



Class 10th

SHORT NOTE

**LINEAR EQUATION IN TWO VARIABLES
MATHS**

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➤ **LINEAR EQUATIONS IN TWO VARIABLES**

A statement of equality of two algebraic expressions, which involve two unknown quantities is known as an equation

- A linear equation is an equation which involves linear polynomials.

➤ **GENERAL FORM OF PAIR OF LINEAR EQUATIONS**

$$\left. \begin{array}{l} a_1x + b_1y + c_1 = 0 \\ a_2x + b_2y + c_2 = 0 \end{array} \right\}$$

where a_1, b_1, c_1 & a_2, b_2, c_2 are constants.

➤ **GRAPH OF LINEAR EQUATION IN TWO VARIABLES**



(i) **Step I :** Obtain the linear equation, let the equation be $ax + by + c = 0$.

(ii) **Step II :** Express y in terms of x to obtain

$$y = - \left(\frac{ax + c}{b} \right)$$

(iii) **Step III :** Give any two values to x and calculate the corresponding values of y from step II, say (α_1, β_1) and (α_2, β_2) . If possible take values of x and y as integers.

(iv) **Step IV :** Plot points (α_1, β_1) and (α_2, β_2) on a graph paper.

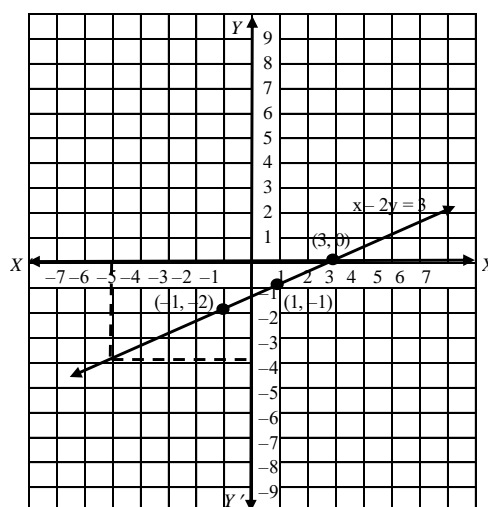
(v) **Step V :** Join the points marked in step IV to obtain a line.

Ex. Draw a graph of the line $x - 2y = 3$.

Sol. we have the following table :

x	1	-1
y	-1	-2

Plotting points $(1, -1)$ & $(-1, -2)$ on graph paper & joining them, we get required graph of equation $x - 2y = 3$.



➤ GRAPHICAL REPRESENTATION OF PAIR OF LINEAR EQUATIONS

Let the system of pair of linear equations be

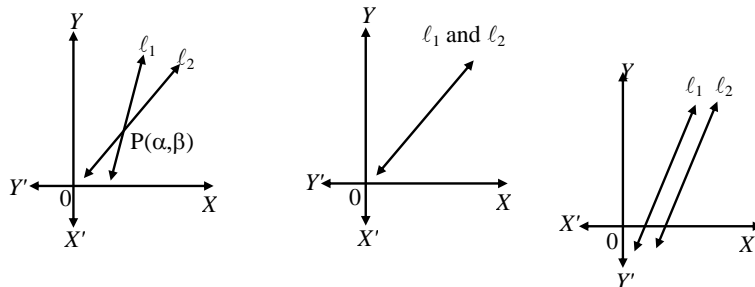
$$a_1x + b_1y = c_1 \quad \dots(1)$$

$$a_2x + b_2y = c_2 \quad \dots(2)$$

(i) The two lines will intersect at one point.

(ii) The two lines will not intersect, however far they are extended, i.e., they are parallel.

(iii) The two lines are coincident lines.



➤ TYPES OF SOLUTIONS

There are three types of solutions:

1. Unique solution.
2. Infinitely many solutions
3. No solution.

(A) Consistent system of linear equations:

If a system of simultaneous linear equations has at least one solution then the system is said to be consistent.

(i) **Consistent equations with unique solution:** The graphs of two equations intersect at a unique point.

(ii) **Consistent equations with infinitely many solutions:** The graphs (lines) of the two equations will be coincident.

(B) Inconsistent Equation :

If a system of simultaneous linear equations has no solution, then the system is said to be inconsistent.

No Solution : The graph (lines) of the two equations are parallel.

S.No	Graph of Two Equations	Types of Equations
1	Intersecting lines	Consistent, with unique solution
2	Coincident	Consistent with infinite solutions
3	Parallel lines	Inconsistent (No solution)



The system of equations is given by

$$a_1x + b_1y + c_1 = 0 \quad \dots(1)$$

$$a_2x + b_2y + c_2 = 0 \quad \dots(2)$$

(a) If $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

Then system of equations is **consistent with unique solution.**

(b) If $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

Then the system of equations is consistent with **infinitely many solutions.**

(c) If $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

Then the system of equation is **inconsistent and has no solution.**

➤ METHOD OF SOLUTION

- **substitution.**
- **Method of Elimination.**
- **Cross- Multiplication.**
- **Graphical.**

These values of x and y can also be written as

$$\frac{x}{b_1c_2 - b_2c_1} = \frac{-y}{a_1c_2 - a_2c_1} = \frac{1}{a_1b_2 - a_2b_1}$$

➤ WORD PROBLEMS ON SIMULTANEOUS LINEAR EQUATIONS

Problems Based on Articles

Ex. Yash attempted all the questions in a test. If he scored 40 marks in the test, receiving 3 marks for each right answer and losing 1 mark for each wrong answer. Had 4 marks been awarded for each correct answer and 2 marks been deducted for each incorrect answer, then Yash would have scored 50 marks. How many questions were there in the test?

Problems Based on Numbers

Ex. What number must be added to each of the numbers, 5, 9, 17, 27 to make the numbers in proportion ?

Problems Based on two digit numbers

Ex. The sum of a two digit number and the number obtained by reversing the order of its digits is 99. If the digits differ by 3, find the number.

Problems Based on Fraction



- Ex.** The sum of the numerator and denominator of a fraction is 3 less than twice the denominator. If the numerator and denominator are decreased by 1, the numerator becomes half the denominator. Determine the fraction.

Problem on Fixed Charges & Running Charges

- Ex.** A lending library has a fixed charge for the first three days and an addition charge for each day thereafter. Sarika paid ₹ 27 for a book kept for seven days. While Radhika paid ₹ 21 for the book she kept for five days. Find the fixed charge and the charge for each extra day.

Problems Based on Speed & Time

- Ex.** Two places A and B are 120 km apart from each other on a highway. One car starts from A and another from B at the same time. If they move in the same direction, they meet in 6 hours and if they move in opposite directions, they meet in 1 hour and 12 minutes. Find the speed of the cars.

Problems Based on Boat & Stream

- Ex.** A person rows downstream 20 km in 2 hours and upstream 4 km in 2 hours. Find man's speed of rowing in still water and the speed of the current.

Problems Based on Area

- Ex.** If in a rectangle, the length is increased and breadth reduced each by 2 metres, the area is reduced by 28 sq. metres. If the length is reduced by 1 metre and breadth increased by 2 metres, the area increases by 33 sq. metres. Find the length and breadth of the rectangle.

Problems Based on Geometry

- Ex.** The larger of two supplementary angles exceeds the smaller by 18 degrees. Find them.