Quadratic Equations

Meaning

Equation of degree 2, in one variable

General Form

$ax^2 + bx + c = 0$ where a, b, c are real numbers and $a \neq 0$

Quadratic Formula

Roots of $ax^2 + bx + c = 0$ are given by

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

Nature of Roots

For quadratic equation $ax^2 + bx + c = 0$, $b^2 - 4ac$ is Discriminant (D)

1. D > 0
Two distinct real root

2. D = 0
Two equal real roots

3. D < 0
No real roots or only imaginary roots

Solution of a Quadratic Equation

By Completing the Square

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

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$$\Rightarrow x^2 - \frac{5}{2}x + \frac{3}{2} = 0$$

$$\Rightarrow \left(x - \frac{5}{4}\right)^2 - \left(\frac{5}{4}\right)^2 + \frac{3}{2} = 0$$

$$\Rightarrow \left(x - \frac{5}{4}\right)^2 - \frac{1}{16} = 0$$

$$\Rightarrow \left(x - \frac{5}{4}\right)^2 = \frac{1}{16}$$

$$\Rightarrow x - \frac{5}{4} = \pm\frac{1}{4}$$

$$\Rightarrow x = \frac{5}{4} + \frac{1}{4} \text{ or } x = \frac{5}{4} - \frac{1}{4}$$

$$\Rightarrow x = \frac{3}{2} \text{ or } x = 1$$

By Factorization

Find the roots of $6x^2 - x - 2 = 0$

Solution: $6x^2 + 3x - 4x - 2 = 0$

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

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

The roots of $6x^2 - x - 2 = 0$ are either

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

$$x = \frac{2}{3} \text{ or } x = \frac{-1}{2}$$

Hence, roots are $\frac{2}{3}, \frac{-1}{2}$

Trace the Mind Map

▸ First Level ▸ Second Level ▸ Third Level