Let's tute ....make it easy

QUADRATIC EQUATIONS

(Quadratic equation is an equation in which the highest power of an unknown variable is 2)

1. Quadratic Equation:

Any equation of the form *p(x)* = 0, where *p(x)* is a polynomial of degree/power **2**, is a quadratic equation.

Example:

$2x^2 + x - 300 = 0$,

$1 - x^2 + 300 = 0$,

$4x + 2 - 3x^2 = 0$, etc.

2. Standard Form of Quadratic Equation:

When we write the terms of *p(x)* in descending order of their degrees, then we get the standard form of the equation i.e.

$$\boldsymbol{ax^2 + bx + c = 0},$$

where *a, b, c* are real numbers, $a \neq 0$.

3. Methods to find roots/solutions of a quadratic equation:

a. Factorization method

b. Completing the square method

c. Discriminant method

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4. Solution of a Quadratic Equation by Factorization:

a. A real number α is said to be a root of the quadratic equation $ax^2 + bx + c = 0$, if $a\alpha^2 + b\alpha + c = 0$ we can say that $\boldsymbol{x = \alpha}$ is a solution of the quadratic equation

Note:

Zeroes of the quadratic polynomial $ax^2 + bx + c$	=	Roots of the quadratic equation $ax^2 + bx + c = 0$

b. If we factorize $ax^2 + bx + c$, $a \neq 0$, into a product of **two linear factors**, then the roots of the quadratic equation $ax^2 + bx + c = 0$ can be found by equating each factor to **zero**.

Example:

The roots of $\boldsymbol{6x^2 - x - 2 = 0}$ are the values of *x* for which

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

$$(3x - 2) = 0 \quad \text{or} \quad (2x + 1) = 0$$

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

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5. Solution of a Quadratic Equation by Completing The Square:

PROCESS OF COMPLETING THE SQUARE

e.g $x^2+2x-1=0$ $x^2+2x=1$	1) Keep all terms containing x on one side. Move the constant to the other.
$x^2+2x+(\;)=1+(\;)$	2) Need to create a perfect square on the L.H.S. Balance the equation.
$\frac{1}{2}\times 2=1=(1)^2=1$	3) Use the formula : Last term $=(\frac{1}{2}\times$ coefficient of the x-term$)^2$
$x^2+2x+(1)=1+(1)$	4) Add this value to both the sides.
$\because a^2+2ab+b^2=(a+b)^2$ $(x+1)^2=2$	5) Simplify & write the perfect square on the L.H.S based on identity.
$x+1=\pm\sqrt{2}$	6) Take the square root throughout & consider both plus and minus signs.
$x=-1\pm\sqrt{2}$ $x=-1+\sqrt{2}$ or $x=-1-\sqrt{2}$	7) Solve for x.

Note:

For equations with coefficient of x^2 other than 1, divide the whole equation by the same number on both the sides to get 1 as the coefficient of x^2 and then start the process of completing the square.

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6. Discriminant:

A discriminant of a quadratic equation determines whether the quadratic equation $ax^2 + bx + c = 0$ has real roots or not.

Note: Check point no. 7: Nature of the roots

$$\textbf{DISCRIMINANT} = b^2 - 4ac$$

7. Quadratic Formula:

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

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

Where, **DISCRIMINANT ≥ 0** (Discriminant = $b^2 - 4ac$)

8. Nature of the roots:

A quadratic equation $ax^2 + bx + c = 0$ has

a. **Two distinct real roots, if** $b^2 - 4ac > 0$

b. **Two equal roots, if** $b^2 - 4ac = 0$

c. **No real roots, if** $b^2 - 4ac = 0$