



UDAAN



2026

POLYNOMIALS

MATHS

LECTURE-5

BY-RITIK SIR



Topics *to be covered*



A Questions on Relation between Zeroes and Coefficients of Quadratic Polynomial

B. Important Question (Part - 01)

RITIK SIR

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Q If α, β are zeroes of $x^2 - 3x + 4$, then find the value of $\alpha + \beta - \alpha\beta$

$$= 3 - 4$$

$$= -1$$

$$x^2 - 3x + 4$$

$$ax^2 + bx + c$$

$$a=1, b=-3, c=4$$

$$\text{Sum} = -\frac{b}{a}$$

$$\alpha + \beta = -\frac{-3}{1}$$

$$\alpha + \beta = 3$$

$$\text{Product} = \frac{c}{a}$$

$$\alpha\beta = \frac{4}{1}$$

Q. $px^2 + qx + c$
 $ax^2 + bx + c$

α
 β

find $\alpha + \beta - 2\alpha\beta$.

$$= \alpha + \beta - 2\alpha\beta$$

$$= -\frac{q}{p} - 2\left(\frac{c}{p}\right)$$

$$= \frac{-q - 2c}{p}$$

$$a=p, b=q, c=c$$

$$\alpha + \beta = -\frac{b}{a}$$

$$\alpha\beta = \frac{c}{a}$$

$$\alpha + \beta = -\frac{q}{p}$$

$$\alpha\beta = \frac{c}{p}$$

Q // $x^2 - x - 4$ $\begin{matrix} \nearrow \alpha \\ \searrow \beta \end{matrix}$

Find $\frac{1}{\alpha} + \frac{1}{\beta}$

$$= \frac{1}{\alpha} + \frac{1}{\beta}$$

$$= \frac{\beta + \alpha}{\alpha\beta}$$

$$= \frac{1}{-4} = -\frac{1}{4}$$

$$= -\frac{1}{2} + \frac{1}{3}$$

$$= -\frac{1}{6}$$

$$a=1, b=-1, c=-4$$

$$S = -\frac{b}{a}$$

$$P = \frac{c}{a}$$

$$\alpha + \beta = -\frac{-1}{1}$$

$$\alpha\beta = \frac{-4}{1}$$

$$\alpha + \beta = 1$$

$$\alpha\beta = -4$$

$$(a+b)^2 = a^2 + b^2 + 2ab$$

$$a^2 + b^2 = (a+b)^2 - 2ab$$

#Q. If α and β are the zeros of the quadratic polynomial $p(x) = 4x^2 - 5x - 1$, find the value of $\alpha^2\beta + \alpha\beta^2$.

Simplify

$$\begin{aligned}
 &= \alpha^2\beta + \alpha\beta^2 \\
 &= \alpha\beta[\alpha + \beta] \\
 &= -\frac{1}{4} \left[\frac{5}{4} \right] \\
 &= -\frac{5}{16} \text{ Ans.}
 \end{aligned}$$

$$\begin{aligned}
 &4x^2 - 5x - 1 \\
 &a = 4, b = -5, c = -1 \\
 &\left. \begin{aligned} \alpha + \beta &= -\frac{b}{a} \\ \alpha + \beta &= -\frac{-5}{4} \end{aligned} \right\} \begin{aligned} \alpha\beta &= \frac{c}{a} \\ \alpha\beta &= \frac{-1}{4} \end{aligned} \\
 &\boxed{\alpha + \beta = \frac{5}{4}} \quad \boxed{\alpha\beta = -\frac{1}{4}}
 \end{aligned}$$

#Q. If α and β are the zeros of the quadratic polynomial $f(x) = kx^2 + 4x + 4$ such that $\alpha^2 + \beta^2 = 24$, find the values of k .

$$\alpha^2 + \beta^2 = 24$$

$$(\alpha + \beta)^2 - 2\alpha\beta = 24$$

$$\left(-\frac{4}{k}\right)^2 - 2\left(\frac{4}{k}\right) = 24$$

$$\frac{16}{k^2} - \frac{8}{k} = 24$$

$$a^2 + b^2 = (a+b)^2 - 2ab$$

$$\alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2\alpha\beta$$

$$kx^2 + 4x + 4$$

$$a=k, b=4, c=4$$

$$\alpha + \beta = -\frac{b}{a} \quad \left\{ \begin{array}{l} \alpha\beta = \frac{c}{a} \end{array} \right.$$

$$\boxed{\alpha + \beta = -\frac{4}{k}} \quad \left\{ \begin{array}{l} \boxed{\alpha\beta = \frac{4}{k}} \end{array} \right.$$

$$\frac{16}{u^2} - \frac{8}{u} = 24$$

$$\frac{16 - 8u}{u^2} = 24$$

$$16 - 8u = 24u^2$$

$$0 = 24u^2 + 8u - 16$$

$$0 = 8[3u^2 + u - 2]$$

$$\frac{0}{8} = 3u^2 + u - 2$$

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

$$3u^2 + 1u - 2 = 0$$

$$S = 1, P = -6$$

$$(3, -2)$$

$$3u^2 + 1u - 2u - 2$$

$$3u[u+1] - 2[u+1] = 0$$

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

$$u+1=0$$

$$u = -1$$

$$3u-2=0$$

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

u	u^2	u
u	u	1
	1	1

#Q. If α, β are the zeros of the polynomial $f(x) = 2x^2 + 5x + k$ satisfying the relation

$$\alpha^2 + \beta^2 + \alpha\beta = \frac{21}{4}, \text{ then find the value of } k \text{ for this to be possible.}$$

A

-2

B

2

C

-3

D

NOTA

$$\alpha^2 + \beta^2 + \alpha\beta = \frac{21}{4}$$

$$(\alpha + \beta)^2 - 2\alpha\beta + \alpha\beta = \frac{21}{4}$$

$$(\alpha + \beta)^2 - \alpha\beta = \frac{21}{4}$$

$$\left(-\frac{5}{2}\right)^2 - \left(\frac{k}{2}\right) = \frac{21}{4}$$

$$2x^2 + 5x + k$$

$a=2, b=5, c=k$

$$\alpha + \beta = -\frac{b}{a} \quad \alpha\beta = \frac{c}{a}$$

$$\alpha + \beta = -\frac{5}{2}$$

$$\alpha\beta = \frac{k}{2}$$

$$\frac{25}{4} - \frac{k}{2} = \frac{21}{4}$$

$$\frac{25}{4} - \frac{21}{4} = \frac{k}{2}$$

$$\frac{25-21}{4} = \frac{k}{2}$$

$$\frac{4}{4} = \frac{k}{2}$$

$$1 = \frac{k}{2}$$

$$\boxed{2 = k} \text{ Ans,}$$

#Q. If sum of the squares of zeros of the quadratic polynomial $f(x) = x^2 - 8x + k$ is 40, find the value of k .

$$\alpha^2 + \beta^2 = 40$$

$$(\alpha + \beta)^2 - 2\alpha\beta = 40$$

$$(8)^2 - 2(k) = 40$$

$$64 - 2k = 40$$

$$64 - 40 = 2k$$

$$24 = 2k$$

$$24 = 2k$$

$$\frac{24}{2} = k$$

$$12 = k$$

$$x^2 - 8x + k$$

$$a=1, b=-8, c=k$$

$$S = -\frac{b}{a}$$

$$\alpha + \beta = -\frac{-8}{1}$$

$$\alpha + \beta = 8$$

$$P = \frac{c}{a}$$

$$\alpha\beta = \frac{k}{1}$$

#Q. If α and β are the zeros of the quadratic polynomial $p(x) = x^2 - ax - b$, then the value of $\alpha^2 + \beta^2$ is:

A $a^2 - 2b$

B $a^2 + 2b$

C $b^2 - 2a$

D $b^2 + 2a$

$$\begin{aligned}
 &= \alpha^2 + \beta^2 \\
 &= (\alpha + \beta)^2 - 2\alpha\beta \\
 &= (a)^2 - 2(-b) \\
 &= \boxed{a^2 + 2b} \text{ Ans.}
 \end{aligned}$$

$$\begin{aligned}
 &x^2 - ax - b \\
 &ax^2 + bx + c \\
 &\boxed{a=1, b=-a, c=-b}
 \end{aligned}$$

$$\begin{aligned}
 &\alpha + \beta = -\frac{b}{a} \quad \left\{ \begin{array}{l} \alpha\beta = \frac{c}{a} \\ \alpha\beta = -\frac{b}{1} \end{array} \right. \\
 &\alpha + \beta = -\frac{-a}{1} \quad \left\{ \begin{array}{l} \alpha\beta = -\frac{b}{1} \end{array} \right. \\
 &\boxed{\alpha + \beta = a}
 \end{aligned}$$

#Q. If α and β are the zeros of the quadratic polynomial $p(x) = 6x^2 + x - 2$, find the

value of $\frac{\alpha}{\beta} + \frac{\beta}{\alpha}$.

$$= \frac{\alpha}{\beta} + \frac{\beta}{\alpha}$$

$$= \frac{\alpha^2 + \beta^2}{\alpha\beta}$$

$$= \frac{(\alpha + \beta)^2 - 2\alpha\beta}{\alpha\beta}$$

$$= \frac{\left(-\frac{1}{6}\right)^2 - 2\left(-\frac{1}{3}\right)}{-\frac{1}{3}}$$

$$= \frac{\frac{1}{36} + \frac{2}{3}}{-\frac{1}{3}}$$

$$= \frac{1 + 24}{36}$$

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

$$= \frac{25}{36} \times -\frac{1}{3}$$

$$= \frac{25 \times -1}{36 \times 3}$$

$$= -\frac{25}{12}$$

Ans,

$$6x^2 + x - 2$$

$$a=6, b=1, c=-2$$

$$\alpha + \beta = -\frac{b}{a} \quad \left\{ \begin{array}{l} \alpha\beta = \frac{c}{a} \\ \alpha\beta = -\frac{2}{6} \end{array} \right.$$

$$\alpha + \beta = -\frac{1}{6}$$

$$\alpha\beta = -\frac{2}{6}$$

$$\alpha\beta = -\frac{1}{3}$$

#GPK

#Q. If α, β are zeroes of quadratic polynomial $5x^2 + 5x + 1$, find the value of

1. $\alpha^2 + \beta^2$

2. $\alpha^{-1} + \beta^{-1}$

$\frac{1}{\alpha} + \frac{1}{\beta}$

Q 2, -3

Sum = $2 + -3 = -1$
 Product = $2 \times -3 = -6$

Q 6, -10



Formula:
 $k [x^2 - (\text{Sum})x + \text{product}]$

non-zero
constant

Ans = $k [x^2 - (-1)x + -6]$
 $= k [x^2 + x - 6]$

$x^2 + x - 6$
 $2x^2 + 2x - 12$
 $100x^2 + 100x - 600$
 $-4x^2 - 4x + 24$

Quad. poly \rightarrow

Sum = -4
 Product = -60

$= k [x^2 - (-4)x + (-60)]$
 $= k [x^2 + 4x - 60]$

$k = 1$

$x^2 + 4x - 60$ Ans //

Q P, q. \rightarrow 2 cases

$$\text{Sum} = p + q$$

$$\text{Product} = pq$$

$$= u [x^2 - Sx + P]$$

$$= u [x^2 - (p+q)x + pq]$$

$$u=1$$

$$= x^2 - (p+q)x + pq$$

#Q. The number of polynomials having -2 and 5 as zeros is:

$-2, 5$

A 1

B 2

C 3

D infinitely many

Q $0, \sqrt{3}$

$$\text{Sum} = \sqrt{3}$$

$$\text{Product} = 0$$

$$= h[x^2 - Sx + P]$$

$$h=1$$

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

$$= \boxed{x^2 - \sqrt{3}x}$$

Q $\frac{1}{4}, -3$

$$\text{Sum} = \frac{1}{4} + -3 = \frac{1}{4} - 3 = \frac{1-12}{4} = \boxed{-\frac{11}{4}}$$

$$\text{Product} = \frac{1}{4} \times -3 = \boxed{-\frac{3}{4}}$$

$$= h[x^2 - Sx + P]$$

$$= h\left[x^2 - \left(-\frac{11}{4}\right)x + -\frac{3}{4}\right]$$

$$= \boxed{h\left[x^2 + \frac{11}{4}x - \frac{3}{4}\right]}$$

$$h=4$$

$$\boxed{4x^2 + 11x - 3} \text{ Ans,}$$

#Q. Find a quadratic polynomial each with the given numbers as the sum and product of its zeros respectively

(i) $\frac{1}{4}, -1$

(ii) $\sqrt{2}, \frac{1}{3}$

(iii) $0, \sqrt{5}$

#6 pm

#6 pm

(i) $\frac{1}{4}, -1$

Sum = $\frac{1}{4}$, product = -1

$= k[x^2 - Sx + P]$

$= k[x^2 - \frac{1}{4}x + -1]$

$k=4$

$4x^2 - x - 4$ Ans,

#Q. Find a quadratic polynomial where zeros are $5 - 3\sqrt{2}$ and $5 + 3\sqrt{2}$.

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$$\text{Sum} = \cancel{5 - 3\sqrt{2}} + \cancel{5 + 3\sqrt{2}}$$

$$= \boxed{10}$$

$$\text{Product} = (5 - 3\sqrt{2})(5 + 3\sqrt{2})$$

$$= (5)^2 - (3\sqrt{2})^2$$

$$= 25 - 18$$

$$= \boxed{7}$$

$$= k[x^2 - Sx + P]$$

$$= k[x^2 - 10x + 7]$$

$$\textcircled{k=1}$$

$$\boxed{x^2 - 10x + 7}$$

Ans //

#Q. Quadratic polynomial $2x^2 - 3x + 1$ has zeros as α and β . Now form a quadratic polynomial whose zeroes are 3α and 3β .

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?

$$\begin{aligned} \text{Sum} &= 3\alpha + 3\beta \\ &= 3(\alpha + \beta) \\ &= 3\left(\frac{3}{2}\right) = \frac{9}{2} \end{aligned}$$

$$\begin{aligned} \text{Product} &= 3\alpha \times 3\beta \\ &= 9\alpha\beta \\ &= 9 \cdot \frac{1}{2} = \frac{9}{2} \end{aligned}$$

$$\begin{aligned} &= k[x^2 - Sx + P] \\ &= k\left[x^2 - \frac{9}{2}x + \frac{9}{2}\right] \end{aligned}$$

$$k=2$$

$$2x^2 - 9x + 9$$

Ans //

$$2x^2 - 3x + 1$$

$$a=2, b=-3, c=1$$

$$\alpha + \beta = -\frac{b}{a} \quad \alpha\beta = \frac{c}{a}$$

$$\alpha + \beta = -\frac{-3}{2}$$

$$\alpha + \beta = \frac{3}{2}$$

$$\alpha\beta = \frac{1}{2}$$

#Q. If α and β are the zeros of the quadratic polynomial $f(x) = x^2 - x - 2$, find a polynomial whose zeros are $2\alpha + 1$ and $2\beta + 1$.

$$\begin{array}{|c|} \hline ? \\ \hline \end{array} \begin{array}{l} \nearrow 2\alpha + 1 \\ \searrow 2\beta + 1 \end{array}$$

$$\begin{aligned} \text{Sum} &= 2\alpha + 1 + 2\beta + 1 \\ &= 2\alpha + 2\beta + 2 \\ &= 2(\alpha + \beta) + 2 \\ &= \textcircled{4} \end{aligned}$$

$$\begin{aligned} \text{Product} &= (2\alpha + 1)(2\beta + 1) \\ &= 4\alpha\beta + 2\alpha + 2\beta + 1 \\ &= 4\alpha\beta + 2(\alpha + \beta) + 1 = 4(-2) + 2(1) + 1 = -8 + 2 + 1 = \textcircled{-5} \end{aligned}$$

$$\begin{aligned} x^2 - x - 2 & \xrightarrow{\alpha, \beta} \\ a=1, b=-1, c=-2 \end{aligned}$$

$$\left. \begin{array}{l} S = -\frac{b}{a} \\ \alpha + \beta = -\frac{-1}{1} \\ \alpha + \beta = 1 \end{array} \right\} \begin{array}{l} P = \frac{c}{a} \\ \alpha\beta = \frac{-2}{1} \\ \alpha\beta = -2 \end{array}$$

$$\begin{aligned} S &= u \\ P &= -S \end{aligned}$$

$$= h[x^2 - Sx + P]$$

$$= h[x^2 - ux - S]$$

$$h(x)$$

$$x^2 - ux - S$$

Answer

#Q. If α and β are zeroes of the quadratic equation $x^2 - 7x + 10$, Find the quadratic whose roots are α^2 and β^2 .



$$x^2 - 7x + 10$$

α
 β

$$\alpha + \beta = 7, \alpha\beta = 10$$

$$\begin{aligned} \text{Sum} &= \alpha^2 + \beta^2 \\ &= (\alpha + \beta)^2 - 2\alpha\beta \\ &= (7)^2 - 2(10) = 49 - 20 = 29 \end{aligned}$$

$$\begin{aligned} \text{Product} &= \alpha^2 \beta^2 \\ &= (\alpha\beta)^2 \\ &= (10)^2 \\ &= 100 \end{aligned}$$

$$\begin{aligned} &= k[x^2 - 29x + 100] \\ &= k[x^2 - 29x + 100] \end{aligned}$$

$k=1$

Ans: $x^2 - 29x + 100$

#Q. α and β are zeroes of a quadratic polynomial $x^2 - ax - b$. Obtain a quadratic polynomial whose zeroes are $3\alpha + 1$ and $3\beta + 1$.

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HGPH

#Q. If α and β are the zeros of the quadratic polynomial $f(x) = 2x^2 - 5x + 7$, find a polynomial whose zeros are $2\alpha + 3\beta$ and $3\alpha + 2\beta$.

#Gp

#Q. If α and β are the zeros of the quadratic polynomial $f(x) = 3x^2 - 4x + 1$, find a quadratic polynomial whose zeros are $\frac{\alpha^2}{\beta}$ and $\frac{\beta^2}{\alpha}$.

#Gp

$$a^3 + b^3 = (a + b)(a^2 - ab + b^2)$$

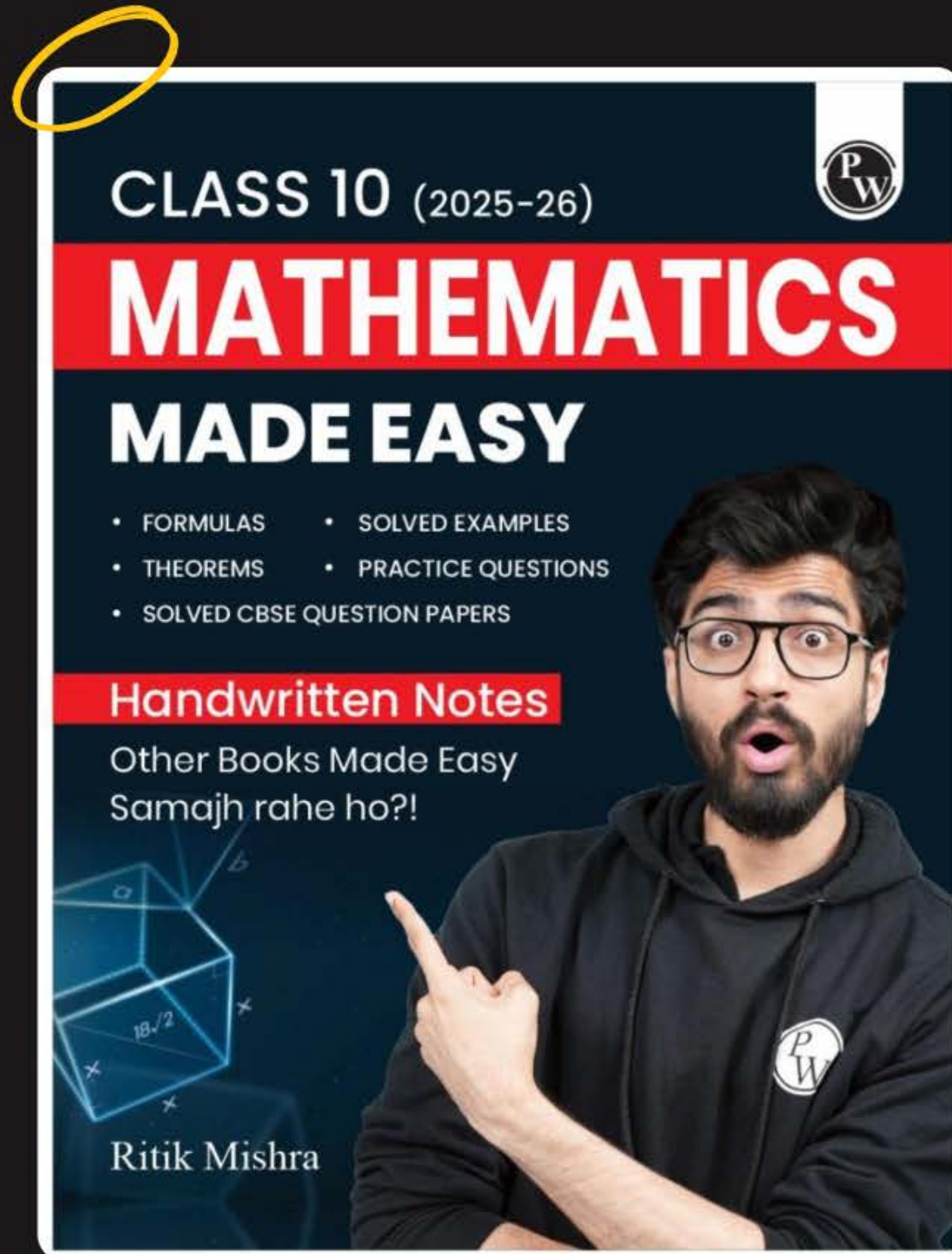
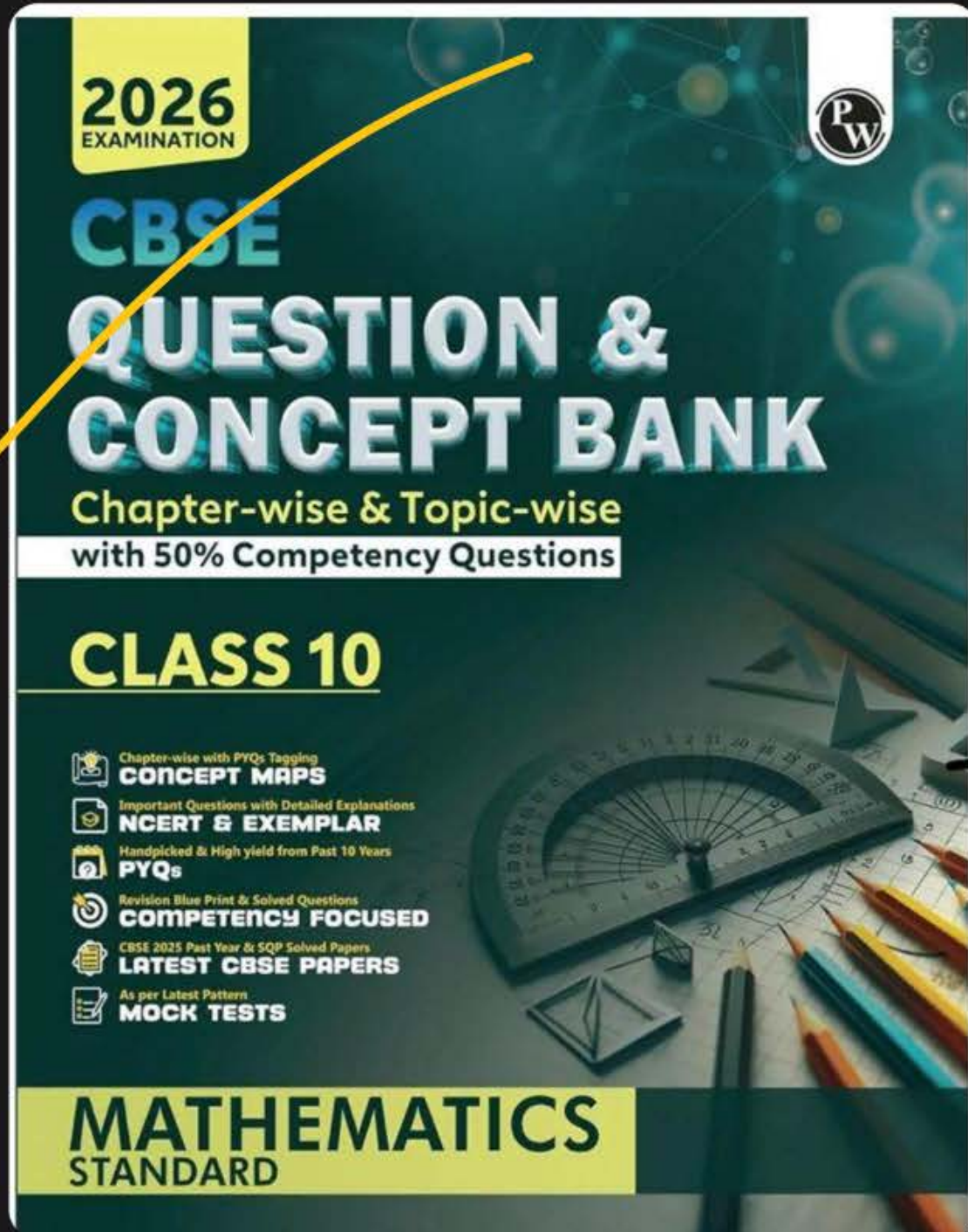
#Q. If α and β are the zeros of the polynomial $x^2 + 4x + 3$, form the polynomial whose zeroes are $1 + \frac{\beta}{\alpha}$ and $1 + \frac{\alpha}{\beta}$.

#Gp

#Q. α and β are zeroes of a quadratic polynomial $px^2 + qx + 1$. Form a quadratic polynomial whose zeroes are $\frac{2}{\alpha}$ and $\frac{2}{\beta}$.

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#Graph





WORK HARD

DREAM BIG

NEVER GIVE UP



Thank
You