UDAAN

2025

Trigonometry

Mathematics | Lecture - 04

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Topics

to be covered

1. Homework Discussion
2. Trigonometric Identities

(Part-1)


WORK HARD
DREAM BIG
NEVER GIVE UP !!

Topic : T Ratios for some specific angles

#Q. If A and B are acute angles such that $\tan A = \frac{1}{2}$, $\tan B = \frac{1}{3}$ and $\tan(A+B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}$, find A + B.

$$\tan(A+B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}$$

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

$$\tan(A+B) = \frac{\frac{3+2}{6}}{\frac{1}{1} - \frac{1}{6}}$$

$$= \frac{\frac{5}{6}}{\frac{5}{6}}$$

$$\tan(A+B) = 1$$

$$\tan(A+B) = \tan(45^\circ)$$

$$\therefore A+B = 45^\circ$$

Topic : T Rations for some specific angles

#Q. If $\tan^2 45° - \cos^2 30° = x \sin 45° \cos 45°$, then x =

A 2

B −2

C −1/2

D 1/2

$$(1)^2 - \left(\frac{\sqrt{3}}{2}\right)^2 = x \times \frac{1}{\sqrt{2}} \times \frac{1}{\sqrt{2}}$$

$$\frac{1}{1} - \frac{3}{4} = x \times \frac{1}{2}$$

$$\frac{4-3}{4} = \frac{x}{2}$$

$$\frac{1}{4} = \frac{x}{2}$$

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

Topic : T Rations for some specific angles

#Q. If $\sqrt{3}\tan\theta = 1$, then find the value of $\sin^2\theta - \cos^2\theta$.

M.I

$\tan\theta = \frac{1}{\sqrt{3}}$

$= \frac{P}{B}$

$P = 1x$

$B = \sqrt{3}x$

M.II

$\tan\theta = \tan 30^\circ$

on comparison

$\theta = 30^\circ$

$= \sin^2 30^\circ - \cos^2 30^\circ$

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

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

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

$= -\frac{2}{4} = -\frac{1}{2}$

Topic : T Rations for some specific angles

#Q. If $\sin\theta - \cos\theta = 0$, then the value of $(\sin^4\theta + \cos^4\theta)$ is

(A) 1

(B) 3/4

(C) 1/2 ✓

(D) 1/4

$\sin\theta = \cos\theta \times 1$

$\frac{\sin\theta}{\cos\theta} = 1$

$\tan\theta = 1$

$\tan\theta = \tan 45^\circ$

$\therefore \theta = 45^\circ$

$\sqrt{2}\times\sqrt{2}$ $\sqrt{2}\times\sqrt{2}$

$= 2$

$= \sin^4 45^\circ + \cos^4 45^\circ$

$= \left(\frac{1}{\sqrt{2}}\right)^4 + \left(\frac{1}{\sqrt{2}}\right)^4$

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

$= \frac{2}{4} = \frac{1}{2}$

Hint : Find θ

Topic : T Rations for some specific angles

#Q. In a ΔABC, if $\angle B = 90^\circ$, BC = 5 cm, AC – AB = 1 cm. Then the value of $\frac{1+\sin C}{1+\cos C}$ is

(A) $\frac{18}{25}$

(B) $\frac{36}{31}$

(C) $\frac{25}{18}$

(D) $\frac{31}{36}$

$$\sin C = \frac{P}{H} = \frac{AB}{AC}$$

$$\cos C = \frac{B}{H} = \frac{BC}{AC}$$

$\sin C = \frac{12}{13}$

$\cos C = \frac{5}{13}$

x

AB = x

AC = 1 + x

$H^2 = P^2 + B^2$

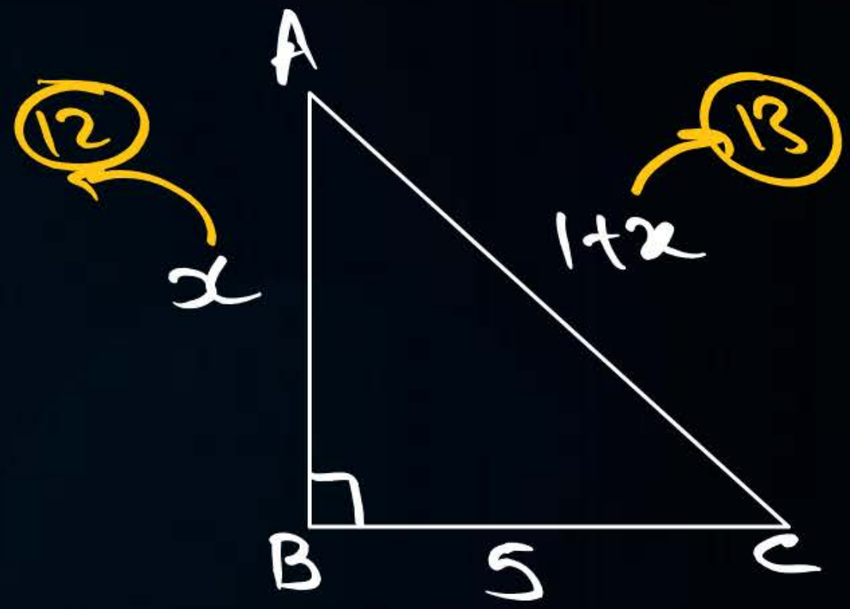
$(1+x)^2 = (x)^2 + (5)^2$

$1 + x^2 + 2x = x^2 + 25$

$1 + 2x = 25$

$2x = 24$

$x = 12$



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

$$= 1 + \frac{12}{13}$$

$$= \frac{\frac{25}{13}}{\frac{18}{13}}$$

$$= \frac{25}{18}$$

$$= 1 + \frac{5}{13}$$

$$= \frac{13+5}{13}$$

$$= \frac{18}{13}$$

Topic : T Rations for some specific angles

#Q. In an acute angled triangle ABC, if $\sin(A + B - C) = 1/2$ and $\cos(B + C - A) = \frac{1}{\sqrt{2}}$. Then measure of angle B is

A $37\frac{1}{2}°$

B $45°$

C $75°$

D $62.5°$

$\sin(A+B-C) = \frac{1}{2}$ $\quad$ $\cos(B+C-A) = \frac{1}{\sqrt{2}}$

$\sin(A+B-C) = \sin 30°$ $\quad$ $\cos(B+C-A) = \cos 45°$

"on comp" $\quad$ "on comp"

$A+B-C = 30°$ (1) $\quad$ $B+C-A = 45°$ (2)

① + ②

$(A+B-C)+(B+C-A)=30+45$

$A+B-C+B+C-A=75$

$2B=75$

$B=\frac{75}{2}$

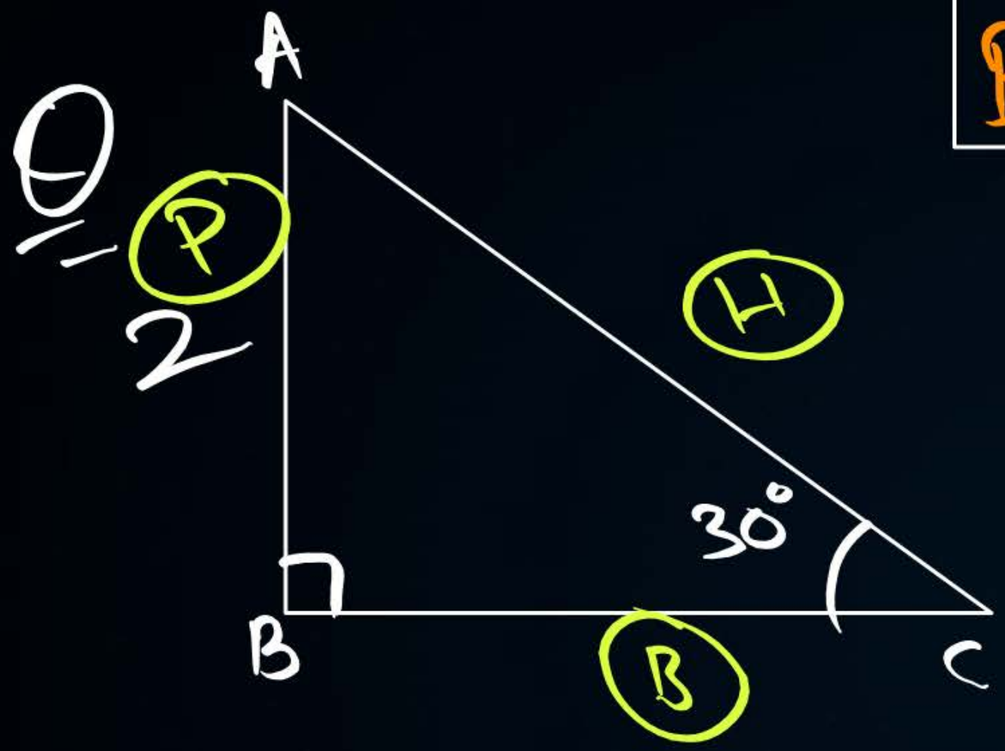
$B=37\frac{1}{2}°$

$37\frac{1}{2}$

$2\overline{)75}$

6

15



$BC = ?$

$\tan 30^\circ = \frac{P}{B} = \frac{AB}{BC}$

$\frac{1}{\sqrt{3}} = \frac{2}{BC}$

$BC = 2\sqrt{3}$

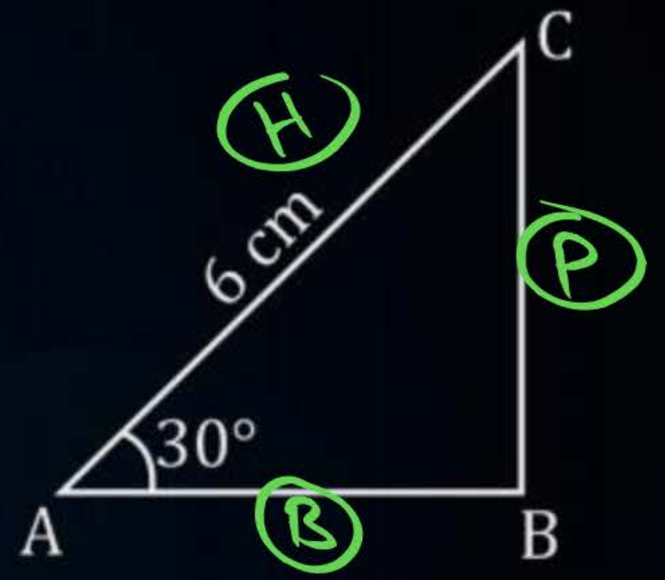
Q $AC = ?$

$\sin 30^\circ = \frac{AB}{AC}$ $\Rightarrow \frac{1}{2} = \frac{2}{AC}$

$AC = 4$

Topic : T Rations for some specific angles

#Q. In figure, lengths of sides BC and AB are respectively



(A) 12 cm, $3\sqrt{3}$ cm

(B) 3 cm, $3\sqrt{3}$ cm

(C) 12 cm, $6\sqrt{3}$ cm

(D) 18 cm, $9\sqrt{3}$ cm

$\sin 30 = \frac{P}{H}$ $\cos 30 = \frac{B}{H}$

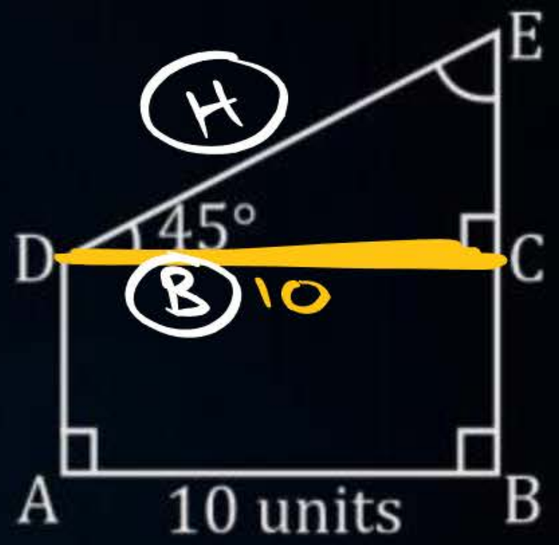
$\sin 30 = \frac{BC}{AC}$ $\frac{\sqrt{3}}{2} = \frac{AB}{6}$

$\frac{1}{2} = \frac{BC}{6}$ $\frac{3\sqrt{3}}{2} = AB$

$3\text{cm} = BC$ $3\sqrt{3}\ \text{cm} = AB$

Topic : T Rations for some specific angles

#Q. In figure, the value of DE is



(A) $5\sqrt{2}$ units

(B) 10 units

(C) $10\sqrt{2}$ units

(D) $15\sqrt{2}$ units

$\frac{B}{H} = \cos 45^\circ$

$\frac{DC}{DE} = \cos 45^\circ$

$\frac{10}{DE} = \frac{1}{\sqrt{2}}$

$10\sqrt{2} = DE$

Topic : Trigonometric ratios of some specific angles

$0 < \theta < 90$

T. ratios \ θ	0°	30°	45°	60°	90°
sin θ	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1
cos θ	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0
tanθ	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	n.d.
cosec θ					
sec θ					
cot θ					

Topic : T Ratios for some specific angles

#Q. What happens to value of $\cos\theta$ when θ increases from $0°$ to $90°$?

[Board Term –I, 2015]

θ $0° \longrightarrow 90°$

Decreases

Topic : Visualization

(i) The value of sin θ increases from 0 to 1 and cos 0 decreases from 1 to 0, when $0 \le \theta \le 90°$.

(ii) Division by 0 is not allowed, hence 1/0 is an indeterminate (not defined) value.

(iii) In the case of tan θ, the value increases from 0 to ∞, where $0 < \theta \le 90°$.

(vi) In the case of cot θ, the values decreases from ∞ to 0, where $0 \le \theta \le 90°$.

(v) IN the case of cosec θ, the values decreases from ∞ to 1, where $0 \le \theta \le 90°$.

(vi) In the case of sec θ, the values increases from 1 to ∞, where $0 \le \theta \le 90°$.

$$\frac{sin(os)}{cos(os)} =$$

Reciprocal Relation.

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

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

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

Quotient Relation.

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

$\cot\theta = \frac{\cos\theta}{\sin\theta}$

1 or Square vali identity.

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

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

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

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

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

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

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

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

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

Proof:

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

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

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

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

Topic : Trigonometric Identities

#Q. Express the ratios cos A, tan A and sec A in terms of sin A.

$\cos A \rightarrow \sin A$

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

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

$\cos A = \pm\sqrt{1-\sin^2 A}$

$\boxed{\cos A = \sqrt{1-\sin^2 A}}$

$\tan A \rightarrow \sin A$

$\tan A = \frac{\sin A}{\cos A}$

$\boxed{\tan A = \frac{\sin A}{\sqrt{1-\sin^2 A}}}$

$\sec A \rightarrow \sin A$

$\sec A \rightarrow \tan A \rightarrow \sin A$

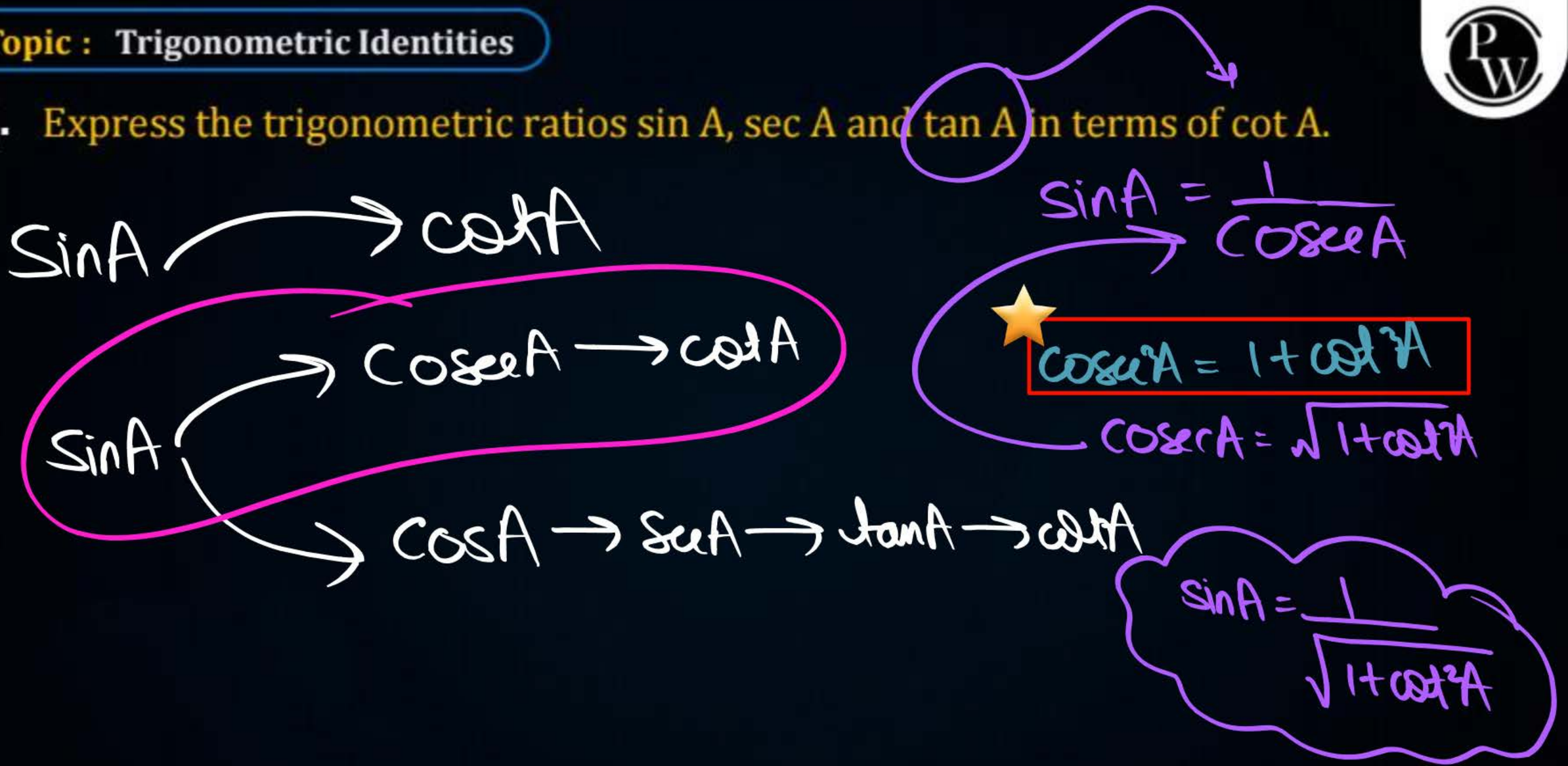
$\sec A \rightarrow \cos A \rightarrow \sin A$

$\sec A = \frac{1}{\cos A}$

$\boxed{\sec A = \frac{1}{\sqrt{1-\sin^2 A}}}$

Topic : Trigonometric Identities

#Q. Express the trigonometric ratios sin A, sec A and tan A in terms of cot A.



$\sec A \longrightarrow \cot A$

$\sec A \rightarrow \cos A \rightarrow \sin A \rightarrow \operatorname{cosec} A \rightarrow \cot A$

$\sec A \rightarrow \tan A \rightarrow \cot A$

$\sec^2 A = 1 + \tan^2 A$

$\sec A = \sqrt{1 + \tan^2 A}$

$\sec A = \sqrt{1 + \frac{1}{\cot^2 A}}$

$\sec A = \sqrt{\frac{\cot^2 A + 1}{\cot^2 A}}$

$\sec A = \frac{\sqrt{\cot^2 A + 1}}{\sqrt{\cot^2 A}}$

$\sec A = \frac{\sqrt{\cot^2 A + 1}}{\cot A}$

$\tan A \longrightarrow \cot A$

$\tan A \begin{cases} \nearrow \cot A \\ \searrow \sec A \end{cases}$

$\tan A = \frac{1}{\cot A}$

Topic : Trigonometric Identities

#Q. Write all the other trigonometric ratios of $\angle A$ in terms of sec A.

$\sin A \rightarrow \sec A$

$\sin A \rightarrow \cos A \rightarrow \sec A$

$\sin A \rightarrow \operatorname{cosec} A$

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

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

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

$\sin A = \sqrt{\frac{1}{1} - \frac{1}{\sec^2 A}}$

$\sin A = \sqrt{\frac{\sec^2 A - 1}{\sec^2 A}}$

$\sin A = \frac{\sqrt{\sec^2 A - 1}}{\sqrt{\sec^2 A}}$

$\boxed{\sin A = \frac{\sqrt{\sec^2 A - 1}}{\sec A}}$

$\cot A \rightarrow \sec A$

$\cot A \rightarrow \tan A \rightarrow \sec A$

$\cot A \rightarrow \operatorname{cosec} A$

$$\cot A = \frac{1}{\tan A}$$

$$\boxed{\cot A = \frac{1}{\sqrt{\sec^2 A - 1}}}$$

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

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

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

H.W

1. $\sec\theta \rightarrow \sin\theta$
2. $\tan\theta \rightarrow \cos\operatorname{ec}\theta$
3. $\cot\theta \rightarrow \sec\theta$
4. $\cos\operatorname{ec}\theta \rightarrow \cos\theta$

DPP abhi nahi banegi...

Wait Karo.....

Aage aane wali classes ki...

THANK YOU