# Quadratic Equations

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

**Roots of a Quadratic Equation:**

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

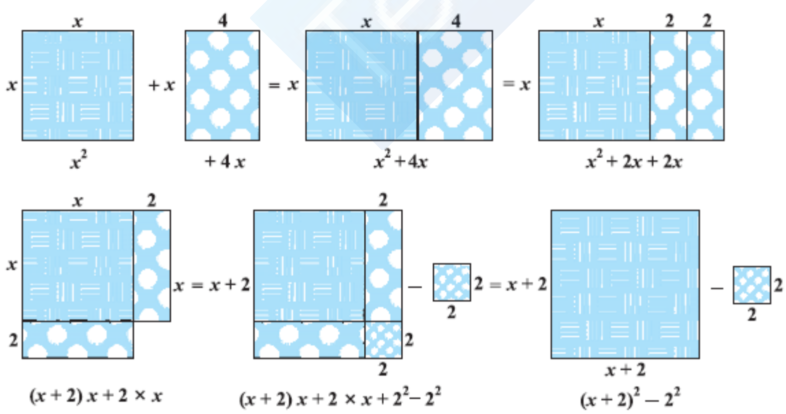
**Solution of Quadratic Equation by Factorisation:**

- To factorise quadratic polynomials the middle term is split.
- By factorizing the equation into linear factors and equating each factor to zero the roots are determined.

**Quadratic Equations - Method of Squares**

Solution of Quadratic Equation by method of Squares

- We can convert any quadratic equation to the form
  $(x + a)$
  $x^2 + 4x$ is being converted to
  $(x + 2)^2 - 4. = (x + 2)^2 - 2^2$



The process is as follows:

$$\left(x^2 + -x\right) \quad -$$

=

$(x \quad 2)$

$(x \quad 2)$

$(x+2)\ x + (x+2\ ) \times$

$(x+2)\ (x+2\ ) -$

$(x \quad 2)$

So, $x^2 + 4x - 5\ (x+2)^2 - 4 - 5 = (x+2)$

So, $x^2 + 4x - 5 = 0$ can be written as $(x+2)$ by this process of completing the square. This is known as the **method of completing the square.**

Solution of Quadratic Equation by using Formula.

The formula is as follows:

The roots of $\frac{\sqrt{b}}{} \quad \frac{\sqrt{b}}{}$

If

Thus, if then the roots of the quadratic equation are given by

$\frac{\sqrt{b}}{}$

This formula for finding the roots of a quadratic equation is known as the Quadratic formula.

**Nature of Roots**

We know that roots of the equation are

$\frac{\sqrt{b}}{} \quad \frac{\sqrt{b}}{}$

Where is known as discriminant.

Nature of roots based on the discriminant value

1. If then the roots are real and equal.
2. If then the roots are real and distinct (unequal)
3. If then the roots are imaginary (not real)