point **(7, 3)**.

Answer: Number of girls = 7, Number of boys = 3.

(ii) 5 pencils and 7 pens together cost ₹50, whereas 7 pencils and 5 pens together cost ₹46. Find the cost of one pencil and that of one pen.

Solution:

Let the cost of 1 pencil = ₹x and 1 pen = ₹y

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

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

Graphical Solution:

From (1), $y = \frac{50 - 5x}{7}$. Points: $(3, 5), (10, 0)$
From (2), $y = \frac{46 - 7x}{5}$. Points: $(3, 5), (8, -2)$

The lines intersect at point **(3, 5)**.

Answer: Cost of 1 pencil = ₹3, Cost of 1 pen = ₹5.

Q2: Half the perimeter of a rectangular garden, whose length is 4 m more than its width, is 36 m. Find the dimensions.

Solution:

Let width = x m and length = y m

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

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

Adding (1) and (2): $2y = 40 \Rightarrow y = 20$

Put $y = 20$ in (2): $x + 20 = 36 \Rightarrow x = 16$

Answer: Length = 20 m, Width = 16 m.

Exercise 3.2 (Substitution Method)

Q1: Solve $2x + 3y = 11$ and $2x - 4y = -24$ and hence find the value of 'm' for which $y = mx + 3$.

Solution:

$2x + 3y = 11$ .....(1)

$2x - 4y = -24$ .....(2)

From (1): $2x = 11 - 3y$. Substitute this in (2):

$(11 - 3y) - 4y = -24 \Rightarrow 11 - 7y = -24 \Rightarrow 7y = 35 \Rightarrow y = 5$

Put $y = 5$ in $2x = 11 - 15 = -4 \Rightarrow x = -2$

Now, $y = mx + 3 \Rightarrow 5 = m(-2) + 3 \Rightarrow 2 = -2m \Rightarrow m = -1$

Answer: $x = -2, y = 5, m = -1$

Q2: Form the pair of linear equations and solve by substitution:
(i) The taxi charges in a city consist of a fixed charge together with the charge for the distance covered. For a distance of 10 km, the charge paid is ₹105 and for 15 km, it is ₹155. What are the fixed charges and the charge per km? How much for 25 km?

Solution:

Let fixed charge = ₹x and charge per km = ₹y

$x + 10y = 105 \Rightarrow x = 105 - 10y$ .....(1)

$x + 15y = 155$ .....(2)

Substitute (1) in (2): $(105 - 10y) + 15y = 155 \Rightarrow 5y = 50 \Rightarrow y = 10$

$x = 105 - 10(10) = 5$

Charge for 25 km = $x + 25y = 5 + 25(10) = 255$

Answer: Fixed charge = ₹5, per km charge = ₹10, and 25 km cost = ₹255.

Exercise 3.3 (Elimination Method)

Q1: Form the pair of linear equations and solve by elimination:

(i) The sum of the digits of a two-digit number is 9. Also, nine times this number is twice the number obtained by reversing the order of the digits. Find the number.

Solution:

Let units digit = x, tens digit = y. Original number = $10y + x$

Sum of digits: $x + y = 9$ .....(1)

Reversed number = $10x + y$

Given: $9(10y + x) = 2(10x + y) \Rightarrow 90y + 9x = 20x + 2y$

$11x - 88y = 0 \Rightarrow x - 8y = 0$ .....(2)

Subtract (2) from (1): $(x - x) + (y - (-8y)) = 9 - 0 \Rightarrow 9y = 9 \Rightarrow y = 1$

Put $y = 1$ in (1): $x + 1 = 9 \Rightarrow x = 8$

Number = $10(1) + 8 = 18$

Answer: The number is 18.

Previous Years' Board Questions (PYQs: 2022-2026)

Q1: For what value of k will the following pair of linear equations have no solution?

$3x + y = 1; (2k - 1)x + (k - 1)y = 2k + 1$. **[CBSE 2024, RBSE 2022]**

Solution:

Condition for no solution: $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

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

Cross multiplying: $3(k - 1) = 1(2k - 1) \Rightarrow 3k - 3 = 2k - 1$

$3k - 2k = 3 - 1 \Rightarrow k = 2$

Answer: $k = 2$

Future Expected Questions

Q1: Solve for x and y: $ax + by = a - b$ and $bx - ay = a + b$ (High Scorers)

Solution:

$ax + by = a - b$ .....(1) (Multiply by $a \Rightarrow a^2x + aby = a^2 - ab$)

$bx - ay = a + b$ .....(2) (Multiply by $b \Rightarrow b^2x - aby = ab + b^2$)

Adding both: $(a^2 + b^2)x = a^2 + b^2 \Rightarrow x = 1$

Put $x = 1$ in (1): $a(1) + by = a - b \Rightarrow by = -b \Rightarrow y = -1$

Answer: $x = 1, y = -1$