CBSE Class 10 Maths Notes Chapter 4: CBSE Class 10 Maths Notes Chapter 4: Quadratic Equations talks about a specific kind of math problem. Quadratic equations often involve variables squared, like x^2.

These notes explain how to solve these equations using different methods, like factorization or the quadratic formula.

They also show how to draw graphs of these equations and understand their shapes. Studying these notes can help students get better at solving math problems and prepare for exams.

CBSE Class 10 Maths Notes Chapter 4 Quadratic Equations PDF

You can access the CBSE Class 10 Maths Notes Chapter 4 on Quadratic Equations in PDF format by clicking on the link provided below.

These notes cover important concepts related to quadratic equations, including various methods of solving them, graphical representations, and practical applications.

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CBSE Class 10 Maths Notes Chapter 4 Quadratic Equations

Quadratic Polynomial

A quadratic polynomial takes the form $ax^2 + bx + c$, where 'a', 'b', and 'c' represent real numbers, and 'a' is not equal to zero.

Quadratic Equation

When a quadratic polynomial is set equal to a constant, it forms a quadratic equation. Any equation expressed as $p(x) = k$, where $p(x)$ represents a polynomial of degree 2 and k is a constant, falls under the category of quadratic equations.

The Standard Form of a Quadratic Equation

In the standard form of a quadratic equation, $ax^2 + bx + c = 0$, where a, b, and c are real numbers and $a \neq 0$. Here, 'a' represents the coefficient of x^2, known as the quadratic coefficient. 'b' stands for the coefficient of x, termed as the linear coefficient. Lastly, 'c' denotes the constant term.

Roots of a Quadratic Equation

The values of x that satisfy a quadratic equation are referred to as the roots of the quadratic equation. If α is a root of the quadratic equation $ax^2 + bx + c = 0$, then $a\alpha^2 + b\alpha + c = 0$. A quadratic equation can possess two distinct real roots, two equal roots, or real roots may not exist at all.

Graphically, the roots of a quadratic equation are the points where the graph of the quadratic polynomial intersects the x-axis. Let's take the example of the graph of the quadratic equation $x^2 - 4 = 0$.

Solving a Quadratic Equation by Factorization Method

Let's consider the quadratic equation $2x^2 - 5x + 3 = 0$. To solve it, we split the middle term by finding two numbers (-2 and -3) such that their sum is equal to the coefficient of x and their product is equal to the product of the coefficient of x^2 and the constant. So, $(-2) + (-3) = (-5)$ and $(-2) \times (-3) = 6$.

By splitting the middle term, we rewrite the equation as $2x^2 - 2x - 3x + 3 = 0$. Then, we factorize it as $2x(x - 1) - 3(x - 1) = 0$, which further simplifies to $(x - 1)(2x - 3) = 0$. Thus, $x = 1$ and $x = 3/2$ are the roots of the given quadratic equation. This method of solving a quadratic equation is called the factorization method.

Solving a Quadratic Equation by Completion of Squares Method

Let's apply the method of completing the square to solve the quadratic equation $2x^2 - 8x = 10$:

(i) Express the quadratic equation in standard form: $2x^2 - 8x - 10 = 0$

(ii) Divide the equation by the coefficient of x^2 to make the coefficient of x^2 equal to 1: $x^2 - 4x - 5 = 0$

(iii) Add the square of half of the coefficient of x to both sides of the equation to get an expression of the form $x^2 \pm 2kx + k^2$: $(x^2 - 4x + 4) - 5 = 0 + 4$

(iv) Isolate the above expression, $(x \pm k)^2$, on the LHS to obtain an equation of the form $(x \pm k)^2 = p^2$: $(x - 2)^2 = 9$

(v) Take the positive and negative square roots: $x - 2 = \pm 3$

$x = -1$ or $x = 5$

Quadratic Formula

The Quadratic Formula provides a direct method to find the roots of a quadratic equation in its standard form.

For the quadratic equation $ax^2 + bx + c = 0$, the formula is:

$$x = [-b \pm \sqrt{(b^2 - 4ac)}] / (2a)$$

By substituting the values of a, b, and c into the formula, we can determine the roots of the equation.

For example, if we have the quadratic equation $x^2 – 5x + 6 = 0$, we can find the roots using the quadratic formula.

Given: $x^2 – 5x + 6 = 0$

Comparing with the standard quadratic equation, we get:

$a = 1$, $b = -5$, and $c = 6$

Since $b^2 – 4ac = (-5)^2 – 4 \times 1 \times 6 = 25 – 24 = 1 > 0$, the roots are real.

Using the quadratic formula:

$x = [-(-5) \pm \sqrt{1}] / (2 * 1)$

$= [5 \pm 1] / 2$

$= (5 + 1)/2$ and $(5 – 1)/2$

$= 6/2, 4/2$

Thus, the roots of the quadratic equation are 3 and 2.

Discriminant

In a quadratic equation $ax^2 + bx + c = 0$, the expression $b^2 - 4ac$ is known as the discriminant, denoted by D.

The discriminant plays a crucial role in determining the nature of the roots of the quadratic equation, depending on the coefficients of the equation.

Nature of Roots

Depending on the value of the discriminant, $D = b^2 - 4ac$, the roots of a quadratic equation, $ax^2 + bx + c = 0$, can fall into three categories.

Case 1: If $D > 0$, the equation has two distinct real roots.

Case 2: If D = 0, the equation has two equal real roots.

Case 3: If D < 0, the equation has no real roots.

Solving using Quadratic Formula when D>0

Solve $2x^2-7x+3=0$ using the quadratic formula.

(i) Identify the coefficients of the quadratic equation. a = 2,b = -7,c = 3

(ii) Calculate the discriminant, b^2-4ac

$D=(-7)^2-4\times2\times3$= 49-24 = 25

D> 0, therefore, the roots are distinct.

(iii) Substitute the coefficients in the quadratic formula to find the roots

$x= [-(-7)\pm \sqrt{((-7)^2-4(2)(3))}]/2(2)$

x=(7 ±5)/4

x=3 and x= 1/2 are the roots.

Solving Quadratic Equation when D=0

Let us take an example of quadratic equation $3x^2 - 2x + 1/3 = 0$.

Here, a = 3, b = -2 and c = 1/3

Determinant, $D = b^2 - 4ac = (-2)^2 - 4\,(3)(1/3)$
= 4 – 4
= 0

Thus, the given equation has equal roots.

Hence the roots are -b/2a and -b/2a, i.e., 1/3 and 1/3.

Solving Quadratic Equation when D < 0

Suppose the quadratic equation is $4x^2 + 3x + 5 = 0$

Comparing with the standard form of quadratic equation, $ax^2 + bx + c = 0$,

a = 4, b = 3, c = 5

By the formula of determinant, we know;

Determinant (D) = $b^2 – 4ac$

= $(3)^2 – 4(4)(5)$

= 9 – 80

= -71 < 0 So, D < 0 and hence the roots are complex (not real). Using quadratic formula, $x = [-b \pm \sqrt{(b^2 – 4ac)}]/ 2a$

= $[-3 \pm \sqrt{(-71)}]/ 2(4)$

= $[-3 \pm \sqrt{(i^2\ 71)}]/ 8$

= $(-3 \pm i\sqrt{71})/8$

Thus, the non-real roots of the equation are $x = (-3 + i\sqrt{71})/8$ and $x\ (-3 – i\sqrt{71})/8$.

Formation of a quadratic equation from its roots

To find out the standard form of a quadratic equation when the roots are given:

Let α and β be the roots of the quadratic equation $ax^2+bx+c=0$. Then,

$(x−\alpha)(x−\beta)=0$

On expanding, we get,

$x^2−(\alpha+\beta)x+\alpha\beta=0$, which is the standard form of the quadratic equation.

Here, $a=1,b=−(\alpha+\beta)$ and $c=\alpha\beta$.

Example: Form the quadratic equation if the roots are −3 and 4.

Solution: Given -3 and 4 are the roots of the equation.

Sum of roots = -3 + 4 = 1

Product of the roots = (-3).(4) = -12

As we know, the standard form of a quadratic equation is:

x^2 − (sum of roots)x + (product of roots) = 0

Therefore, by putting the values, we get

$x^2 – x – 12 = 0$

Which is the required quadratic equation.

Sum and Product of Roots of a Quadratic Equation

Let α and β be the roots of the quadratic equation $ax^2+bx+c=0$. Then,

Sum of roots = $\alpha + \beta = -b/a$

Product of roots = $\alpha\beta = c/a$

Example: Given, $x^2 - 5x + 8 = 0$ is the quadratic equation. Find the sum and product of its roots.

Solution: $x^2 - 5x + 8 = 0$ is the quadratic equation given in the form of $ax^2 + bx + c = 0$.
Hence,
a = 1
b = -5
c = 8

Sum of roots = -b/a = 5

Product of roots = c/a = 8

Benefits of CBSE Class 10 Maths Notes Chapter 4 Quadratic Equations

Benefits of studying CBSE Class 10 Maths Notes Chapter 4 Quadratic Equations include:

Concept Clarity: The notes provide clear explanations of quadratic equations, helping students understand the fundamentals.

Problem Solving: They offer solved examples and practice questions, aiding students in honing their problem-solving skills.

Exam Preparation: The notes cover essential topics required for exams, serving as a comprehensive study resource.

Revision Aid: They act as a handy revision tool, summarizing key concepts and formulas for quick review.

Improved Performance: By understanding quadratic equations better, students can enhance their performance in exams and assessments.