Notes for Quadratic Equations

Quadratic polynomial: A Polynomial of the form $\boldsymbol{p(x) = ax^2 + bx + c}$, where a 0 and a, b, c are real numbers and x is a real variable is called a **quadratic polynomial**.

Quadratic equation: An equation $p(x) = 0$, where $p(x)$ is a quadratic polynomial is called a quadratic equation i.e. $ax^2 + bx + c = 0$, a 0.

Roots of Quadratic Equations

Those values of x for which $ax^2 + bx + c = 0$ is satisfied are called **Roots** of quadratic equation.

Quadratic equation is classified into two categories

- Pure quadratic equation of type

  $ax^2 + c = 0$

  by putting $b = 0$ in $ax^2 + bx + c = 0$
- Affected quadratic equation of type $ax^2 + bx + c = 0$, b 0.

Roots of Quadratic Equations

If α, β are the **Roots** of the polynomial $ax^2 + bx + c$. Then α, β are called roots of corresponding equation

$ax^2 + bx + c = 0$

$\Rightarrow \quad p(\alpha) = p(\beta) = 0$

i.e. $a\alpha^2 + b\alpha + c = 0$

and $a\beta^2 + b\beta + c = 0$

Pure quadratic $ax^2 + c = 0$ can be solved by any one of the following methods:

- By Taking square root
- By factorisation

Affected quadratic equation can be solved by any one of the following method:

- By splitting middle term
- By method of completing the square

The quadratic formula or Sridharacharya's formula to find the roots of $ax^2 + bx + c = 0$ is

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

$D = b^2 - 4ac$, is called the discriminant which decides the nature of roots.

- If $D > 0$, Roots are real and unequal.
- If $D = 0$, Roots are real and equal.
- If $D < 0$, No Real roots are possible.