

Class 10 Maths

Chapter 4: Quadratic Equations

1. Introduction & Standard Form

A quadratic equation in the variable x is an equation of the form $ax^2 + bx + c = 0$, where a , b , and c are real numbers and $a \neq 0$.

- Standard Form: $ax^2 + bx + c = 0$ is called the standard form of a quadratic equation when the terms are written in descending order of their degrees.
- Examples: $2x^2 + x - 300 = 0$, $x^2 - 3x - 10 = 0$.

2. Roots (or Solutions) of a Quadratic Equation

A real number α is called a root of the quadratic equation $ax^2 + bx + c = 0$, $a \neq 0$ if $a\alpha^2 + b\alpha + c = 0$.

- The zeroes of the quadratic polynomial $ax^2 + bx + c$ and the roots of the quadratic equation $ax^2 + bx + c = 0$ are the same.
- A quadratic equation can have at most two real roots.

3. Methods to Solve Quadratic Equations

1. By Factorisation:

To factorise the equation $ax^2 + bx + c = 0$, we split the middle term (bx) into two terms such that their sum is " b " and their product is " ac ". Then we equate each linear factor to zero to find the roots.

2. By Quadratic Formula:

The roots of a quadratic equation $ax^2 + bx + c = 0$ are given by the formula:

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

This formula is applicable only if $b^2 - 4ac \geq 0$.

4. Nature of Roots and Discriminant

The expression $b^2 - 4ac$ is called the Discriminant (D) of the quadratic equation.

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

The nature of roots depends on the value of the Discriminant (D):

- If $D > 0$ ($b^2 - 4ac > 0$): The equation has **two distinct real roots**.
- If $D = 0$ ($b^2 - 4ac = 0$): The equation has **two equal real roots** (or coincident roots). Each root is $-b/2a$.
- If $D < 0$ ($b^2 - 4ac < 0$): The equation has **no real roots** (the roots are imaginary/complex).