UDAAN

2026

Trigonometry

MATHS | LECTURE-9

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Topics *to be covered*

A Questions (Special Class)

#Q. If $\sin\theta + \cos\theta = \sqrt{2}$, then prove that $\tan\theta + \cot\theta = 2$.

$S + C = \sqrt{2}$

$(S+C)^2 = (\sqrt{2})^2$

$S^2 + C^2 + 2SC = 2$

$1 + 2SC = 2$

$2SC = 1$

$\boxed{SC = 1/2}$

L.H.S $= \tan\theta + \cot\theta$

$= \frac{S}{C} + \frac{C}{S}$

$= \frac{S^2 + C^2}{CS}$

$= \frac{1}{CS}$

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

$= \boxed{2}$ H.P

#Q. If θ is an acute angle and $\tan\theta + \cot\theta = 2$, then the value of $\sin^3\theta + \cos^3\theta$ is

(A) 1

(B) $\frac{1}{2}$

(C) $\frac{\sqrt{2}}{2}$

(D) $\sqrt{2}$

$(s+c)^2 = s^2 + c^2 + 2sc$

$(s+c)^2 = 1 + \cancel{2}\left(\frac{1}{\cancel{2}}\right)$

$(s+c)^2 = 2$

$(s+c) = \pm\sqrt{2}$

$s+c = \sqrt{2}$

$\frac{s}{c} + \frac{c}{s} = 2$

$\frac{s^2+c^2}{sc} = 2$

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

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

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

$= (s+c)(s^2+c^2-sc)$

$= (s+c)(1-sc)$

$= (s+c)\left(1-\frac{1}{2}\right)$

$= (s+c) \times \frac{1}{2}$

$= \frac{\sqrt{2}}{2}$ //

$a + b$

#Q. Prove that $(1 - \sin\theta + \cos\theta)^2 = 2(1 + \cos\theta)(1 - \sin\theta)$

L.H.S

$= (1-\sin\theta)^2 + (\cos\theta)^2 + 2(1-\sin\theta)(\cos\theta)$

$= 1 + \sin^2\theta - 2\sin\theta + \cos^2\theta + 2\cos\theta - 2\sin\theta\cos\theta$

1

$= 2 - 2\sin\theta + 2\cos\theta - 2\sin\theta\cos\theta$

$= 2(1-\sin\theta) + 2\cos\theta(1-\sin\theta)$

$= (1-\sin\theta)[2+2\cos\theta] = \boxed{2(1-\sin\theta)(1+\cos\theta)}$

#Q. $\dfrac{1+\cos\theta-\sin^2\theta}{\sin\theta(1+\cos\theta)} = \cot\theta$

L.H.S

$$= \frac{\cos^2\theta + \cos\theta}{\sin\theta(1+\cos\theta)}$$

$$= \frac{\cos\theta\,\cancel{(\cos\theta+1)}}{\sin\theta\,\cancel{(1+\cos\theta)}}$$

$$= \boxed{\cot\theta}$$

#atpata

#Q. If $\cos A + \cos^2 A = 1$, prove that $\sin^2 A + \sin^4 A = 1$

$\cos A + \cos^2 A = 1$

$\cos A = 1 - \cos^2 A$

$\boxed{\cos A = \sin^2 A}$

$= \sin^2 A (1 + \sin^2 A)$

$= \cos A (1 + \cos A)$

$= \cos A + \cos^2 A$

$= \boxed{1}$

#Q. Prove that: $(\sec\theta - \operatorname{cosec}\theta)(1 + \tan\theta + \cot\theta) = \sec\theta\tan\theta - \operatorname{cosec}\theta\cot\theta$.

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

L.H.S

$= \left(\frac{1}{C} - \frac{1}{S}\right)\left(\frac{1}{1} + \frac{S}{C} + \frac{C}{S}\right)$

$= \left(\frac{S-C}{CS}\right)\left(\frac{CS+S^2+C^2}{CS}\right)$

$= \frac{S^3-C^3}{C^2S^2}$

$= \frac{S^{\cancel{3}}}{C^2\cancel{S^2}} - \frac{C^{\cancel{3}}}{\cancel{C^2}S^2}$

$= \frac{S}{C^2} - \frac{C}{S^2}$

$= \frac{S}{C}\times\frac{1}{C} - \frac{C}{S}\times\frac{1}{S}$

$= \boxed{\tan\theta\sec\theta - \cot\theta\operatorname{cosec}\theta}$

#GPK #S²PD

#Q. $(1+\cot A+\tan A)(\sin A-\cos A)=\frac{\sec A}{\operatorname{cosec}^2 A}-\frac{\operatorname{cosec} A}{\sec^2 A}=\sin A\tan A-\cot A\cos A$

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

#Q. $\dfrac{\tan^3\theta}{1+\tan^2\theta}+\dfrac{\cot^3\theta}{1+\cot^2\theta}=\sec\theta\,\mathrm{cosec}\,\theta-2\sin\theta\cos\theta$

$$=\frac{\tan^3\theta}{\sec^2\theta}+\frac{\cot^3\theta}{\mathrm{cosec}^2\theta}$$

$$=\frac{S^3}{C^{\cancel{3}}}\times\frac{\cancel{C^2}}{1}+\frac{C^3}{S^{\cancel{3}}}\times\frac{\cancel{S^2}}{1}$$

$$=\frac{S^3}{C}+\frac{C^3}{S}$$

$$=\frac{S^4+C^4}{CS}$$

$$=\frac{(S^2)^2+(C^2)^2}{CS}$$

$$=\frac{(S^2+C^2)^2-2S^2C^2}{CS}$$

$$=\frac{1-2S^2C^2}{CS}$$

$$=\frac{1}{CS}-\frac{2\cancel{S^2}\cancel{C^2}}{\cancel{C}\cancel{S}}$$

$\sec\theta\,\mathrm{cosec}\,\theta-2\sin\theta\cos\theta$

#Q. $\left(\tan\theta + \frac{1}{\cos\theta}\right)^2 + \left(\tan\theta - \frac{1}{\cos\theta}\right)^2 = 2\left(\frac{1+\sin^2\theta}{1-\sin^2\theta}\right)$

#GPU

#Q. $\dfrac{\tan A}{(1+\tan^2 A)^2} + \dfrac{\cot A}{(1+\cot^2 A)^2} = \sin A \cos A$

L.H.S

$$= \frac{\tan A}{(\sec^2 A)^2} + \frac{\cot A}{(\operatorname{cosec}^2 A)^2}$$

$$= \frac{\frac{s}{\cancel{c}}}{\frac{1}{c^4}} + \frac{\frac{c}{\cancel{s}}}{\frac{1}{s^4}}$$

$$= sc^3 + cs^3$$

$$= sc(c^2+s^2) = \boxed{sc}$$

#Q. Show that :

$$\frac{1+\tan A}{2\sin A}+\frac{1+\cot A}{2\cos A}=\operatorname{cosec} A+\sec A$$

$$= \frac{1+\frac{S}{C}}{2S} + \frac{1+\frac{C}{S}}{2C}$$

$$= \frac{\frac{C+S}{C}}{\frac{2S}{1}} + \frac{\frac{S+C}{S}}{\frac{2C}{1}}$$

$$= \frac{C+S}{2SC} + \frac{S+C}{2CS}$$

$$= \frac{C+S+S+C}{2SC}$$

$$= \frac{2C+2S}{2SC}$$

$$= \frac{\cancel{2}(C+S)}{\cancel{2}SC}$$

$$\frac{C+S}{CS} = \operatorname{cosec} A + \sec A$$

Proof:

$$\boxed{\sin^2\theta+\cos^2\theta=1}$$

$$=\left(\frac{P}{H}\right)^2+\left(\frac{B}{H}\right)^2$$

$$=\frac{P^2}{H^2}+\frac{B^2}{H^2}$$

$$=\frac{P^2+B^2}{H^2}$$

$$=\frac{H^2}{H^2}=1$$

$$1+\tan^2\theta=\sec^2\theta.$$

$$1+\left(\frac{P}{B}\right)^2=\left(\frac{H}{B}\right)^2$$

$$1+\frac{P^2}{B^2}=\frac{H^2}{B^2}$$

$$\frac{B^2+P^2}{B^2}=\frac{H^2}{B^2}$$

$$\boxed{\frac{H^2}{B^2}=\frac{H^2}{B^2}}$$

2nd proof

$$\boxed{\sin^2\theta + \cos^2\theta = 1}$$

$\cos^2\theta$

$$\frac{\sin^2\theta + \cos^2\theta}{\cos^2\theta} = \frac{1}{\cos^2\theta}$$

$$\boxed{\tan^2\theta + 1 = \sec^2\theta}$$

$\sin^2\theta$

$$\frac{\sin^2\theta + \cos^2\theta}{\sin^2\theta} = \frac{1}{\sin^2\theta}$$

$$\boxed{1 + \cot^2\theta = \operatorname{cosec}^2\theta}$$

#Q. If $\operatorname{cosec}\theta = 2x$ and $\cot\theta = \frac{2}{x}$, find the value of $\boxed{2\left(x^2 - \frac{1}{x^2}\right)}$.

$\operatorname{cosec}\theta = 2x$ — (1)

$\cot\theta = \frac{2}{x}$ — (2)

Squaring both and subtracting,

$$\operatorname{cosec}^2\theta - \cot^2\theta = 4x^2 - \frac{4}{x^2}$$

$$1 = 4\left[x^2 - \frac{1}{x^2}\right]$$

Ans

$$\boxed{\frac{1}{2} = 2\left[x^2 - \frac{1}{x^2}\right]}$$

#Q. If $1 + \sin^2\theta = 3 \sin\theta \cos\theta$, prove that $\tan\theta = 1$ or $1/2$.

$$\frac{1+\sin^2\theta}{\cos^2\theta} = \frac{3\sin\theta\cos\theta}{\cos^2\theta}$$

$$\sec^2\theta + \tan^2\theta = 3\tan\theta$$

$$1+\tan^2\theta + \tan^2\theta = 3\tan\theta$$

$$\boxed{2\tan^2\theta - 3\tan\theta + 1 = 0}$$

let, $\tan\theta = x$

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

$P = 2,\ S = -3$

$-2, -1$

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

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

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

$$x = 1, \tfrac{1}{2}$$

$$\tan\theta = 1, \tfrac{1}{2}$$

#Q. Prove the following identity :

$$2(\sin^6\theta + \cos^6\theta) - 3\boxed{(\sin^4\theta + \cos^4\theta)} + 1 = 0$$

$= 2(1-3s^2c^2) - 3(1-2s^2c^2) + 1$

$= 2 - \cancel{6s^2c^2} - 3 + \cancel{6s^2c^2} + 1$

$= 2 - 3 + 1 = -1 + 1 = 0$ R.H.S

$= s^4 + c^4$

$= (s^2)^2 + (c^2)^2$

$= (s^2 + c^2)^2 - 2s^2c^2$

$= \boxed{1 - 2s^2c^2}$

$= s^6 + c^6$

$= (\overset{a}{s^2})^3 + (\overset{b}{c^2})^3$

$= (s^2 + c^2)(s^4 + c^4 - s^2c^2)$

$= s^4 + c^4 - s^2c^2$

$= 1 - 2s^2c^2 - s^2c^2$

$= \boxed{1 - 3s^2c^2}$

#Q. Prove that : $\sin^2\theta \cdot \tan\theta + \cos^2\theta \cdot \cot\theta + 2\sin\theta \cdot \cos\theta = \tan\theta + \cot\theta$.

$$= s^2 \cdot \frac{s}{c} + c^2 \cdot \frac{c}{s} + 2sc$$

$$= \frac{s^3}{c} + \frac{c^3}{s} + \frac{2sc}{1}$$

$$= \frac{\boxed{s^4 + c^4 + 2s^2c^2}}{cs}$$

$$= \frac{(s^2)^2 + (c^2)^2 + 2s^2c^2}{cs}$$

RHS bhi solve kar sakte ho

$$= \frac{(s^2+c^2)^2}{cs}$$

$$= \frac{1}{cs}$$

$$= \frac{s^2+c^2}{cs}$$

$$= \boxed{\tan\theta + \cot\theta}$$

#Q. Find the value of x for which

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$$(\sin A + \operatorname{cosec} A)^2 + (\cos A + \sec A)^2 = x + \tan^2 A + \cot^2 A$$

#Q. Evaluate the following :

2025

$$\frac{3\sin 30^\circ - 4\sin^3 30^\circ}{2\sin^2 50^\circ + 2\cos^2 50^\circ}$$

$2(\sin^2 50^\circ + \cos^2 50^\circ)$

$\downarrow$

1

#Q. Prove that $\frac{\cos A+\sin A-1}{\cos A-\sin A+1} = \operatorname{cosec} A - \cot A$

2025

special

#Q. If $\cot\theta + \cos\theta = p$ and $\cot\theta - \cos\theta = q$, prove that $p^2 - q^2 = 4\sqrt{pq}$.

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#Q. If $a \sec\theta + b \tan\theta = m$ and $b \sec\theta + a \tan\theta = n$, prove that $\boxed{a^2 + n^2 = b^2 + m^2}$

2025

$a^2 - b^2 = m^2 - n^2$

#Q. Use the identity : $\sin^2 A + \cos^2 A = 1$ to prove that $\boxed{\tan^2 A + 1 = \sec^2 A}$.

Hence, find the value of $\tan A$, when $\sec A = \frac{5}{3}$, where A is an acute angle.

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#Q. Prove that :

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$$\frac{\cos\theta - 2\cos^3\theta}{\sin\theta - 2\sin^3\theta} + \cot\theta = 0$$

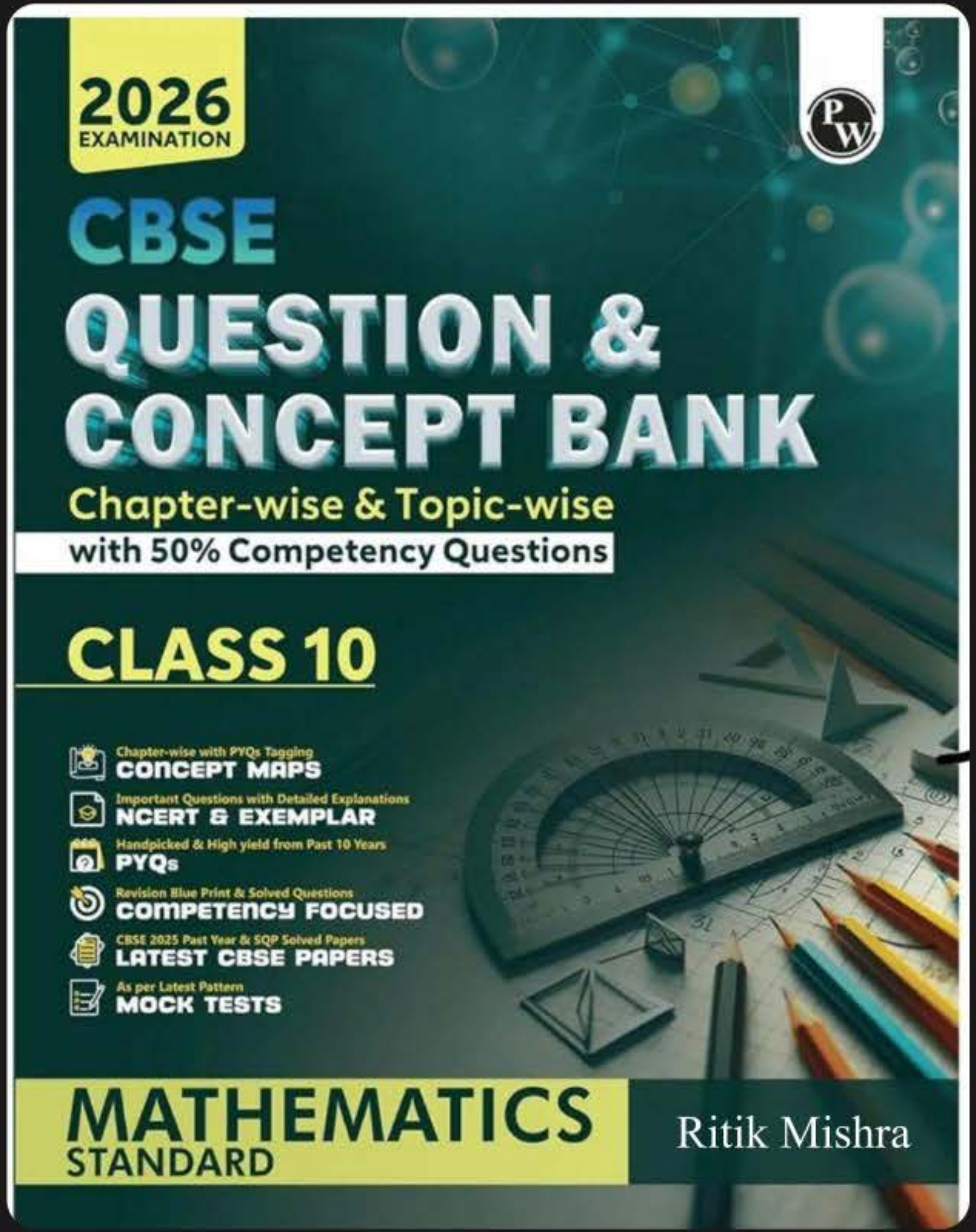
#Q. If $\sin\theta + \cos\theta = x$, prove that :

2025

$$\sin^4\theta + \cos^4\theta = \frac{2 - (x^2 - 1)^2}{2}$$

#Q. If $\sin\theta + \cos\theta = x$, prove that $\sin^6\theta + \cos^6\theta = \dfrac{4-3\left(x^2-1\right)^2}{4}$.

#GPU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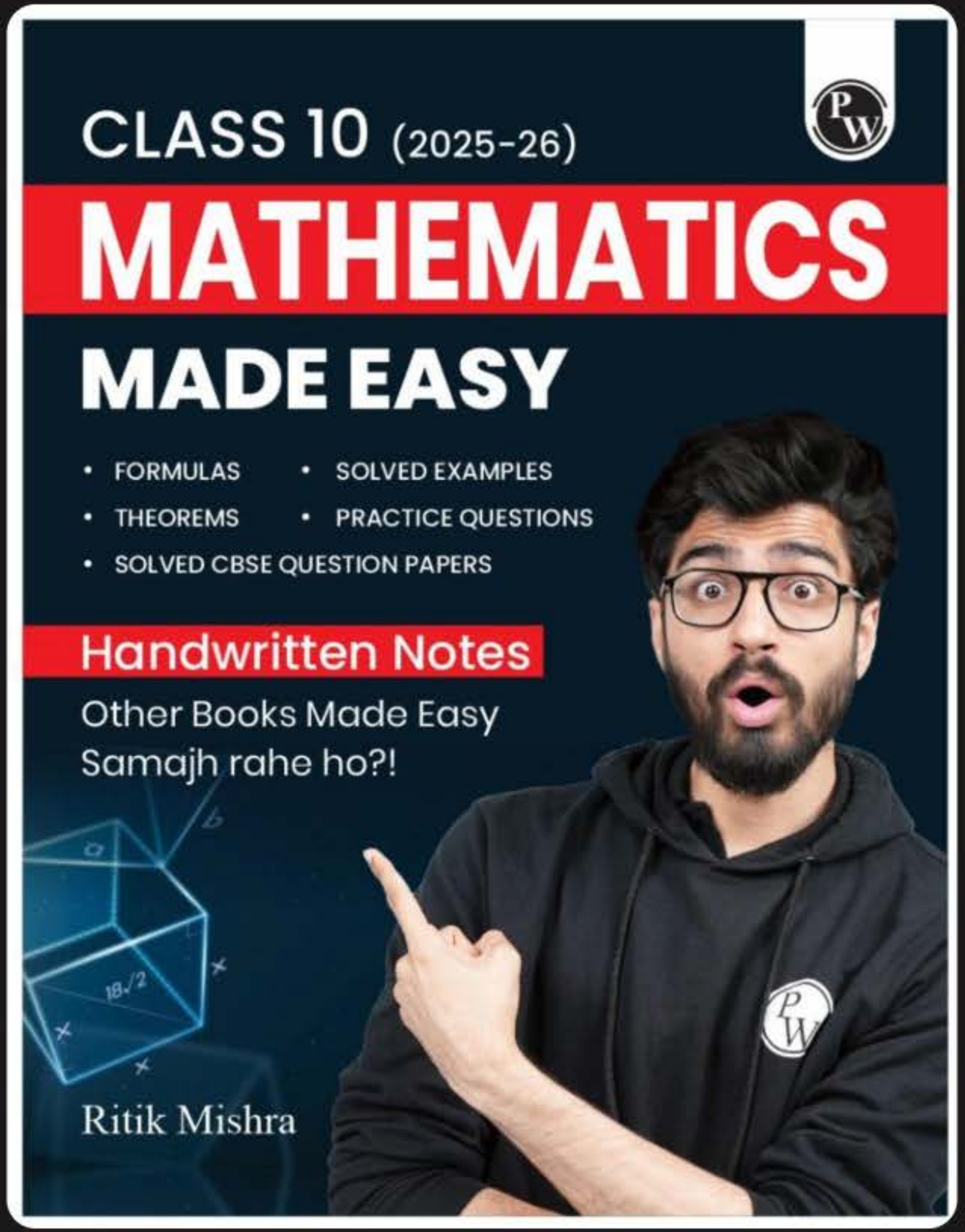

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