UDAAN

2026

Trigonometry

MATHS | LECTURE-6

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Topics *to be covered*

A Trigonometric Identities (Part - 02)

Reciprocal identity

$\sin\theta \longleftrightarrow \operatorname{cosec}\theta$

$\cos\theta \longleftrightarrow \sec\theta$

$\tan\theta \longleftrightarrow \cot\theta$

Quotient identity

$\tan\theta = \dfrac{\sin\theta}{\cos\theta}$ $\cot\theta = \dfrac{\cos\theta}{\sin\theta}$

'1' or Square wali

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

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

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

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

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

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

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

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

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

#Q. Prove the following identity :

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

L.H.S

$$\frac{\frac{\sin\theta}{\cos\theta} + \sin\theta}{\frac{\sin\theta}{\cos\theta} - \sin\theta}$$

$$\frac{\cancel{\sin\theta}\left[\frac{1}{\cos\theta} + 1\right]}{\sin\theta\left[\frac{1}{\cos\theta} - 1\right]}$$

$$\boxed{\frac{\sec\theta + 1}{\sec\theta - 1}} = \text{R.H.S}$$

H.P

#Q. Prove the following identity :

$$\frac{\sin\theta}{1+\cos\theta}+\frac{1+\cos\theta}{\sin\theta}=2\,\text{cosec}\,\theta$$

$$\text{L.H.S} = \frac{\sin^2\theta+(1+\cos\theta)^2}{(1+\cos\theta)\sin\theta}$$

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

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

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

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

$$= \frac{2}{\sin\theta}$$

$$= \boxed{2\,\text{cosec}\,\theta} = \text{R.H.S}$$

H.P

#Q. Prove the following identity :

$$\frac{\sin A - \sin B}{\cos A + \cos B} + \frac{\cos A - \cos B}{\sin A + \sin B} = 0$$

L.H.S

$$= \frac{(\sin A + \sin B)(\sin A - \sin B) + (\cos A - \cos B)(\cos A + \cos B)}{(\cos A + \cos B)(\sin A + \sin B)}$$

$$= \frac{\sin^2 A - \sin^2 B + \cos^2 A - \cos^2 B}{D}$$

$$= \frac{\cancel{1} - \cancel{\cos^2 A} - \cancel{1} + \cancel{\cos^2 B} + \cancel{\cos^2 A} - \cancel{\cos^2 B}}{D}$$

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

$$= \boxed{0} = \text{R.H.S}$$

H.P

#Q. Prove the following identity :

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

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

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

$$=\boxed{\frac{2}{S^2-C^2}}=\frac{2}{S^2-(1-S^2)}=\frac{2}{S^2-1+S^2}=\boxed{\frac{2}{2S^2-1}}=\frac{2}{2(1-C^2)-1}=\frac{2}{2-2C^2-1}=\boxed{\frac{2}{1-2C^2}}$$

#Q. Prove the following identity : $\operatorname{cosec}^2\theta + \sec^2\theta = \operatorname{cosec}^2\theta \sec^2\theta$

L.H.S

$$= \operatorname{cosec}^2\theta + \sec^2\theta$$

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

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

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

$$= \boxed{\operatorname{cosec}^2\theta \times \sec^2\theta} = \text{R.H.S}$$

H.P

#Q. Prove the following identity : (cosec θ – sin θ) (sec θ – cos θ) (tan θ + cot θ) = 1

L.H.S

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

$$= \left(\frac{1 - S^2}{S}\right)\left(\frac{1 - C^2}{C}\right)\left(\frac{S^2 + C^2}{CS}\right)$$

$$= \frac{C^2}{S} \times \frac{S^2}{C} \times \frac{1}{CS} = \frac{\cancel{C^2}\cancel{S^2}}{\cancel{S^2}\cancel{C^2}} = \boxed{1} = \text{R.H.S}$$

#Q. Prove the following identity : $(1 + \cot\theta - \operatorname{cosec}\theta)(1 + \tan\theta + \sec\theta) = 2$

L.H.S

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

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

$$= \frac{sc + s^2 + \cancel{s} + c^2 + cs + \cancel{c} - \cancel{c} - \cancel{s} - 1}{sc}$$

$$= \frac{2sc + \cancel{1} - \cancel{1}}{sc} = \frac{2\cancel{s}\cancel{c}}{\cancel{s}\cancel{c}} = \boxed{2}$$

#Q. Prove the following identity :

$$\frac{\sin\theta - 2\sin^3\theta}{2\cos^3\theta - \cos\theta} = \tan\theta$$

L.H.S

$$= \frac{\sin\theta\left[1-2\sin^2\theta\right]}{\cos\theta\left[2\cos^2\theta-1\right]}$$

$$= \tan\theta\left[\frac{1-2(1-\cos^2\theta)}{2\cos^2\theta-1}\right]$$

$$= \tan\theta\left[\frac{1-2+2\cos^2\theta}{2\cos^2\theta-1}\right]$$

$$= \tan\theta\left[\frac{\cancel{2\cos^2\theta-1}}{\cancel{2\cos^2\theta-1}}\right]$$

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

#Q. Prove the following identity :

$$\frac{\tan\theta - \cot\theta}{\sin\theta\cos\theta} = \sec^2\theta - \csc^2\theta = \tan^2\theta - \cot^2\theta$$

L.H.S

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

$$= \frac{\frac{s^2-c^2}{cs}}{\frac{sc}{1}}$$

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

$$= \frac{\cancel{s^2}}{\cancel{s^2}c^2} - \frac{\cancel{c^2}}{s^2\cancel{c^2}}$$

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

$$= \boxed{\sec^2\theta - \csc^2\theta}$$

$$= (1+\tan^2\theta) - (1+\cot^2\theta)$$

$$= \cancel{1} + \tan^2\theta - \cancel{1} - \cot^2\theta$$

$$= \boxed{\tan^2\theta - \cot^2\theta}$$

#Q. Prove the following identity : $\sec^4\theta - \sec^2\theta = \tan^4\theta + \tan^2\theta$

L.H.S

$= (\sec^2\theta)^2 - (\sec^2\theta)$

$= (1+\tan^2\theta)^2 - (1+\tan^2\theta)$

$= \cancel{1} + \tan^4\theta + 2\tan^2\theta - \cancel{1} - \tan^2\theta$

$= \boxed{\tan^4\theta + \tan^2\theta}$

#Q. Prove the following identity :

$$2\sec^2\theta - \sec^4\theta - 2\,\mathrm{cosec}^2\theta + \mathrm{cosec}^4\theta = \cot^4\theta - \tan^4\theta$$

$$= 2(1+\tan^2\theta) - (1+\tan^2\theta)^2 - 2(1+\cot^2\theta) + (1+\cot^2\theta)^2$$

$$= 2 + 2\tan^2\theta - (1 + \tan^4\theta + 2\tan^2\theta) - 2 - 2\cot^2\theta + (1 + \cot^4\theta + 2\cot^2\theta)$$

$$= \cancel{2} + \cancel{2\tan^2\theta} - \cancel{1} - \tan^4\theta - \cancel{2\tan^2\theta} - \cancel{2} - \cancel{2\cot^2\theta} + \cancel{1} + \cot^4\theta + \cancel{2\cot^2\theta}$$

$$= \boxed{\cot^4\theta - \tan^4\theta}$$

#Q. Prove the following identity :

$(\sin\theta + \operatorname{cosec}\theta)^2 + (\cos\theta + \sec\theta)^2 = 7 + \tan^2\theta + \cot^2\theta$

L.H.S

$= \sin^2\theta + \operatorname{cosec}^2\theta + 2\sin\theta\operatorname{cosec}\theta + \cos^2\theta + \sec^2\theta + 2\cos\theta\sec\theta$

$= 1 + 1 + \cot^2\theta + 2\cancel{\sin\theta} \times \frac{1}{\cancel{\sin\theta}} + 1 + \tan^2\theta + 2\cancel{\cos\theta} \times \frac{1}{\cancel{\cos\theta}}$

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

$= \boxed{7 + \cot^2\theta + \tan^2\theta}$

#Q. Prove the following identity :

$(\sin\theta + \sec\theta)^2 + (\cos\theta + \operatorname{cosec}\theta)^2 = (1 + \sec\theta \operatorname{cosec}\theta)^2$

L.H.S

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

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

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

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

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

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

$= \boxed{(1 + \sec\theta \operatorname{cosec}\theta)^2}$

#Q. Prove the following identity :

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

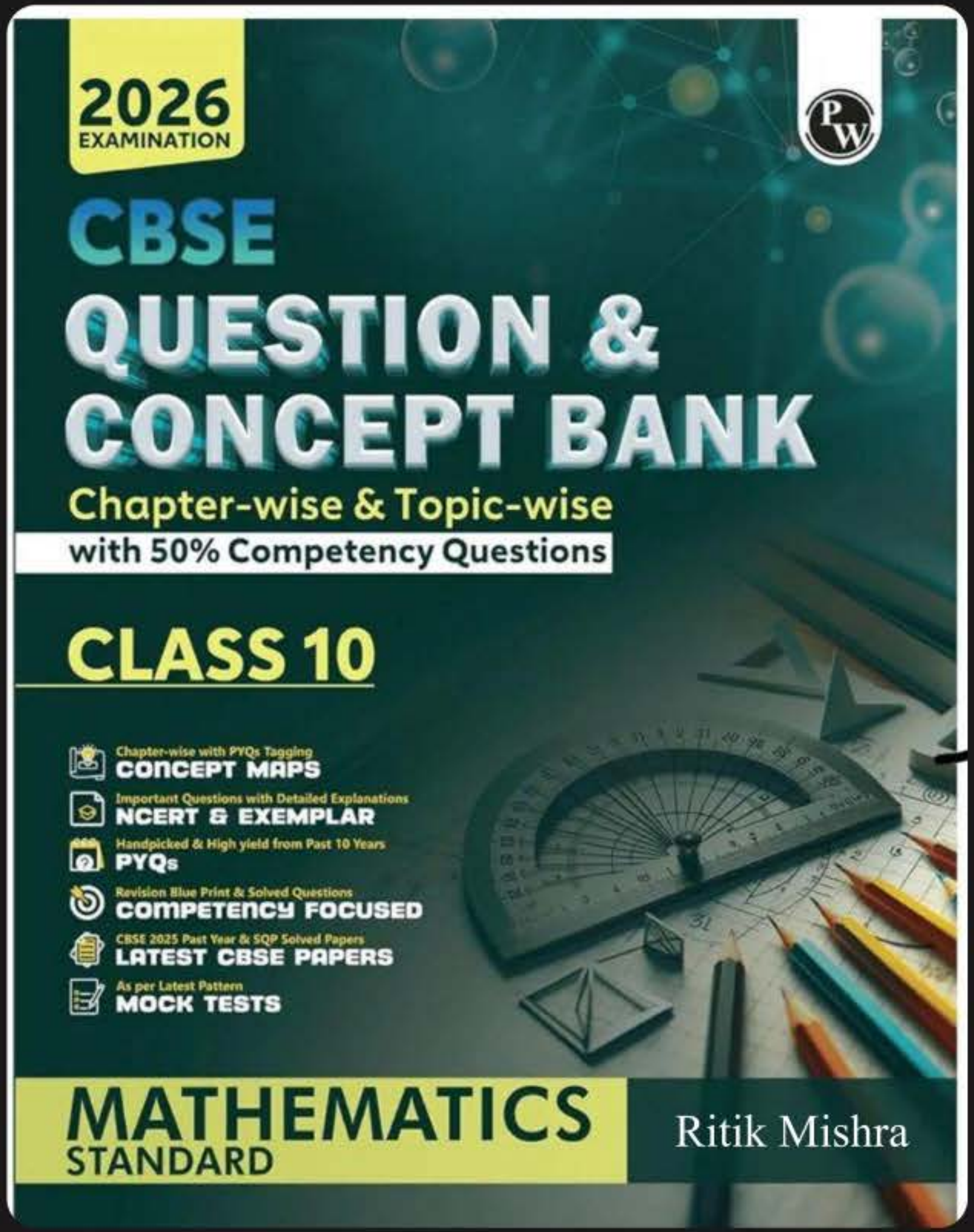
#S²BD

#GPK

#Q. Prove the following identity :

#GPK

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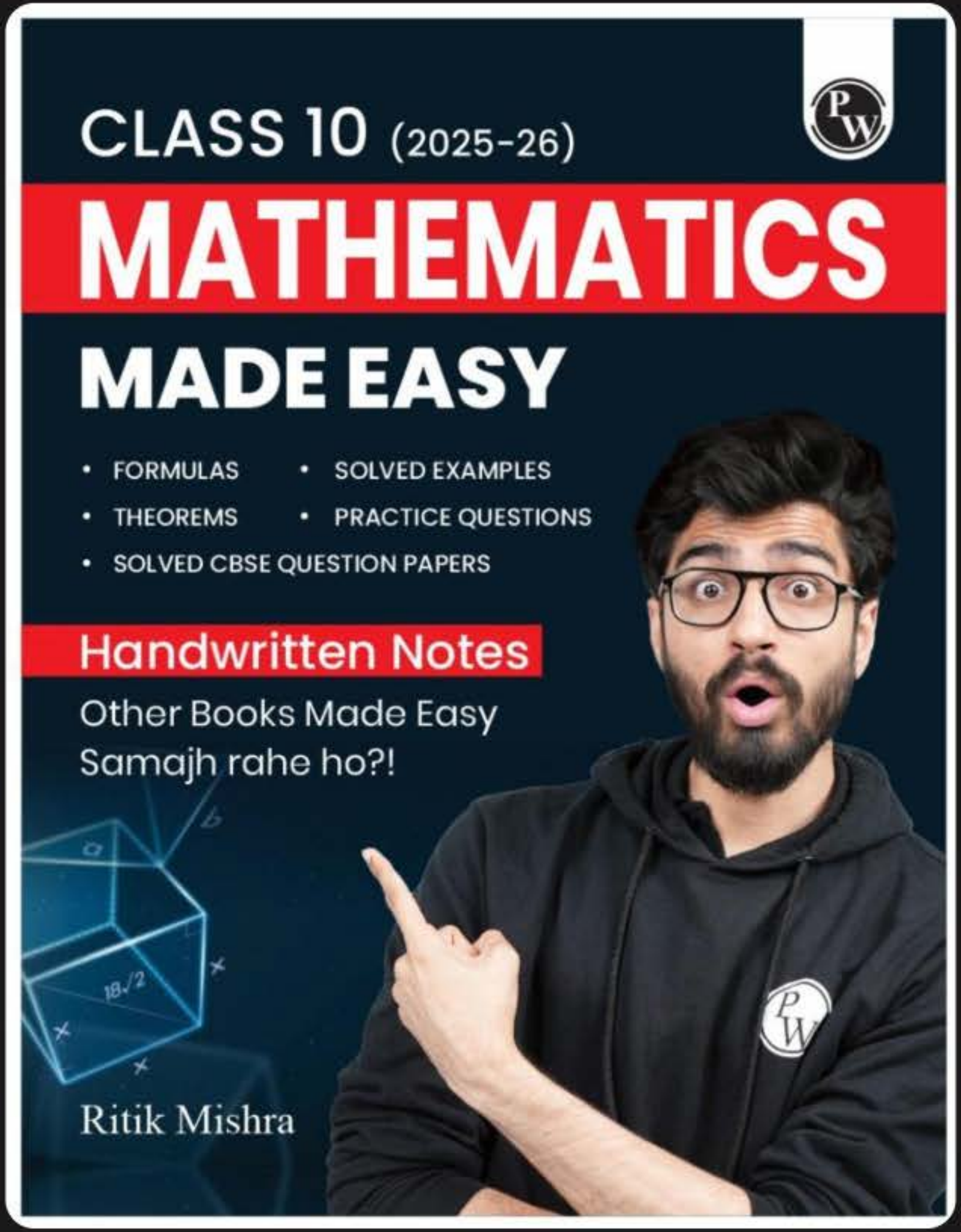
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