
UDAAN
2026
Trigonometry
MATHS
LECTURE-8
BY-RITIK SIR

Topics *to be covered*

A Questions - Trigonometric Identities (Part - 04)

9 lectures

DPPs

Practice sheet.

Question Bank

#Q. Prove the following identity :

$$\cot^2 A\left(\frac{\sec A - 1}{1 + \sin A}\right) + \sec^2 A\left(\frac{\sin A - 1}{1 + \sec A}\right) = 0$$

L.H.S

$$= \frac{\cot^2 A(\sec^2 A - 1) - \sec^2 A(1 - \sin^2 A)}{(1+\sin A)(\sec A + 1)}$$

$$= \frac{\cot^2 A \times \tan^2 A - \sec^2 A \times \cos^2 A}{D}$$

$$= \frac{\frac{1}{\cancel{\tan^2 A}} \times \cancel{\tan^2 A} - \frac{1}{\cancel{\cos^2 A}} \times \cancel{\cos^2 A}}{D}$$

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

$$= \frac{0}{D} = \boxed{0}$$

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

L.H.S

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

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

$$= (c+s)\left[\frac{s}{c} + \frac{c}{s}\right]$$

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

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

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

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

$$= \frac{1}{s} + \frac{1}{c}$$

$$= \boxed{\mathrm{cosec}\theta + \sec\theta}$$

Concept

$$\sec^2\theta - \tan^2\theta = 1$$

$$\boxed{(\sec\theta + \tan\theta)(\sec\theta - \tan\theta) = 1}$$

$$\boxed{\sec\theta + \tan\theta = \frac{1}{\sec\theta - \tan\theta}}$$

Prove!

Q $\dfrac{1}{\sec\theta + \tan\theta} = \sec\theta - \tan\theta.$

$$= \frac{1}{\sec\theta + \tan\theta} \times \frac{\sec\theta - \tan\theta}{\sec\theta - \tan\theta}$$

$$= \frac{\sec\theta - \tan\theta}{\sec^2\theta - \tan^2\theta} = \boxed{\sec\theta - \tan\theta}$$

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

$$\boxed{(\operatorname{cosec}\theta + \cot\theta)(\operatorname{cosec}\theta - \cot\theta) = 1}$$

$$\boxed{\operatorname{cosec}\theta + \cot\theta = \frac{1}{\operatorname{cosec}\theta - \cot\theta}}$$

Q $\sec\theta + \tan\theta = P.$

$\sec\theta - \tan\theta = ?$

$$\sec\theta - \tan\theta = \frac{1}{\sec\theta + \tan\theta} = \frac{1}{P}$$

#Q. If $\sec\theta + \tan\theta = p$, obtain the values of $\sec\theta$, $\tan\theta$ and $\sin\theta$ in terms of p.

$\sec\theta + \tan\theta = p \quad -(1)$

$\Rightarrow \sec\theta - \tan\theta = 1/p \quad -(2)$

(1) + (2)

$\sec\theta + \cancel{\tan\theta} = p$

$(+)\ \sec\theta - \cancel{\tan\theta} = 1/p$

$2\sec\theta = p + \frac{1}{p}$

$2\sec\theta = \frac{p^2+1}{p}$

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

(1) − (2)

$\cancel{\sec\theta} + \tan\theta = p$

$(-)\ \cancel{\sec\theta} - \tan\theta = 1/p$

$2\tan\theta = p - \frac{1}{p}$

$\boxed{\tan\theta = \frac{p^2-1}{2p}}$

$\sin\theta = \frac{\tan\theta}{\sec\theta}$

$\sin\theta = \frac{\frac{p^2-1}{\cancel{2p}}}{\frac{p^2+1}{\cancel{2p}}}$

$\boxed{\sin\theta = \frac{p^2-1}{p^2+1}}$

$$\frac{\tan\theta}{\sec\theta} = \frac{\frac{S}{\cancel{C}}}{\frac{1}{\cancel{C}}} = \sin\theta$$

$$\frac{\cot\theta}{\operatorname{cosec}\theta} = \frac{\frac{C}{\cancel{S}}}{\frac{1}{\cancel{S}}} = \cos\theta$$

#Q. If $\boxed{\operatorname{cosec}\theta + \cot\theta = p}$, then prove that $\boxed{\cos\theta = \frac{p^2-1}{p^2+1}}$

#GPL

$\operatorname{cosec}\theta + \cot\theta = p$ — (1)

$\operatorname{cosec}\theta - \cot\theta = 1/p$ — (2)

(1) + (2)

$\cos\theta = \frac{\cot\theta}{\operatorname{cosec}\theta} =$

$\operatorname{cosec}\theta = \frac{p^2+1}{2p}$

(1) − (2)

$\cot\theta = \frac{p^2-1}{2p}$

M.I

#Q. Prove the following identity :

$$\frac{1}{\text{cosecA} - \text{cotA}} - \frac{1}{\text{sinA}} = \frac{1}{\text{sinA}} - \frac{1}{\text{cosecA} + \text{cotA}}$$

Solve R.H.S $\rightarrow$ $\cot\theta$

L.H.S

$$= \frac{1}{\frac{1}{s} - \frac{c}{s}} - \frac{1}{s}$$

$$= \frac{1}{\frac{1-c}{s}} - \frac{1}{s}$$

$$= \frac{s}{1-c} - \frac{1}{s}$$

$$= \frac{s^2 - 1(1-c)}{(1-c)s}$$

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

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

$$= \frac{c - c^2}{(1-c)s}$$

$$= \frac{c\cancel{(1-c)}}{\cancel{(1-c)}s}$$

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

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

#Q. Prove the following identity :

M.II

$$\frac{1}{\text{cosecA} - \text{cotA}} - \frac{1}{\text{sinA}} = \frac{1}{\text{sinA}} - \frac{1}{\text{cosecA} + \text{cotA}}$$

L.H.S

$= \cancel{\text{cosecA}} + \ldots - \cancel{\text{cosecA}}$

$= \boxed{\cot A}$

R.H.S

$= (\text{cosecA}) - (\text{cosecA} - \cot A)$

$= \cancel{\text{cosecA}} - \cancel{\text{cosecA}} + \cot A$

$= \boxed{\cot A}$

$\therefore$ L.H.S = R.H.S

H.P

#Q. If $\sin\theta + \cos\theta = p$ and $\sec\theta + \operatorname{cosec}\theta = q$, show that $q(p^2 - 1) = 2p$.

L.H.S

$= q(p^2-1)$

$= (\sec\theta + \operatorname{cosec}\theta)\left[(\sin\theta+\cos\theta)^2 - 1\right]$

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

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

$= \left(\frac{s+c}{\cancel{c}\cancel{s}}\right)\left(2\cancel{s}\cancel{c}\right) = 2(s+c) = \boxed{2p}$ H.P

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

#Q. If a cot θ + b cosec θ = p and b cot θ + a cosec θ = q, then $p^2 - q^2$.

A $a^2 - b^2$

B $b^2 - a^2$

C $a^2 + b^2$

D $b - a$

$$= p^2 - q^2$$
$$= (a\cot\theta + b\operatorname{cosec}\theta)^2 - (b\cot\theta + a\operatorname{cosec}\theta)^2$$
$$= a^2\cot^2\theta + b^2\operatorname{cosec}^2\theta \cancel{\mp 2ab\cot\theta\operatorname{cosec}\theta} - b^2\cot^2\theta - a^2\operatorname{cosec}^2\theta \cancel{- 2ab\cot\theta\operatorname{cosec}\theta})$$
$$= \cot^2\theta(a^2 - b^2) + \operatorname{cosec}^2\theta(b^2 - a^2)$$
$$= \cot^2\theta(a^2 - b^2) - \operatorname{cosec}^2\theta(a^2 - b^2)$$
$$= a^2 - b^2(\cot^2\theta - \operatorname{cosec}^2\theta)$$
$$= a^2 - b^2(-1) = \boxed{-a^2 + b^2}$$

#QI

#Q. If $\boxed{\tan\theta + \sin\theta = m}$, $\boxed{\tan\theta - \sin\theta = n}$, show that $\boxed{m^2 - n^2 = 4\sqrt{mn}.}$

L.H.S

$= m^2 - n^2$

$= (\tan\theta + \sin\theta)^2 - (\tan\theta - \sin\theta)^2$

$= (t^2 + s^2 + 2ts) - (t^2 + s^2 - 2ts)$

$= \cancel{t^2} + \cancel{s^2} + 2ts - \cancel{t^2} - \cancel{s^2} + 2ts$

$= \boxed{4\tan\theta\sin\theta}$

R.H.S

$= 4\sqrt{mn}$

$= 4\sqrt{(t+s)(t-s)}$

$= 4\sqrt{t^2 - s^2}$

$= 4\sqrt{\frac{s^2}{c^2} - s^2}$

$= 4\sqrt{s^2\left(\frac{1}{c^2} - 1\right)}$

$= 4\sqrt{\frac{s^2(1-c^2)}{c^2}}$

$= 4\sqrt{\frac{s^2 \cdot s^2}{c^2}}$

$= 4\sqrt{\left(\frac{s \cdot s}{c}\right)^2}$

$= 4 \cdot \frac{s}{c} \cdot s$

$= \boxed{4\tan\theta\sin\theta}$

#Q. If $a \cos\theta + b \sin\theta = m$ and $a \sin\theta - b \cos\theta = n$, prove that $a^2 + b^2 = m^2 + n^2$.

#GPK

#Q. If $x = a\cos\theta$ and $y = b\sin\theta$, then $b^2x^2 + a^2y^2 =$

$$= b^2x^2 + a^2y^2$$

(A) a^2b^2

$$= b^2(a^2\cos^2\theta) + a^2(b^2\sin^2\theta)$$

(B) ab

$$= b^2a^2\cos^2\theta + a^2b^2\sin^2\theta$$

(C) a^4b^4

$$= b^2a^2[\cos^2\theta + \sin^2\theta] \quad 1$$

(D) $a^2 + b^2$

$$= b^2a^2$$

#Q. If $\boxed{\operatorname{cosec}\theta - \sin\theta = m}$ and $\boxed{\sec\theta - \cos\theta = n,}$ prove that $(m^2n)^{2/3} + (\overset{2}{n}m^{\cancel{3}})^{2/3} = 1.$

$m = \operatorname{cosec}\theta - \sin\theta$

$m = \dfrac{1}{\sin\theta} - \sin\theta$

$m = \dfrac{1 - s^2}{s}$

$\boxed{m = \dfrac{c^2}{s}}$

$n = \sec\theta - \cos\theta$

$n = \dfrac{1}{c} - c$

$n = \dfrac{1 - c^2}{c}$

$\boxed{n = \dfrac{s^2}{c}}$

L.H.S

$= (m^2n)^{2/3} + (n^2m)^{2/3}$

$= \left[\left(\dfrac{c^2}{s}\right)^2 \cdot \dfrac{s^2}{c}\right]^{2/3} + \left[\left(\dfrac{s^2}{c}\right)^2 \cdot \dfrac{c^2}{s}\right]^{2/3}$

$= \left[\dfrac{c^4}{\cancel{s^2}} \cdot \dfrac{\cancel{s^2}}{\cancel{c}}\right]^{2/3} + \left[\dfrac{s^4}{\cancel{c^2}} \cdot \dfrac{\cancel{c^2}}{\cancel{s}}\right]^{2/3}$

$= (c^3)^{2/3} + (s^3)^{2/3}$

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

HOT

#Q. If $\boxed{a\cos\theta - b\sin\theta = c}$, prove that $\boxed{a\sin\theta + b\cos\theta = \sqrt{a^2 + b^2 - c^2}}$

$$a\cos\theta - b\sin\theta = c$$

Squaring both sides,

$$(a\cos\theta - b\sin\theta)^2 = c^2$$

$$a^2\cos^2\theta + b^2\sin^2\theta - 2ab\cos\theta\sin\theta = c^2$$

$$a^2(1-\sin^2\theta) + b^2(1-\cos^2\theta) - 2ab\cos\theta\sin\theta = c^2$$

$$\underline{a^2} - a^2\sin^2\theta + \underline{b^2} - b^2\cos^2\theta - 2ab\cos\theta\sin\theta = \underline{c^2}$$

$$a^2 + b^2 - c^2 = a^2\sin^2\theta + b^2\cos^2\theta + 2ab\sin\theta\cos\theta$$

$$a^2 + b^2 - c^2 = (a\sin\theta + b\cos\theta)^2$$

$$\boxed{\sqrt{a^2 + b^2 - c^2} = a\sin\theta + b\cos\theta}$$

#QI ⇒ Tough Question

#Q. If $\cos\theta + \sin\theta = \sqrt{2}\cos\theta$, show that $\cos\theta - \sin\theta = \sqrt{2}\sin\theta$

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

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

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

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

add $\sin^2\theta$ both sides,

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

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

$$\boxed{\sqrt{2}\sin\theta = \cos\theta - \sin\theta}$$

H.P

#QT

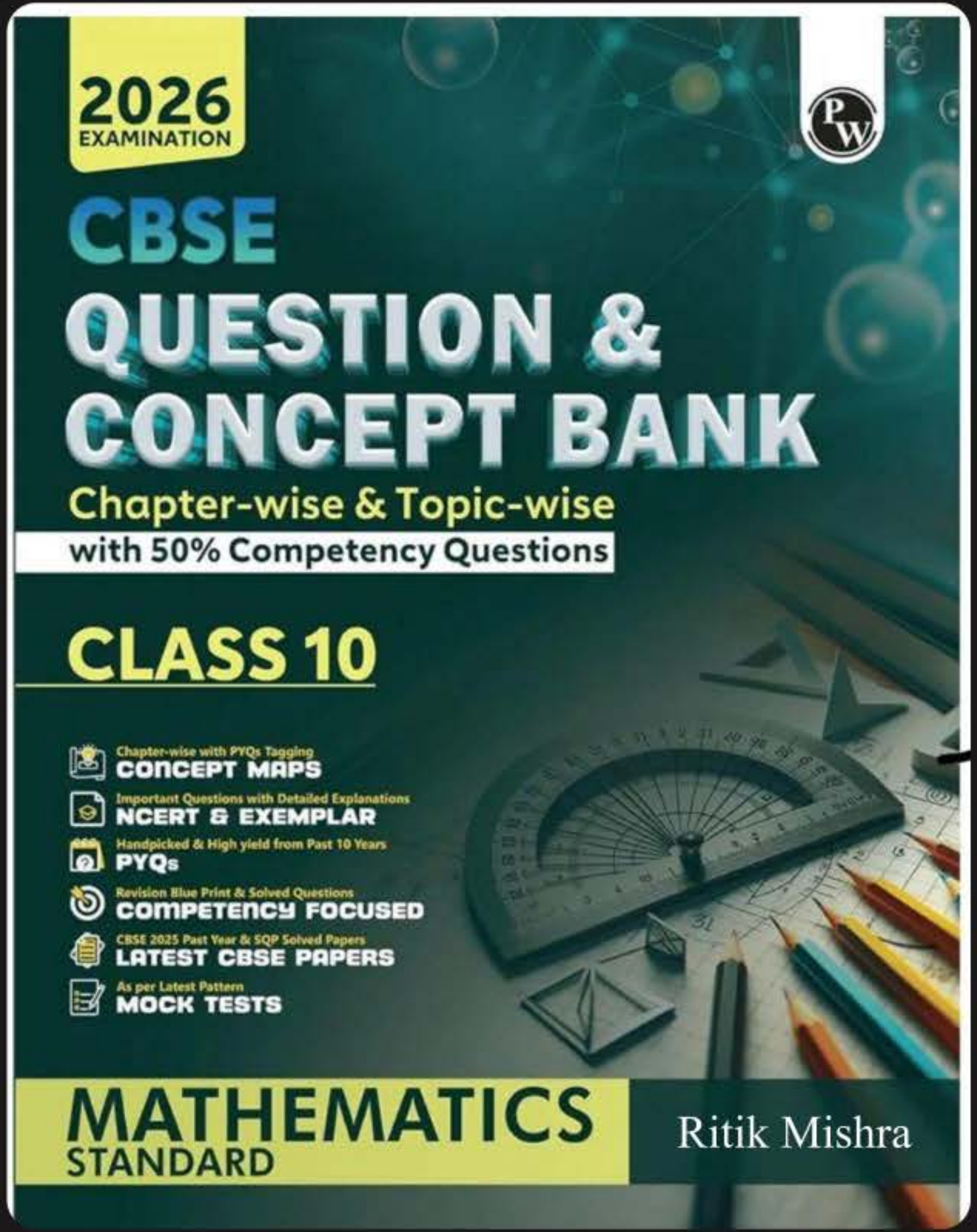
#Q. If $\operatorname{cosec}\theta - \cot\theta = \sqrt{2}\cot\theta$, then prove that $\operatorname{cosec}\theta + \cot\theta = \sqrt{2}\operatorname{cosec}\theta$.

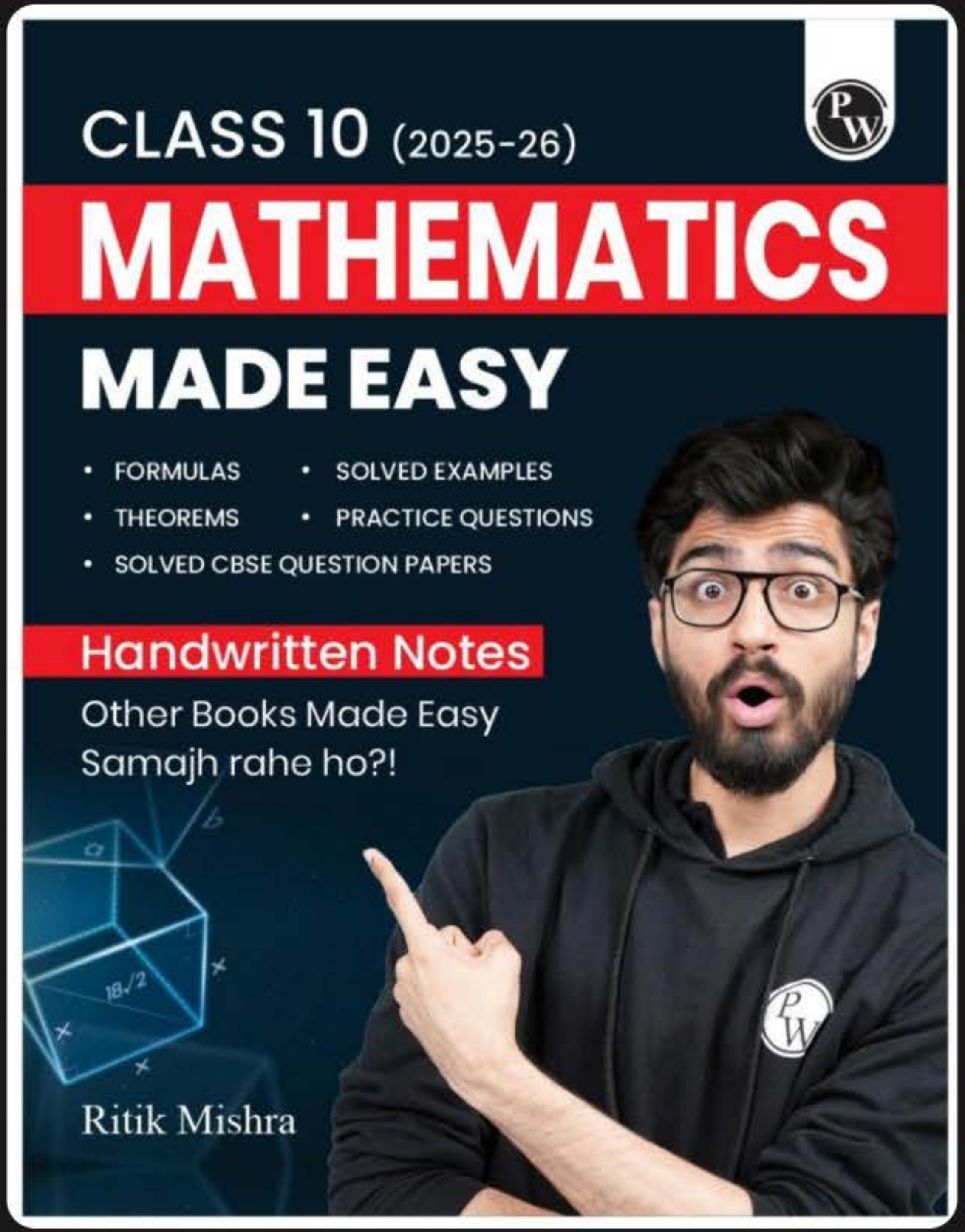
#S²BD
#GPU

lecture key Questions dubara repeat.

DPP's

Question Bank.

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