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CLASS – 10

MATHEMATICS

Chapter – 4

QUADRATIC EQUATIONS

Part – 3

Solution of a Quadratic Equation by Factorisation

Shubham Tiwari

OVERVIEW

1. Quadratic Equations
2. Solution of a Quadratic Equation by Factorisation
3. Nature of Roots

ROOTS OF A QUADRATIC EQUATION

We say that $x = \alpha$ (where α is a real number) is a solution of quadratic equation $ax^2 + bx + c = 0$, $a \neq 0$, if $a(\alpha)^2 + b(\alpha) + c = 0$

$x^2 + 5x + 6 = 0$

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

$x[x+3] + 2[x+3] = 0$

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

$x+3 = 0$ | $x+2 = 0$

$x = -3$ | $x = -2$

$4 - 10 + 6$

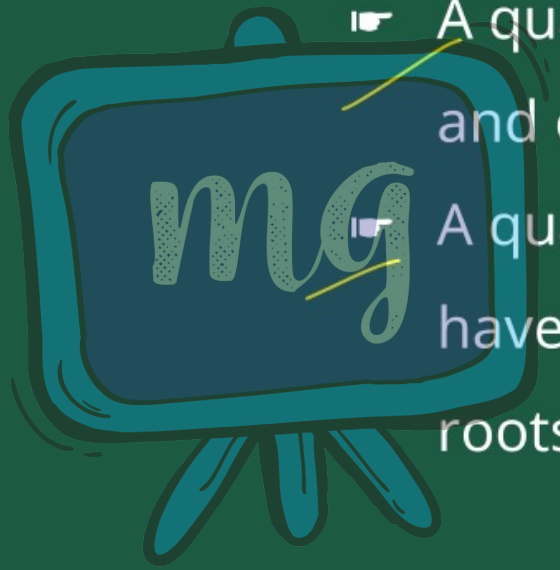
$10 - 10 = 0$

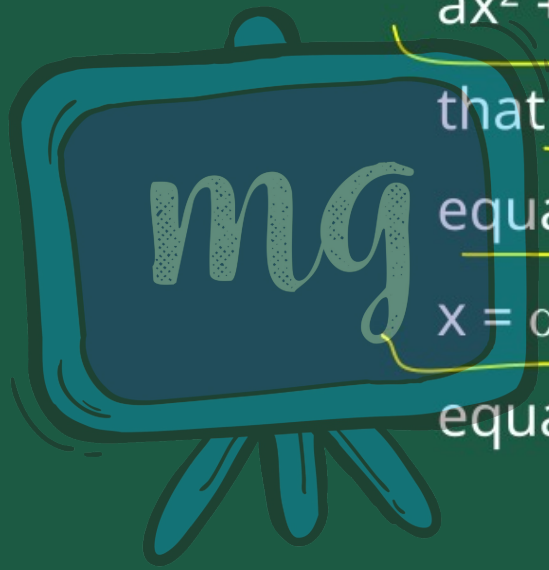
$9 - 15 + 6$

$15 - 15 = 0$

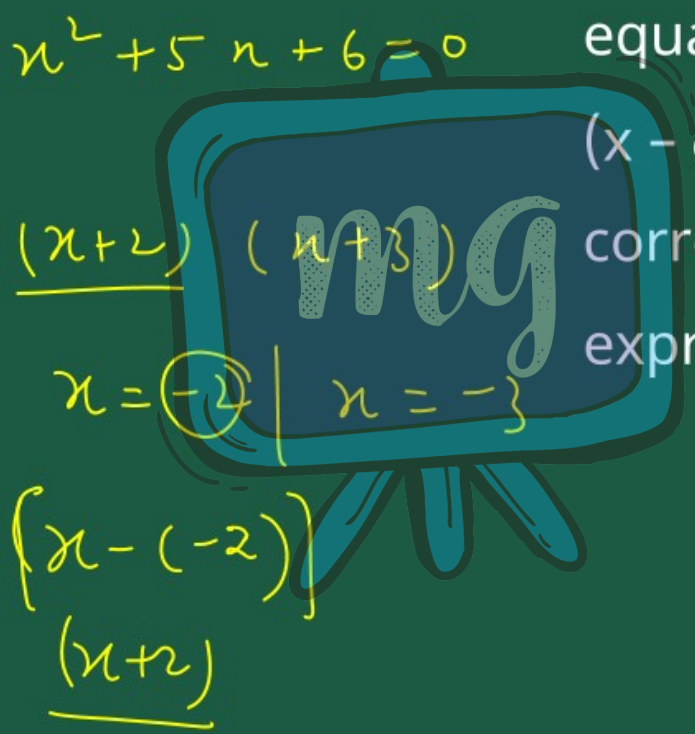
Note

- A quadratic equation has two and only two roots.
- A quadratic equation can not have more than two different roots.



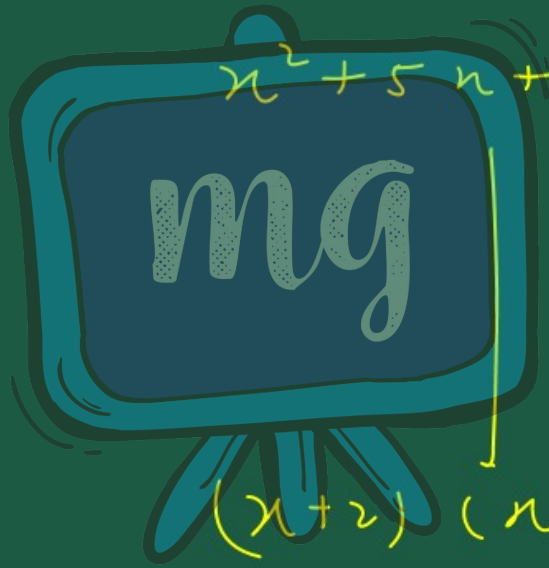


☛ If α and β are the roots of $ax^2 + bx + c = 0$ then we say that $x = \alpha, \beta$ satisfies the equation $ax^2 + bx + c = 0$ or $x = \alpha, \beta$ are solution of the equation $ax^2 + bx + c = 0$.



☛ If α be a root of the quadratic equation $ax^2 + bx + c = 0$ then $(x - \alpha)$ is a factor of corresponding quadratic expression $ax^2 + bx + c$.

FACTORISATION METHOD



$x^2 + 5x + 6 = 0$

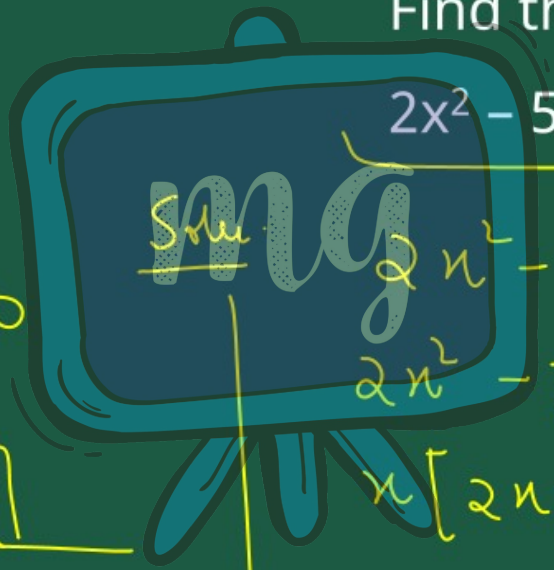
$(x+2)(x+3)$

$x = -2 \mid x = -3$

Example : 3

Find the roots of the equation

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



Sol:

$2x^2 - 5x + 3 = 0$

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

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

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

$2x - 3 = 0$

$2x = 3$

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

$x - 1 = 0$

$x = 1$

Example : 4

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

Solution:

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

$6x^2 - (4-3)x - 2 = 0$

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

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

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

$3x - 2 = 0$

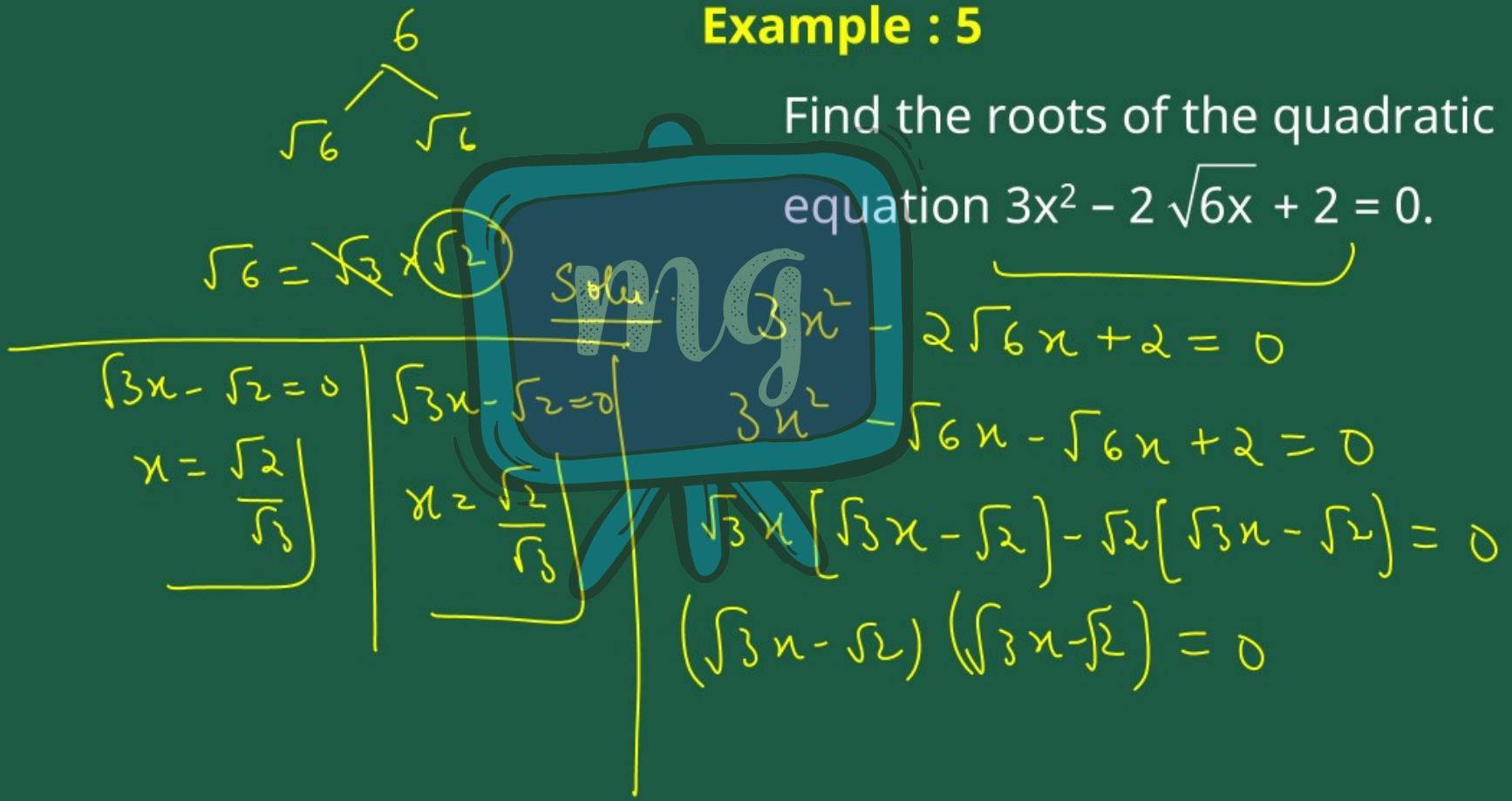
$x = \frac{2}{3}$

$2x + 1 = 0$

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

Example : 5

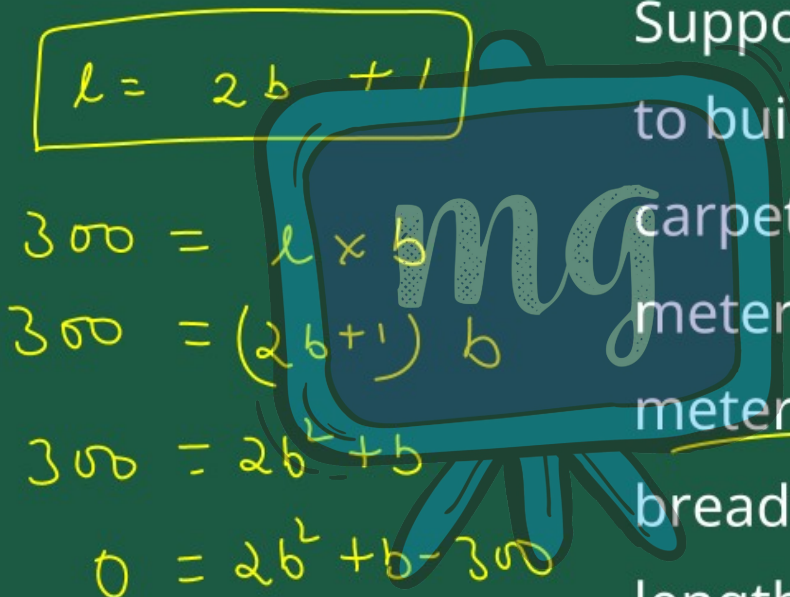
Find the roots of the quadratic equation $3x^2 - 2\sqrt{6x} + 2 = 0$.



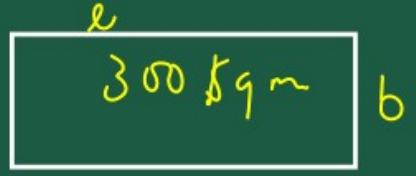
Example : 6

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

Section 4.1



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?



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

$2b^2 + 25b - 24b - 300 = 0$

$b[2b+25] - 12[2b+25] = 0$

$(2b+25)(b-12) = 0$

$2b+25 = 0$

$b = -\frac{25}{2}$

$b - 12 = 0$

$b = 12$

600

10 60

30 × 2

10 × 15 × 2 × 2

5 × 2 × 5 × 3 × 2 × 2

25 × 24

Here $l = 2b + 1$

$l = 2 \times 12 + 1$

$l = 24 + 1$

$\boxed{l = 25}$

Thus, the length and breadth of the prayer hall are 25 m and 12 m. respectively.

LEARNING OUTCOMES

1. Roots of Quadratic Equation
2. Solution of a Quadratic Equation by Factorisation

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ASSESSMENT

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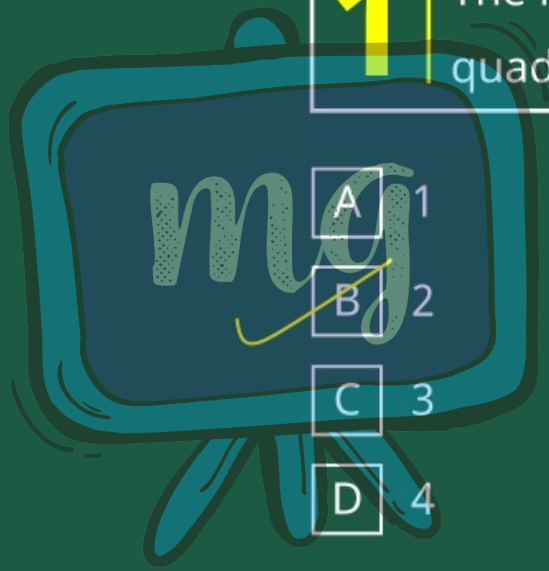
1 The maximum number of roots for a quadratic equation is equal to :



A 1

B 2

C 3

D 4

ASSESSMENT

2 The roots of $100x^2 - 20x + 1 = 0$ is :

A 1/20 and 1/20

B 1/10 and 1/20

C 1/10 and 1/10

D None of the above

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

$100 \times \frac{1}{100} - 20 \times \frac{1}{10} + 1 = 0$

$-2 + 1 = 0$

$= 0$

ASSESSMENT

3 The one root of equation $4x^2 - 2x + k - 4 = 0$ is reciprocal of the other. The value of k is :

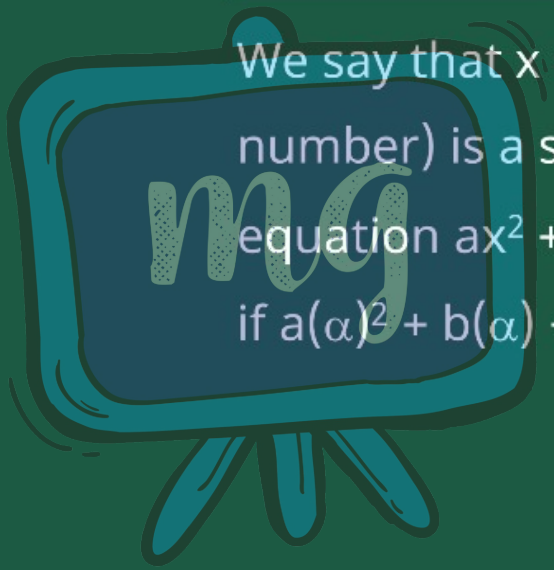
A -8

B 8

C -4

D 4

ROOTS OF A QUADRATIC EQUATION



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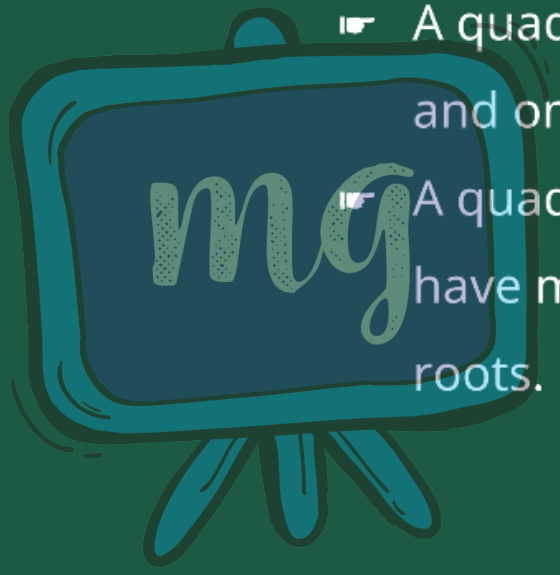

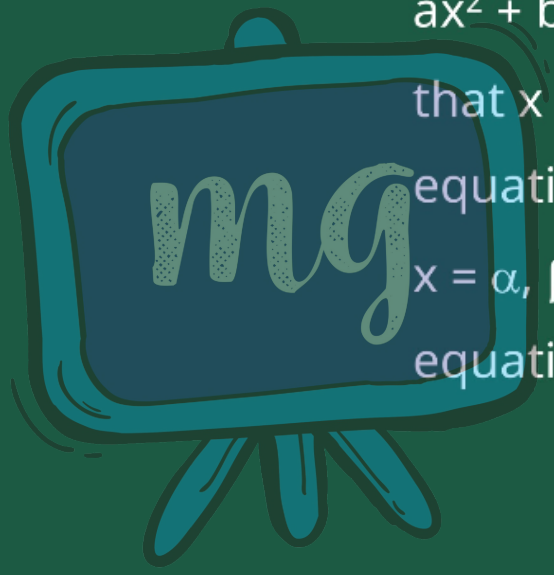

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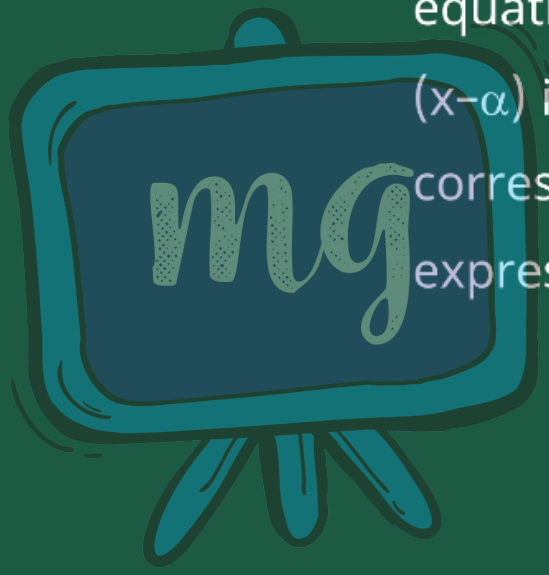

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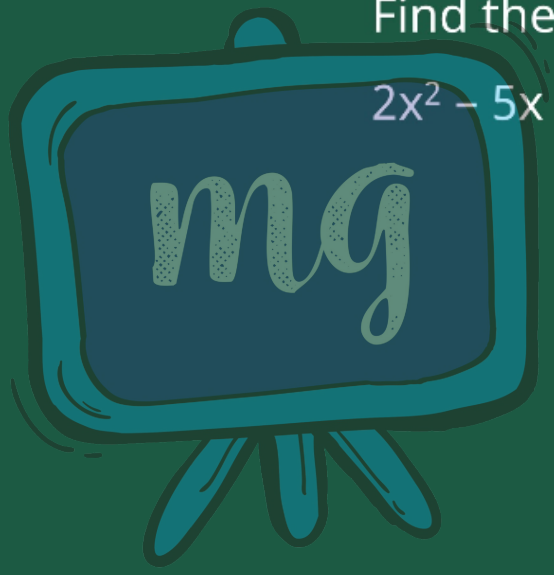

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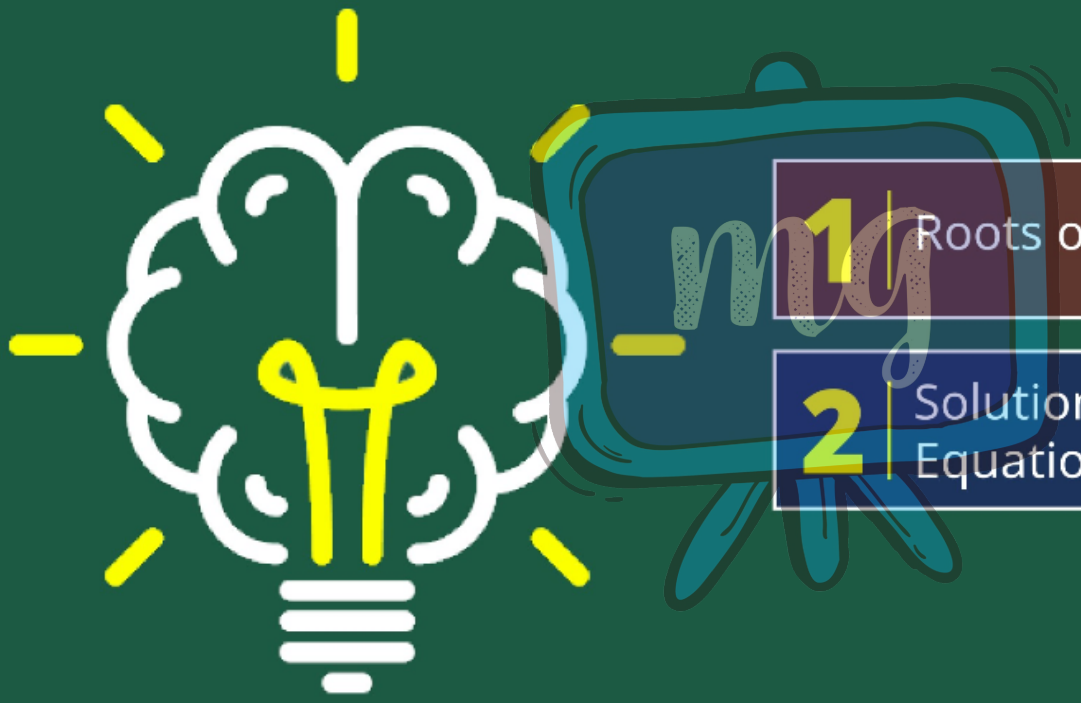

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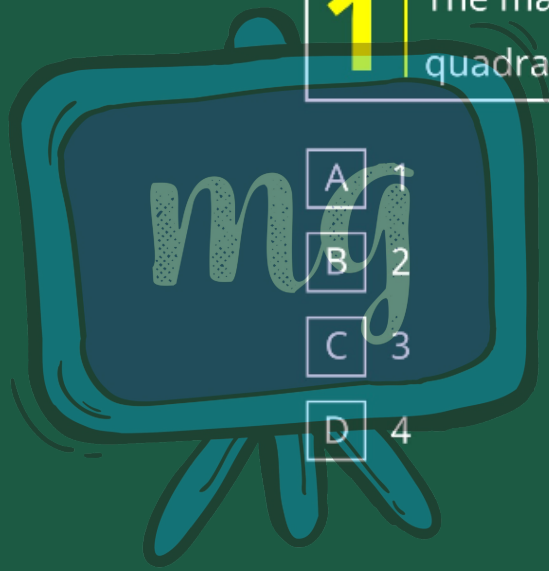

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