



# UDAAN



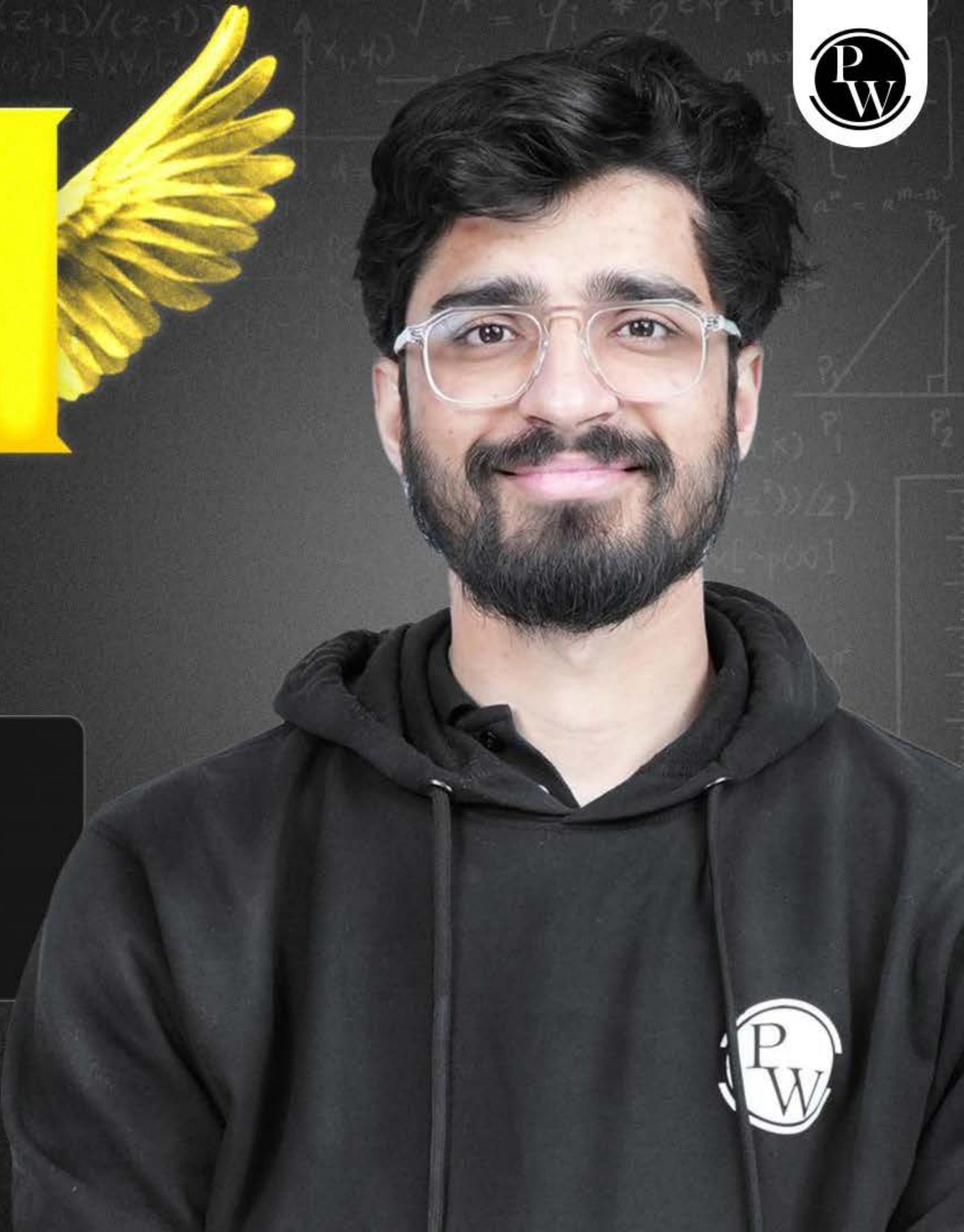
## 2026

# POLYNOMIALS

MATHS

LECTURE-5

BY-RITIK SIR



# Topics *to be covered*

**A**

Questions on Relation between Zeroses and Coefficients of Quadratic Polynomial

B. Important Question (Part - 01)



# RITIK SIR

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Q

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

$$\alpha + \beta$$

$$= 3 - 4$$

$$= -1$$

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

$$ax^2 + bx + c$$

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

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

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

$$\alpha + \beta = 3$$

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

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

$$Q: \begin{cases} px^2 + qx + c \\ ax^2 + bx + c \end{cases}$$

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

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

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

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

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

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

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

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

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

$$\text{Q} \equiv [x^2 - x - 4] \rightarrow \alpha, \beta$$

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

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

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

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

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

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

$$S = -\frac{b}{a} \quad P = \frac{c}{a}$$

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

$$\alpha + \beta = 1$$

$$\alpha \beta = -4$$

$$\alpha \beta = -4$$

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

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

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

*Simplify*

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

$$= \alpha\beta(\alpha + \beta)$$

$$= -\frac{1}{4} \left[ \frac{5}{4} \right]$$

$$= -\frac{5}{16}$$

Ans.,

$$4x^2 - 5x - 1$$

$$a=4, b=-5, c=-1$$

$$\alpha + \beta = -\frac{b}{a} \quad \left. \begin{array}{l} \alpha + \beta = -\frac{5}{4} \\ \alpha\beta = \frac{c}{a} \end{array} \right\} \alpha\beta = -\frac{1}{4}$$

$$\alpha + \beta = -\frac{5}{4} \quad \left. \begin{array}{l} \alpha + \beta = -\frac{5}{4} \\ \alpha\beta = -\frac{1}{4} \end{array} \right\} \alpha\beta = -\frac{1}{4}$$

$$\alpha + \beta = -\frac{5}{4}$$

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

$$\begin{aligned}\alpha^2 + \beta^2 &= 24 \\ (\alpha + \beta)^2 - 2\alpha\beta &= 24 \\ (-\frac{4}{k})^2 - 2(\frac{4}{k}) &= 24\end{aligned}$$

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

$$\begin{aligned}\alpha^2 + \beta^2 &= (\alpha + \beta)^2 - 2\alpha\beta \\ \alpha^2 + \beta^2 &= (\alpha + \beta)^2 - 2\alpha\beta\end{aligned}$$

$$\begin{aligned}kx^2 + 4x + 4 &\\ a = k, b = 4, c = 4 &\\ \alpha + \beta = -\frac{b}{a} & \quad \left. \begin{array}{l} \alpha\beta = \frac{c}{a} \\ \alpha + \beta = -\frac{4}{k} \\ \alpha\beta = \frac{4}{k} \end{array} \right\}\end{aligned}$$

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

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

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

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

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

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

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

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

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

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

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

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

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

$$u+1=0$$

$$u = -1$$

$$3u-2=0$$

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



#Q. If  $\alpha, \beta$  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

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

B

2

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

C

-3

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

D

NOTA

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

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

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

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

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

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

$$\frac{2S}{4} - \frac{u}{2} = \frac{v}{4}$$

$$\frac{2S}{4} - \frac{v}{4} = \frac{u}{2}$$

$$\frac{2S - v}{4} = \frac{u}{2}$$

$$\cancel{x}/\cancel{x} = \frac{u}{2}$$

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

$$2 = u \text{ Ans.}$$

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

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

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

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

$$64 - 2k = 40$$

$$64 - 40 = 2k$$

$$24 = 2k$$

$$24 = 2k$$

$$12 = k$$

$$12 = k$$

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

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

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

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

$$\alpha + \beta = 8$$

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

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

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

A

$$a^2 - 2b$$

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

B

$$a^2 + 2b$$

C

$$b^2 - 2a$$

D

$$b^2 + 2a$$

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

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

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

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

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

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

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

$$= \frac{\left(-\frac{1}{6}\right)^2 - 2\left(-\frac{1}{3}\right)}{-\frac{1}{3}} = \frac{\frac{25}{36}}{-\frac{1}{3}}$$

$$= \frac{25 \times 3}{-1 \times 36} = \frac{-25}{12}$$

$$= \frac{1 + 24}{36} = \frac{-1}{3}$$

$$\begin{array}{|c|} \hline 6x^2 + x - 2 \\ \hline a=6, b=1, c=-2 \\ \hline \end{array}$$

$$\left. \begin{array}{l} \alpha + \beta = -\frac{b}{a} \\ \alpha \beta = \frac{c}{a} \end{array} \right\} \left. \begin{array}{l} \alpha + \beta = -\frac{1}{6} \\ \alpha \beta = -\frac{2}{6} \\ \alpha \beta = -\frac{1}{3} \end{array} \right\}$$

11GPV

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

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

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

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

$$\textcircled{Q} \quad 2, -3$$

$$\text{Sum} = 2 + -3 = -1$$

$$\text{Product} = 2 \times -3 = -6$$

$$\textcircled{Q} \quad 6, -10$$

Quad. poly  $\Rightarrow$

$$\text{Sum} = -4$$

$$\text{Product} = -60$$

formula:

$$= u [x^2 - (\text{Sum})x + \text{product}]$$

non-zero  
constant

$$\text{Ans} = u [x^2 - (-1)x + -6]$$

$$= u [x^2 + x - 6]$$

$$\begin{aligned} & x^2 + x - 6 \\ & 2x^2 + 2u - 12 \\ & 100x^2 + 100x - 600 \\ & -4x^2 - 4u + 24 \end{aligned}$$

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

$$= u [x^2 + 4u - 60]$$

$$u = 1$$

$$x^2 + 4u - 60$$

Ans,

Q  $P, q \rightarrow \underline{\text{Zeros}}$

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

$$\text{Product} = Pq$$

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

$$= u [x^2 - (P+q)x + Pq]$$

$$u=1$$

$$= \boxed{x^2 - (P+q)x + Pq}$$

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

- A 1
- B 2
- C 3
- D infinitely many

-2 1 5

$$\theta = 0, \sqrt{3}$$

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

$$\text{Product} = 0$$

$$= h[x^2 - 5x + P]$$

$$h=1$$

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

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

$$\theta = \frac{1}{4}, -3$$

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

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

$$= h[x^2 - 5x + P]$$

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

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

$$h=4$$

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

#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)  $0, \sqrt{5}$

#GPM

#GPM

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

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

$$= h(x^2 - Sx + P)$$

$$= h\left(x^2 - \frac{1}{4}x + -1\right)$$

$h=4$

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

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

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

$$= \boxed{10}$$

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

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

$$= 25 - 18$$

$$= \boxed{7}$$

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

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

$$h = 1$$

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

Ans/

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

?

$$3\beta = h[x^2 - Sx + P]$$

$$= h[x^2 - \frac{9}{2}x + \frac{9}{2}]$$

$$h = 2$$

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

Sum =  $3\alpha + 3\beta$

$$= 3(\alpha + \beta)$$

$$= 3 \left( \frac{-b}{a} \right) = \boxed{\frac{9}{2}}$$

Product =  $3\alpha \times 3\beta$

$$= 9\alpha\beta$$

$$= 9 \cdot \frac{1}{2} = \boxed{\frac{9}{2}}$$

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

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

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

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

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

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

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

$$\boxed{?} \quad \begin{matrix} \nearrow 2\alpha+1 \\ \searrow 2\beta+1 \end{matrix}$$

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

$$\text{Product} = (2\alpha + 1)(2\beta + 1)$$

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

$$\begin{matrix} \nearrow \alpha \\ \searrow \beta \end{matrix}$$

$$x^2 - x - 2$$

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

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

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

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

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

$h \in \mathbb{C}$

$$x^2 - ux - s$$

Ans<sub>11</sub>

#Q. If  $\alpha$  and  $\beta$  are zeroes of the quadratic equation  $x^2 - 7x + 10$ . Find the quadratic whose zeroes are  $\alpha^2$  and  $\beta^2$ .

$$? \rightarrow \alpha^2 \rightarrow \beta^2$$

$$\text{Sum} = \alpha^2 + \beta^2$$

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

$$= (7)^2 - 2(10) = 49 - 20 = 29$$

$$\text{Product} = \alpha^2 \beta^2$$

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

$$= (10)^2$$

$$= 100$$

$$x^2 - 7x + 10 \rightarrow \alpha \rightarrow \beta$$

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

$$\therefore u[x^2 - Sx + P]$$

$$= u[x^2 - 29x + 100]$$

$$u=l$$

$$\text{Ans}: x^2 - 29x + 100$$

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

~~#GSPU~~

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



#Q. If  $\alpha$  and  $\beta$  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  $\frac{\beta^2}{\alpha}$ .

~~#GPH~~

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

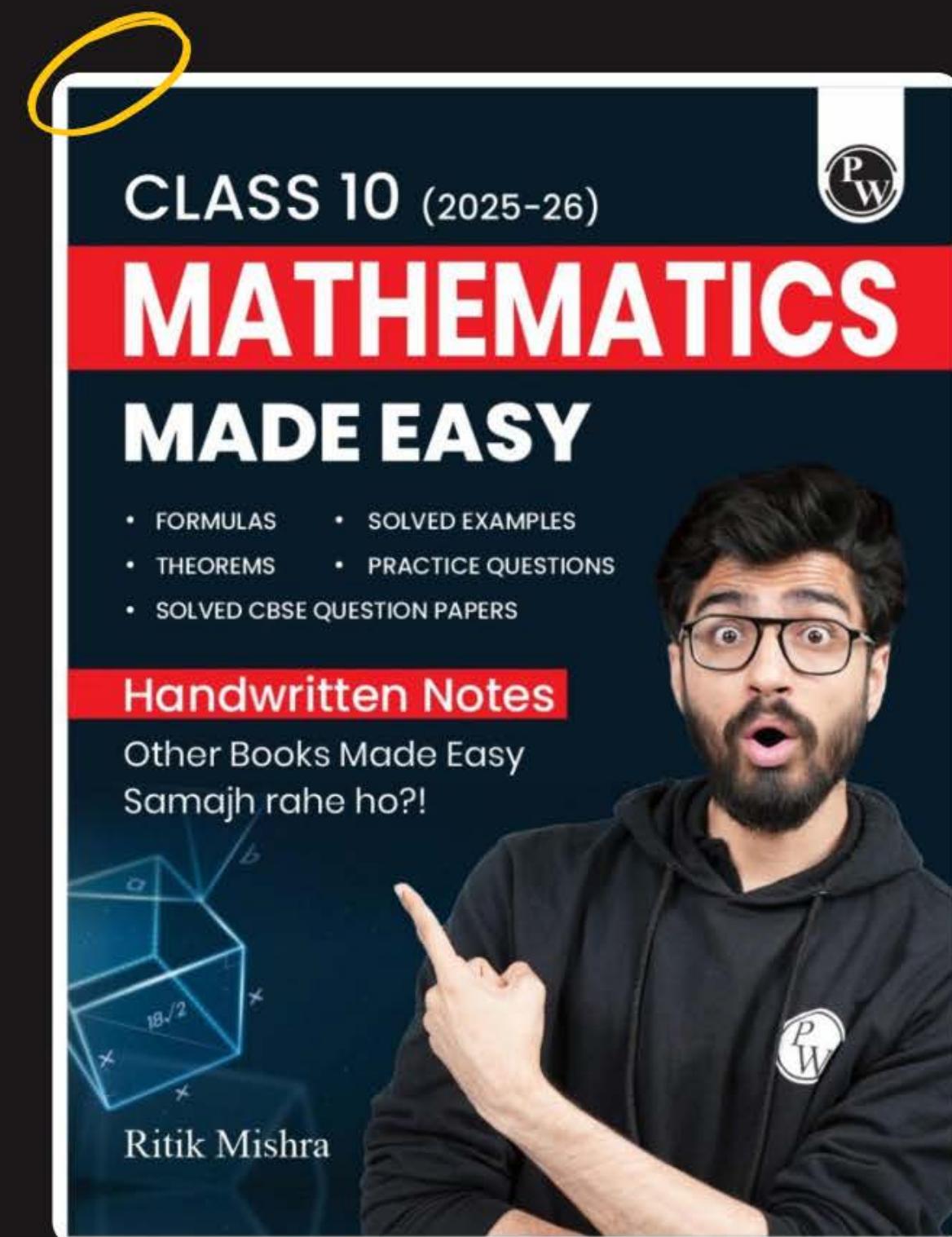
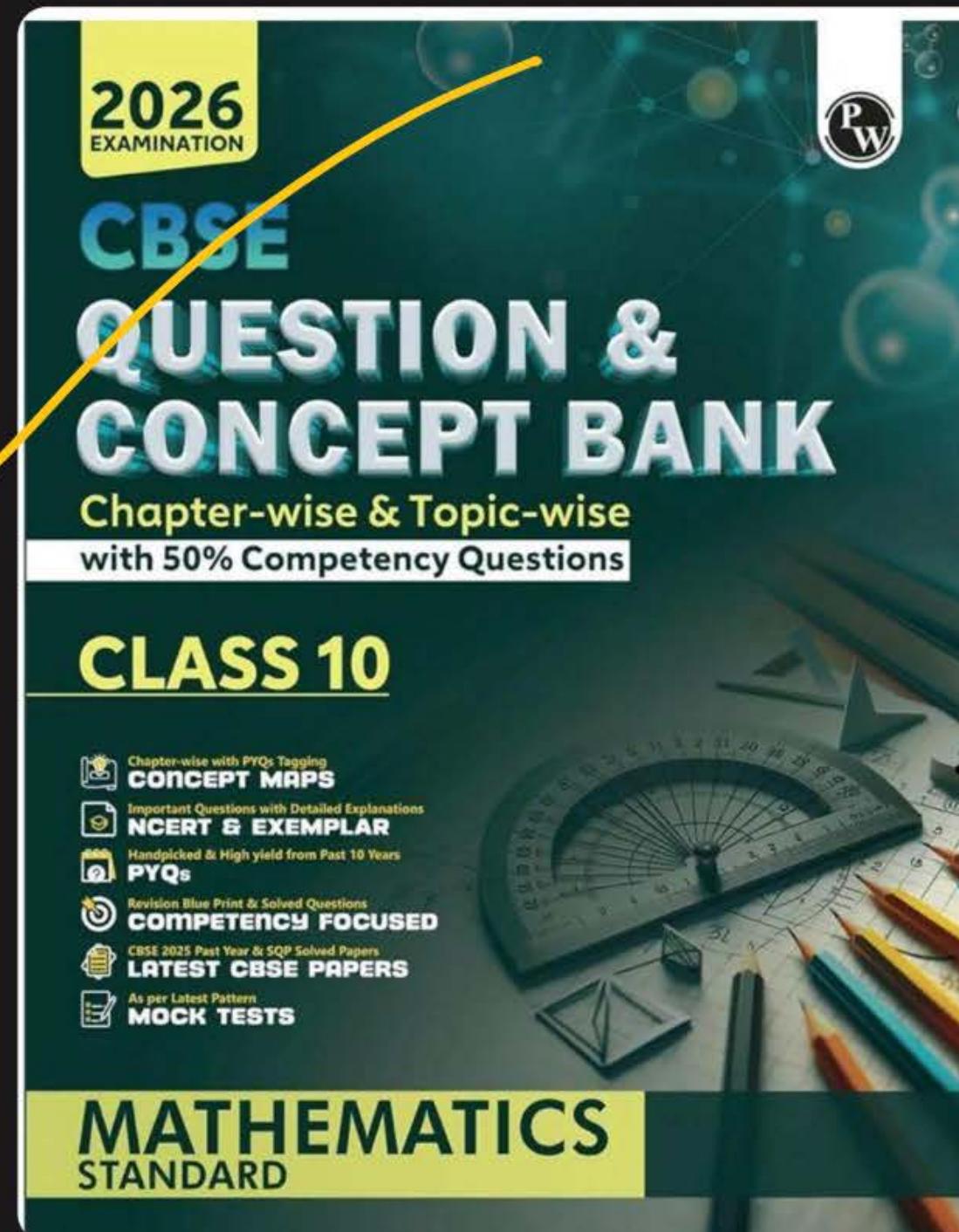
#Q. If  $\alpha$  and  $\beta$  are the zeros of the polynomial  $x^2 + 4x + 3$ , form the polynomial whose zeroes are  $1 + \frac{\beta}{\alpha}$  and  $1 + \frac{\alpha}{\beta}$ .

#GPh

#Q.  $\alpha$  and  $\beta$  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*