

## Chapter 4: Quadratic Equations – Easy Notes

### 1. What is a Quadratic Equation?

A **quadratic equation** is an equation of the form:

$$a \cdot x^2 + b \cdot x + c = 0$$

Where:

- $x$  is the variable,
- $a$ ,  $b$ , and  $c$  are real numbers,
- $a \neq 0$  ( $a$  should not be zero).

**Examples:**

- $2x^2 + 3x + 1 = 0 \rightarrow$  Quadratic
- $x^2 - 25 = 0 \rightarrow$  Quadratic
- $x^3 + x = 0 \rightarrow$  Not quadratic (degree 3)

### 2. How Quadratic Equations Arise in Real Life

Quadratic equations appear in many real-life situations, like:

- Area of rectangles/squares
- Age problems
- Motion (speed, time, distance)
- Cost and revenue in business

**Example:**

A hall has an area of  $300 \text{ m}^2$ . Length =  $2x + 1$ , Breadth =  $x$

Area = Length  $\times$  Breadth

So:  $(2x + 1) \times x = 300$

$\Rightarrow 2x^2 + x - 300 = 0 \rightarrow$  This is a quadratic equation.

### 3. How to Identify a Quadratic Equation

A quadratic equation must be able to be written in this form:

$$a \cdot x^2 + b \cdot x + c = 0$$


Sometimes, you must **simplify** first.

**Example:**

$$(x - 2)^2 + 1 = 2x - 3$$

$\rightarrow$  Expand both sides:

$$x^2 - 4x + 5 = 2x - 3$$

$\Rightarrow x^2 - 6x + 8 = 0$   This is a quadratic equation.

## 4. Methods to Solve Quadratic Equations

### A. Factorisation Method (Split the middle term)

#### Steps:

1. Multiply  $a \times c$
2. Find two numbers that multiply to  $a \cdot c$  and add to  $b$
3. Break the middle term
4. Factorise and solve

**Example:** Solve  $2x^2 - 5x + 3 = 0$

Step 1:  $2 \times 3 = 6$ , and  $-2 + (-3) = -5$

Step 2: Break the middle term:

$$2x^2 - 2x - 3x + 3 = 0$$

Step 3: Take common:

$$2x(x - 1) - 3(x - 1) = 0$$

Step 4:  $(2x - 3)(x - 1) = 0$

Solutions:  $x = 3/2$  or  $x = 1$

### B. Quadratic Formula

Use this when factorisation is hard.

#### Formula:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

This works for all quadratic equations.

## 5. Discriminant and Nature of Roots

The **discriminant** is:

$$D = b^2 - 4ac$$

It tells us how many and what kind of solutions the quadratic equation has.

Value of D	Nature of Roots
$D > 0$	Two distinct real roots
$D = 0$	Two equal real roots
$D < 0$	No real roots (imaginary)

## 6. Solving Word Problems with Quadratics

Situation Type	Let x be...
Age problems	Present age
Area problems	Length or breadth
Consecutive numbers	x and x + 1
Speed problems	Speed or time

**Tip:** Translate words into equations, simplify, and solve using any method.

## 7. Frequently Asked Exam Questions

Type of Question	Based On Section
Form an equation from a story	Real-life situations
Solve by factorisation	Section 4.3
Solve by formula	Section 4.4
Find nature of roots using discriminant	Section 4.4
Word problems (age, speed, geometry, etc.)	Exercises and examples

### ✓ Summary for Quick Revision

- **Standard Form:**  $a \cdot x^2 + b \cdot x + c = 0$
- **Roots using formula:**  $x = [-b \pm \sqrt{(b^2 - 4ac)}] / (2a)$
- **Discriminant (D):**  $b^2 - 4ac$
- **Nature of Roots:**
  - $D > 0 \rightarrow 2$  real & distinct roots
  - $D = 0 \rightarrow 2$  equal real roots
  - $D < 0 \rightarrow$  No real roots

- **Factorisation Method:** Use when splitting the middle term is easy
- **Word Problems:** Translate into equations and solve