Under CSR Support by
ipca | Foundation

missiongyan®
LET'S LEARN TOGETHER

Class - 10

Mathematics

Chapter - 4

Quadratic Equation

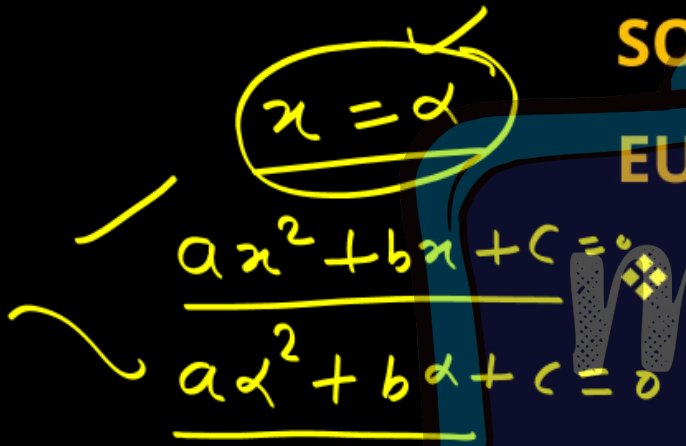
Part - 2

Harsh Goyal

Under CSR Support by ipca | Foundation

QUADRATIC EQUATION

missiongyan® LET'S LEARN TOGETHER



SOLUTION OF A QUADRATIC EUQATION BY FACTORISATION

A real number α is called a root of the quadratic equation

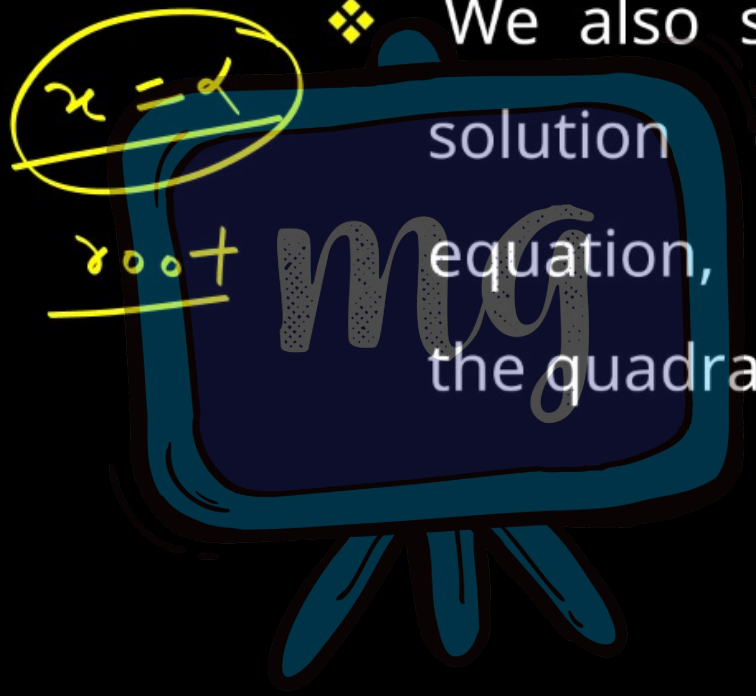
$ax^2 + bx + c = 0, a \neq 0$ if

$a\alpha^2 + b\alpha + c = 0, a \neq 0$

Under CSR Support by
ipca | Foundation

QUADRATIC EQUATION

missiongyan®
LET'S LEARN TOGETHER



- We also say that $x = \alpha$ is a solution of the quadratic equation, or that α satisfies the quadratic equation.

Under CSR Support by ipca | Foundation

QUADRATIC EQUATION

missiongyan® LET'S LEARN TOGETHER

NOTE

- 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.

$ax^2 + bx + c = 0$

$x = \alpha$, $x = \beta$

Under CSR Support by ipca | Foundation

QUADRATIC EQUATION

missiongyan® LET'S LEARN TOGETHER

EXAMPLE 3 :

Find the roots of the equation

$2x^2 - 5x + 3 = 0$, by factorisation.

$2x^2 - 2x - 3x + 3 = 0$

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

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

$x - 1 = 0$ or $2x - 3 = 0$

$x = 1$ or $x = \frac{3}{2}$

$2 \times 3 = 6$

5

$-2 \times -3 = 6$

$-2 + (-3) = -5$

Under CSR Support by ipca | Foundation

QUADRATIC EQUATION

missiongyan® LET'S LEARN TOGETHER

EXAMPLE 4 :

Find the roots of the quadratic equation $6x^2 - x^2 - 2 = 0$.

2	12
2	6
3	3
	1

$2 \times 2 \times 3$

4×3

$4 - 3 = 1$

$6x^2 - x - 2 = 0$

$6x^2 - 4x + 3x - 2 = 0$

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

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

$3x - 2 = 0$, $2x + 1 = 0$

$x = \frac{2}{3}$, $x = \frac{-1}{2}$

12

-1

12×1

3×4

6×2

Under CSR Support by ipca | Foundation

QUADRATIC EQUATION

missiongyan LET'S LEARN TOGETHER

EXAMPLE 5 :

Find the roots of the quadratic equation $3x^2 - 2\sqrt{6}\,x + 2 = 0$

$\sqrt{6}, \sqrt{6}$

$\sqrt{3} + \sqrt{3} = 2\sqrt{3}$

$\sqrt{3} \times \sqrt{3} = 3$

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

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

$\sqrt{3}x(\sqrt{3}x - \sqrt{2}) - \sqrt{2}(\sqrt{3}x - \sqrt{2})$

$(\sqrt{3}x - \sqrt{2})(\sqrt{3}x - \sqrt{2}) = 0$

$\sqrt{3}x - \sqrt{2} = 0$ | $\sqrt{3}x - \sqrt{2} = 0$

$x = \frac{\sqrt{2}}{\sqrt{3}}$

$x = \frac{\sqrt{2}}{\sqrt{3}}, \frac{\sqrt{2}}{\sqrt{3}}$

$3 \times 2 = 6$

$2\sqrt{6}$

$3 = \sqrt{3} \times \sqrt{3}$

$\sqrt{6} = \sqrt{2} \times 3$

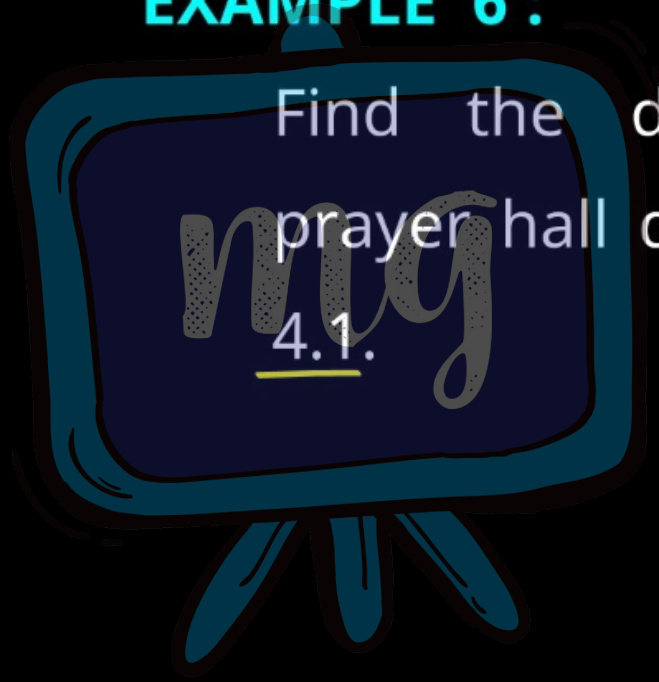
$= \sqrt{2}\sqrt{3}$

Under CSR Support by
ipca | Foundation

QUADRATIC EQUATION

missiongyan®
LET'S LEARN TOGETHER

EXAMPLE 6 :



Find the dimensions of the prayer hall discussed in Section 4.1.

Under CSR Support by
ipca | Foundation

QUADRATIC EQUATION

missiongyan®
LET'S LEARN TOGETHER

- Suppose a charity trust decides to build a prayer hall having a carpet area of 300 square meters with its length one meter more than twice its breadth. What should be the length and breadth of the hall?

Under CSR Support by ipca | Foundation

missiongyan® LET'S LEARN TOGETHER

QUADRATIC EQUATION

22, 23

24, 25

600

30×20

10, 20, 30

5

5, 15, 25, 35

15×16

$14 \times$

$(2x+1)x = 300$

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

$2x^2 - 24x + 25x - 300$

$= 0$

$\Rightarrow 2x(x-12) + 25(x-12) = 0$

$25 \times 24 = 600$

$\Rightarrow (x-12)(2x+25) = 0$

$x = 12, \quad x = -\frac{25}{2}$

let breadth $= x$ metre

length $= 2x+1$ $\quad x = 12$

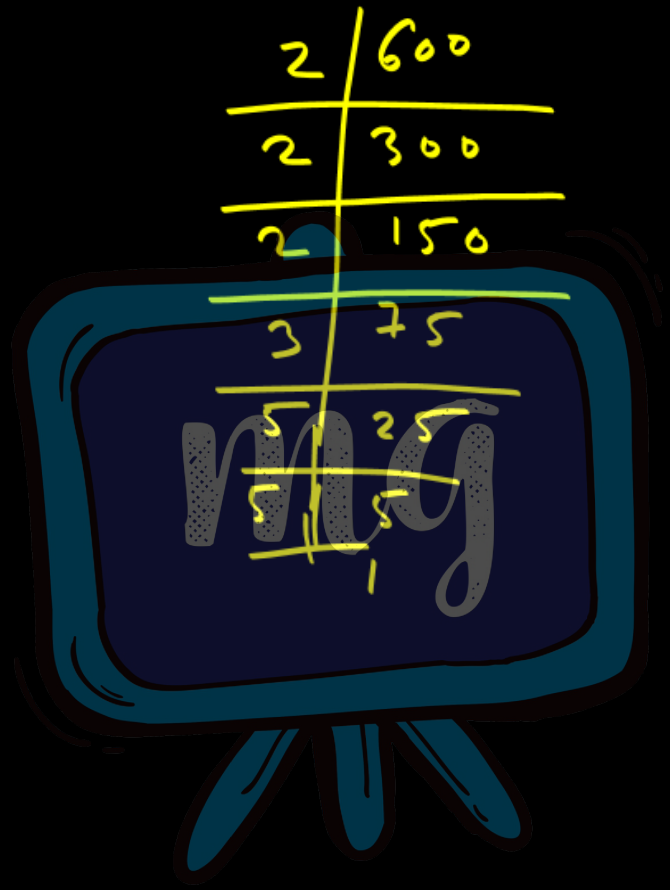
$l = 25$

area $= 300$

$l \times b = 300$

Under CSR Support by
ipca | Foundation

missiongyan®
LET'S LEARN TOGETHER



600

$2 \times 2 \times 2 \times 3 \times 5 \times 5$

$= 2^3 \times 3 \times 5^2$

Under CSR Support by ipca | Foundation

QUADRATIC EQUATION

missiongyan® LET'S LEARN TOGETHER

EXERCISE 4.2

1. Find the roots of the following quadratic equations by factorisation :

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

$x^2 - 5x + 2x - 10 = 0$

$\Rightarrow x(x-5) + 2(x-5) = 0$

$\Rightarrow (x-5)(x+2) = 0$

$x = 5$

$x = -2$

Under CSR Support by
ipca | Foundation

QUADRATIC EQUATION

missiongyan®
LET'S LEARN TOGETHER

(ii) $2x^2 + x - 6 = 0$

$2x^2 + 4x - 3x - 6 = 0$

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

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

$x = -2$ | $x = \frac{3}{2}$

12

3, 4

4x, -3x

mg

Under CSR Support by
ipca | Foundation

QUADRATIC EQUATION

missiongyan®
LET'S LEARN TOGETHER

(iii) $\sqrt{2}x^2 + 7x + 5\sqrt{2} = 0$

$\Rightarrow \sqrt{2}x^2 + 2x + 5x + 5\sqrt{2} = 0$

$\Rightarrow \sqrt{2}x(x + \sqrt{2}) + 5(x + \sqrt{2}) = 0$

$\Rightarrow (x + \sqrt{2})(\sqrt{2}x + 5) = 0$

$\therefore x + \sqrt{2} = 0$

$x = -\sqrt{2}$

$\sqrt{2}x + 5 = 0$

$\sqrt{2}x = -5$

$x = \frac{-5}{\sqrt{2}}$

$x =$

$\sqrt{2} \times 5\sqrt{2}$

$= 10$

2×5

7

Under CSR Support by
ipca | Foundation

missiongyan®
LET'S LEARN TOGETHER

QUADRATIC EQUATION

(iv) $2x^2 - x + \frac{1}{8} = 0$

$x =$

$\frac{16x^2 - 8x + 1 = 0}{8}$

$\Rightarrow 16x^2 - 8x + 1 = 0$

$16x^2 - 4x - 4x + 1 = 0$

$4x(4x-1) - 1(4x-1) = 0$

$(4x-1)(4x-1) = 0$

$\Rightarrow x = \frac{1}{4}, \frac{1}{4}$

1, 4

$16 \times 1 = 16$

$8 \quad 4 \times 4$

Under CSR Support by
ipca | Foundation

QUADRATIC EQUATION

missiongyan®
LET'S LEARN TOGETHER

(v) $100x^2 - 20x + 1 = 0$

$100 \times 1 = 100$

$100x^2 - 10x - 10x + 1 = 0$ | 20

$\Rightarrow 10x(10x-1) - 1(10x-1) = 0$ | 10×10

$\Rightarrow (10x-1)(10x-1) = 0$ | $\frac{1}{10}, \frac{1}{10}$

$\Rightarrow x = \frac{1}{10}, \frac{1}{10}$

Under CSR Support by
ipca | Foundation

QUADRATIC EQUATION

missiongyan®
LET'S LEARN TOGETHER

2. Solve the problems given in Example 1.



Under CSR Support by
ipca | Foundation

QUADRATIC EQUATION

missiongyan®
LET'S LEARN TOGETHER

EXAMPLE 1 :

Represent the following situations mathematically :

(i) John and Jivanti together have 45 marbles. Both of them lost 5 marbles each, and the product of the number of marbles they now have is 124.

Under CSR Support by ipca | Foundation

missiongyan® LET'S LEARN TOGETHER

2	324
2	162
3	81
3	27
3	9
3	3
	1

$2 \times 2 \times 3 \times 3 \times 3 \times 3$

12 27

36, 9

let John have x marble

Jivanti $= 45 - x$ → (y)

2c

$45 - x - 5$

$40 - x$

$x - 5$

$(x-5)(40-x) = 124$

$\Rightarrow 40x - x^2 - 200 + 5x = 124$

$\Rightarrow x^2 + 45x - 324 = 0$

$x^2 + 36x - 9x - 324 = 0$

$\Rightarrow x(x+36) - 9(x+36) = 0$

$(x+36)(x-9) = 0$

$\Rightarrow x = -36, \; x = 9$

Under CSR Support by
ipca | Foundation

QUADRATIC EQUATION

missiongyan®
LET'S LEARN TOGETHER

We would like to find out how have is many marbles they had to start with.



Under CSR Support by
ipca | Foundation

QUADRATIC EQUATION

missiongyan®
LET'S LEARN TOGETHER

(ii) A cottage industry produces a certain number of toys in a day. The cost of production of each toy (in rupees) was found to be 55 minus the number of toys produced in a day. On a particular day, the total cost of production was ₹ 750.

Under CSR Support by
ipca | Foundation

missiongyan®
LET'S LEARN TOGETHER

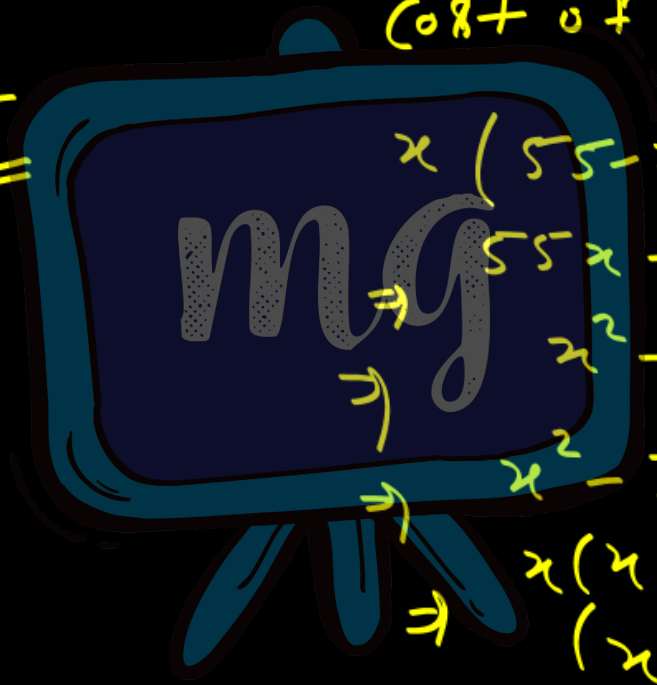
10
20
30
40

750

let toys produced in a day $= x$

Cost of production $= 55 - x$

30×25



$x(55-x) = 750$

$\Rightarrow 55x - x^2 = 750$

$\Rightarrow x^2 - 55x + 750 = 0$

$\Rightarrow x^2 - 30x - 25x + 750 = 0$

$x(x-30) - 25(x-30) = 0$

$(x-30)(x-25) = 0$

$\therefore x = 30, 25$

$\begin{array}{r|l} 2 & 750 \\ 5 & 375 \\ 5 & 75 \\ & 15 \end{array}$

Under CSR Support by
ipca | Foundation

QUADRATIC EQUATION

missiongyan®
LET'S LEARN TOGETHER

We would like to find out the number of toys produced on that day.



Under CSR Support by ipca | Foundation

QUADRATIC EQUATION

missiongyan® LET'S LEARN TOGETHER

3. Find two numbers whose sum is 27 and product is 182.

Let two numbers are x & y

$x + y = 27$ ⇒ $y = 27 - x$

$xy = 182$

$x(27 - x) = 182$

$27x - x^2 = 182$

$x^2 - 27x + 182 = 0$

$x^2 - 14x - 13x + 182 = 0$

$x(x - 14) - 13(x - 14) = 0$

$(x - 14)(x - 13) = 0$

$x = 13, 14$

$x = 13$, $y = 14$

182 = 14 × 13

27

$x = 14$, $x = 13$