# QUADRATIC EQUATIONS

PPT4

**SUBJECT: MATHEMATICS**
**CHAPTER NUMBER: 04**
**CHAPTER NAME : QUADRATIC EQUATIONS**



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## Quadratic Equation

When we equate a quadratic polynomial to a constant, we get a quadratic equation.

Any equation of the form $p(x)= ax^2+bx+c$, where $p(x)$ is a polynomial of degree 2 and c is a constant, is a quadratic equation.

## The standard form of a Quadratic Equation

The standard form of a quadratic equation is $ax^2+bx+c=0$, where a,b and c are real numbers and $a\neq0$.
'a' is the coefficient of $x^2$. It is called the quadratic coefficient. 'b' is the coefficient of x. It is called the linear coefficient. 'c' is the constant term.

# LEARNING OUTCOME

1. Students will be able to find solution of a Quadratic Equations .
2.Students will be able to find solution of quadratic equation by completing the square method.

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Solutions of a quadratic equation by completing the square method

https://youtu.be/cIZi_taMEVY(14.20)

## Solution of a Quadratic Equation by Completing the Square

In this method, we convert the quadratic equation into a form so that the term containing $x$ is completely inside a square. Then by taking the square roots, we can easily find its roots.

### Steps Involved in the Method of Completing the Square

**Step 1** Write the quadratic equation in the form $ax^2 + bx + c = 0,\ a \neq 0.$

**Step 2** Divide the equation throughout by $a$, if it is not unity.

$$x^2 + \frac{b}{a}x + \frac{c}{a} = 0$$

**Step 3** Bring the constant term on R.H.S.

$$x^2 + \frac{b}{a}x = -\frac{c}{a}$$

**Step 4** Add square of half the coefficient of $x$ *i.e.*, $\left(\frac{b}{2a}\right)^2$ on both sides.

$$x^2 + 2\left(\frac{b}{2a}\right) + \left(\frac{b}{2a}\right)^2 = \left(\frac{b}{2a}\right)^2 - \frac{c}{a}$$

**Step 5** Write R.H.S. as a perfect square

$$\left(x + \frac{b}{2a}\right)^2 = \frac{b^2 - 4ac}{4a^2}$$

**Step 6** Take square root of both sides and obtain the values of $x$.

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

Hence, $x = \dfrac{b}{2a} \pm \sqrt{\dfrac{b^2 - 4ac}{2a}}.$

REMARK Instead of dividing the quadratic equation throughout by $a$, we can also multiply the equation throughout by $a$ and then complete its square.

Find the roots of the equation $2x^2 + x - 4 = 0$ by the method of completing the square.

$$2x^2 + x - 4 = 0$$

$\Rightarrow$ $$2x^2 + x = 4$$

$\Rightarrow$ $$x^2 + \frac{1}{2}x = \frac{4}{2}$$ [Dividing both sides by 2]

Adding $\left[\frac{1}{2} \text{ coefficient of } x\right]^2$ *i.e.*, $\left(\frac{1}{2} \times \frac{1}{2}\right)^2$, on both sides, we get

$$x^2 + \frac{1}{2}x + \frac{1}{16} = \frac{1}{16} + 2 \quad \Rightarrow \quad \left(x + \frac{1}{4}\right)^2 = \left(\frac{\sqrt{33}}{4}\right)^2$$

$$x + \frac{1}{4} = \pm \frac{\sqrt{33}}{4}$$

$\Rightarrow$ $$x = \frac{-1 \pm \sqrt{33}}{4}$$

Hence, the roots of the equation are $\frac{-1+\sqrt{33}}{4}$ and $\frac{-1-\sqrt{33}}{4}$.

Solve the equation $2x^2 - 7x + 3 = 0$ by the method of completing the square

Solve the equation $2x^2 - 7x + 3 = 0$ by the method of completing the square.

Given : $2x^2 - 7x + 3 = 0$

$\Rightarrow \quad 2x^2 - 7x = -3$ [Transferring the constant term]

$\Rightarrow \quad x^2 - \frac{7}{2}x = -\frac{3}{2}$ [Dividing both sides by 2]

Adding $\left[\frac{1}{2}\text{ coefficient of } x\right]^2$ *i.e.*, $\left[\frac{1}{2}\times\left(-\frac{7}{2}\right)\right]^2$ on both sides, we get

$$x^2 - \frac{7}{2}x + \left(-\frac{7}{4}\right)^2 = \left(-\frac{7}{4}\right)^2 - \frac{3}{2}$$

$$\left(x - \frac{7}{4}\right)^2 = \frac{49-24}{16} = \frac{25}{16} = \left(\frac{5}{4}\right)^2$$

$\Rightarrow \quad x - \frac{7}{4} = \pm\frac{5}{4} \quad \Rightarrow \quad x = \frac{7}{4} \pm \frac{5}{4}$

$\Rightarrow \quad x = \frac{7}{4} + \frac{5}{4}$ or $x = \frac{7}{4} - \frac{5}{4}$

$\Rightarrow \quad x = \frac{7+5}{4} = 3$ or $x = \frac{7-5}{4} = \frac{2}{4} = \frac{1}{2}$

Hence, the roots of the equation are 3 and $\frac{1}{2}$.

Solve the equation $2x^2 + x + 4 = 0$ by the method of completing the square(if they exist)

Find the roots of $2x^2 + x + 4 = 0$ by the method of completing the square. (if they exist)

Given : $2x^2 + x + 4 = 0 \quad \Rightarrow \quad 2x^2 + x = -4$

$$x^2 + \frac{1}{2}x = -\frac{4}{2} \qquad \text{[Dividing both sides by 2]}$$

Adding $\left[\frac{1}{2}\text{coefficient of } x\right]^2$ *i.e.,* $\left(\frac{1}{2} \times \frac{1}{2}\right)^2$ or $\frac{1}{16}$ to both sides, we get

$$x^2 + \frac{1}{2}x + \frac{1}{16} = \frac{1}{16} - 2 \qquad \Rightarrow \qquad \left(x + \frac{1}{4}\right)^2 = \frac{1-32}{16} = -\frac{31}{16} < 0$$

But $\left(x + \frac{1}{4}\right)^2$ cannot be negative for any real value of $x$.

$\Rightarrow$ No real value of $x$ can satisfy the given equation.

Hence, the given equation has no real roots.

HOME ASSIGNMENT Ex. 4.3 Q. No 1& 3

AHA

Find the roots of the following quadratic equations, if they exist, using the quadratic formula: (i) $3x^2 – 5x + 2 = 0$

(ii) $x^2 + 4x + 5 = 0$

# THANKING YOU

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