BAL BHARATI PUBLIC SCHOOL, PITAMPURA, DELHI – 110034

SUBJECT: MATHEMATICS

CHAPTER: 4

TOPIC: Quadratic Equation

STEP 1:- **GUIDELINES AND INTRODUCTION**

Guidelines:

Dear students, Kindly refer to the following notes/video links from the Chapter- "Quadratic Equation " and thereafter do the questions in your Maths notebook.

(Chapter4 – part 1)

LINK FOR THE CHAPTER: http://ncert.nic.in/textbook/textbook.htm?jemh1=4-15

INTRODUCTION

1) 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.

2) $ax^2 + bx + c = 0$, a ≠ 0, is called the standard form of quadratic equation.

3) The word "quadratic" comes from "*quadratum*", the Latin word for square. Hence, we define a quadratic equation as an equation where the variable is of the second degree. Therefore, a quadratic equation is also called an "Equation of Degree 2".

STEP 2:
Subtopic:

(i)   Quadratic Equation
(ii)   Solution of Quadratic equation by factorization
(iii) Forming a quadratic equation in a given situation and solving it

STEP 3: Key Points and Important Link for References

(i)   Quadratic Equation
$ax^2 + bx + c = 0$, a ≠ 0, is called the standard form of quadratic equation
For example (i) $2x^2+5x+3=0$;   Here, a=2, b=3 and c=5

(ii) $x^2-3x=0$;   Here, a=1 , b=-3 and c=0

But sometimes, the quadratic equation does not come in the standard form. These are the hidden quadratic equations which we may have to reduce to the standard form. Here are some examples:

Equation	Standard Form	Coefficients	Explanation
$x^2 - 3x = 1$	$x^2 - 3x - 1 = 0$	$a = 1$, $b = -3$, $c = -1$	Compare it to the general form of the quadratic equation and subtract 1 from both sides.
$2(z^2 - 2z) = 5$	$2z^2 - 4z - 5 = 0$	$a = 2$, $b = -4$, $c = -5$	We need to expand (open the brackets) by multiplying 2 with z^2 and $-2z$ and also we need to bring 5 to the left side to equate the equation with 0.
$y(y-2) = 0$	$y^2 - 2y = 0$	$a = 1$, $b = -2$, $c = 0$	We need to expand, multiply y with both y and -2 and the output you get is in the desired standard form.

Refer to the following link for more on the topic:
https://www.youtube.com/watch?v=UZTvYYoOrmI&list=PLmdFyQYShrjc6bN89NAbgJcUYGgM1r2wF&index=1

Q Check whether $x^3 - 4x^2 - x + 1 = (x - 2)^3$ is a quadratic equation.

Here RHS can be expanded as $x^3 - 6x^2 + 12x - 8$
Therefore, we get $x^3 - 4x^2 - x + 1 = x^3 - 6x^2 + 12x - 8$
i.e. $2x^2 - 13x + 9 = 0$

So, the given equation is a quadratic equation.

(ii)   Solution of Quadratic Equation by Factorization

Refer to the given link to understand the solution of quadratic equation:

https://www.youtube.com/watch?v=5Bs-QhklV-g&list=PLmdFyQYShrjc6bN89NAbgJcUYGgM1r2wF&index=11

Q Find the roots of the following Quadratic equations:

(i) $x^2 - 3x - 10 = 0$

$x^2 - 3x - 10$

$= x^2 - 5x + 2x - 10$

$= x(x - 5) + 2(x - 5)$

$= (x - 5)(x + 2)$

Roots of this equation are the values for which $(x - 5)(x + 2) = 0$

$\therefore\ x - 5 = 0$ or $x + 2 = 0$

i.e., $x = 5$ or $x = -2$

(ii) Given equation is $\dfrac{2}{5}x^2 - x - \dfrac{3}{5} = 0$.

On multiplying by 5 on both sides, we get

$\Rightarrow$ $\qquad\qquad\qquad\qquad 2x^2 - 5x - 3 = 0$

$\qquad\qquad\qquad\qquad 2x^2 - (6x - x) - 3 = 0$ $\qquad$ [by splitting the middle term]

$\Rightarrow$ $\qquad\qquad\qquad\qquad 2x^2 - 6x + x - 3 = 0$

$\Rightarrow$ $\qquad\qquad\qquad\qquad 2x(x - 3) + 1(x - 3) = 0$

$\Rightarrow$ $\qquad\qquad\qquad\qquad (x - 3)(2x + 1) = 0$

Now, $\qquad\qquad\qquad\qquad x - 3 = 0 \Rightarrow x = 3$

and $\qquad\qquad\qquad\qquad 2x + 1 = 0$

$\Rightarrow$ $\qquad\qquad\qquad\qquad x = -\dfrac{1}{2}$

Hence, the roots of the equation $2x^2 - 5x - 3 = 0$ are $-\dfrac{1}{2}$ and 3.

(III) Given equation is $3\sqrt{2}\,x^2 - 5x - \sqrt{2} = 0$.

$\qquad\qquad\qquad\qquad 3\sqrt{2}\,x^2 - (6x - x) - \sqrt{2} = 0$ $\qquad$ [by splitting the middle term]

$\qquad\qquad\qquad\qquad 3\sqrt{2}x^2 - 6x + x - \sqrt{2} = 0$

$\qquad\qquad\qquad\qquad 3\sqrt{2}x^2 - 3\sqrt{2}\cdot\sqrt{2}x + x - \sqrt{2} = 0$

$\Rightarrow$ $\qquad\qquad\qquad\qquad 3\sqrt{2}\,x(x - \sqrt{2}) + 1(x - \sqrt{2}) = 0$

$\Rightarrow$ $\qquad\qquad\qquad\qquad (x - \sqrt{2})(3\sqrt{2}x + 1) = 0$

Now, $\qquad\qquad\qquad\qquad x - \sqrt{2} = 0 \Rightarrow x = \sqrt{2}$

and $\qquad\qquad\qquad\qquad 3\sqrt{2}\,x + 1 = 0$

$\Rightarrow$ $\qquad\qquad\qquad\qquad x = -\dfrac{1}{3\sqrt{2}} = \dfrac{-\sqrt{2}}{6}$

Hence, the roots of the equation $3\sqrt{2}x^2 - 5x - \sqrt{2} = 0$ are $-\dfrac{\sqrt{2}}{6}$ and $\sqrt{2}$.

Refer to the following links:

https://www.youtube.com/watch?v=UtReXKgmQ10

https://www.youtube.com/watch?v=qeByhTF8WEw

(iii)   Forming a Quadratic Equation in a Given Situation

https://www.youtube.com/watch?v=fHqfCxwGBKE&list=PLmdFyQYShrjc6bN89NAbgJcUYGgM1r2wF&index=2

Q.The altitude of a right triangle is 7cm less than its base. If the hypotenuse is 13 cm, find the other two sides.

Let the base of the right triangle be x cm.
Its altitude = $(x - 7)$ cm
From pythagoras theorem,

Base^2 + Altitude^2 = Hypotenuse^2

$\therefore x^2 + (x - 7)^2 = 13^2$

$\Rightarrow x^2 + x^2 + 49 - 14x = 169$

$\Rightarrow 2x^2 - 14x - 120 = 0$

$\Rightarrow x^2 - 7x - 60 = 0$

$\Rightarrow x^2 - 12x + 5x - 60 = 0$

$\Rightarrow x(x - 12) + 5(x - 12) = 0$

$\Rightarrow (x - 12)(x + 5) = 0$

Either $x - 12 = 0$ or $x + 5 = 0$, i.e., $x = 12$ or $x = -5$
Since sides are positive, x can only be 12.
Therefore, the base of the given triangle is 12 cm and the altitude of this triangle will be $(12 - 7)$ cm = 5 cm.

Step 4 : **Points to Remember**

1) Always simplify the given equation to check if it is a quadratic equation or not
2) A quadratic equation is factorized into two linear factors and then apply the zero product principle i.e. if the product of two numbers/variables/algebraic expressions a and b is zero, then either a=0 or b=0 or both a and b are zeroes.

ASSIGNMENT

1) Do NCERT EX 4.1 and 4.2 in the CW/HW register.

   Do the following questions in your practice register:

2) Determine if $(x - 2)^2 - 25 = 0$ is quadratic or not.
3) Divide 12 into two parts s.t. the sum of their squares is 74.
4) One side of a rectangle exceeds its other side by 2 cm. If its area is 195 cm, determine the sides of the rectangle.

ANSWER KEY   Q 2) Yes   Q3) 5 and 7   Q4) 13 cm and 15cm

NOTE

1. Refer to the following links to practice more questions:

a) https://diksha.gov.in/play/collection/do_31292439596866764812 58?referrer=utm_source%3Ddiksha_mobile%26utm_content%3Ddo_31292439596866764812 58%26utm_campaign%3Dshare_content

b) From Khan Academy Assignments

https://www.khanacademy.org/math/in-in-grade-10-ncert

c) www.examfear.com

d) http://www.ei-india.com/mindspark-math (free trial for 60 days)

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