Lecture Notes – Introduction to Quadratic Equations (Class 11 – ISC)

1. Definition of a Quadratic Equation

A **quadratic equation** is a polynomial equation of degree 2 in one variable x of the form:

$$ax^2 + bx + c = 0$$

where:

- a, b, c are real numbers and $a \neq 0$
- x is the variable or unknown

2. Standard Form

The **standard form** of a quadratic equation is:

$$ax^2 + bx + c = 0$$

- $a \rightarrow$ coefficient of x^2
- $b \rightarrow$ coefficient of x
- $c \rightarrow$ constant term

3. Degree of an Equation

- The **degree** of an equation is the highest power of the variable.
- For a quadratic equation, the degree is **2**.

Examples:

- $3x^2 + 5x - 2 = 0 \rightarrow$ degree = 2
- $x^3 - 2x + 1 = 0 \rightarrow$ degree = 3 (not quadratic)

4. Quadratic Expressions vs. Quadratic Equations

- **Quadratic expression**: An algebraic expression of the form $ax^2 + bx + c$ (no equality sign).
  Example: $2x^2 - 3x + 5$
- **Quadratic equation**: A quadratic expression **set equal to zero**.
  Example: $2x^2 - 3x + 5 = 0$

Model Problems

Example 1: Identify whether the following are quadratic equations

a) $x^2 + 5x + 6 = 0 \rightarrow$ Quadratic (degree 2)
b) $3x + 4 = 0 \rightarrow$ Not quadratic (degree 1)
c) $2x^2 - 7 = 0 \rightarrow$ Quadratic (degree 2)

Example 2: Write the standard form of the equation

Given: $4 - 3x^2 + 2x = 0$
Arrange in standard form: $-3x^2 + 2x + 4 = 0$
(Optional: Multiply by -1 to get $3x^2 - 2x - 4 = 0$)

Example 3: Form a quadratic equation from given roots

Given roots: 2 and 3
Sum of roots $\alpha + \beta = 5$
Product of roots $\alpha\beta = 6$
Equation: $x^2 - (\alpha + \beta)x + \alpha\beta = 0$

$$x^2 - 5x + 6 = 0$$
