# 📘 Chapter 3: Pair of Linear Equations in Two Variables – Easy Notes

## 1. What is a Linear Equation in Two Variables?

A linear equation in two variables is written as:

**a·x + b·y + c = 0**

Where:

- x and y are variables,
- a, b, and c are real numbers,
- a ≠ 0 or b ≠ 0 (at least one must not be zero).

Examples:

- 2x + 3y = 6
- x − y + 4 = 0

Each linear equation gives a straight line when graphed.

## 2. What is a Pair of Linear Equations?

It means two linear equations in two variables, like:

$a_1·x + b_1·y + c_1 = 0$
$a_2·x + b_2·y + c_2 = 0$

Solving this pair means finding values of x and y that satisfy both equations at the same time.

## 3. Graphical Representation

When these equations are plotted as lines on a graph:

| Type of Lines | Solution Type | Meaning |
| --- | --- | --- |
| Intersect at 1 point | One solution | Consistent and independent |
| Same line | Infinite solutions | Consistent and dependent |
| Parallel lines | No solution | Inconsistent |

## 4. How to Check Type Without Graph

Compare these ratios:

$a_1/a_2, b_1/b_2, c_1/c_2$

| Condition | Solution Type |
| --- | --- |
| $a_1/a_2 \neq b_1/b_2$ | One solution |
| $a_1/a_2 = b_1/b_2 \neq c_1/c_2$ | No solution |
| $a_1/a_2 = b_1/b_2 = c_1/c_2$ | Infinite solutions |

## 5. Methods to Solve Pair of Equations

**A. Substitution Method – Steps:**

1. Solve one equation for x or y.
2. Substitute that expression into the other equation.
3. Solve the resulting single-variable equation.
4. Use the result to find the second variable.

Example:
$x + y = 5 \rightarrow y = 5 - x$

Substitute into second equation, solve for x.

**B. Elimination Method – Steps:**

1. Make coefficients of x or y equal by multiplying equations.
2. Add or subtract the equations to eliminate one variable.
3. Solve for the remaining variable.
4. Substitute back to get the other variable.

**C. Cross-Multiplication Method:**

Only used when both equations are in standard form:

$a_1 \cdot x + b_1 \cdot y + c_1 = 0$
$a_2 \cdot x + b_2 \cdot y + c_2 = 0$

**Use this formula:**

$$x / (b_1 \cdot c_2 - b_2 \cdot c_1) = y / (c_1 \cdot a_2 - c_2 \cdot a_1) = 1 / (a_1 \cdot b_2 - a_2 \cdot b_1)$$

Then solve.

# 6. Common Word Problems

| Type of Problem | Let x and y represent… |
|---|---|
| Age problems | Present ages |
| Money problems | Number of notes or coins |
| Speed & Distance | Speeds or time taken |
| Geometry problems | Length and breadth |
| Number-related problems | Two unknown numbers |

Translate the problem into two equations and solve using any method.

## 7. Summary for Quick Revision

- Standard form: $a \cdot x + b \cdot y + c = 0$
- Number of solutions:

- One solution → lines intersect
- Infinite solutions → same line
- No solution → parallel lines
- Solving methods:
  - Substitution
  - Elimination
  - Cross-multiplication
- Word problems: convert statements into equations, then solve