UDAAN

2025

Trigonometry

Mathematics | Lecture - 02

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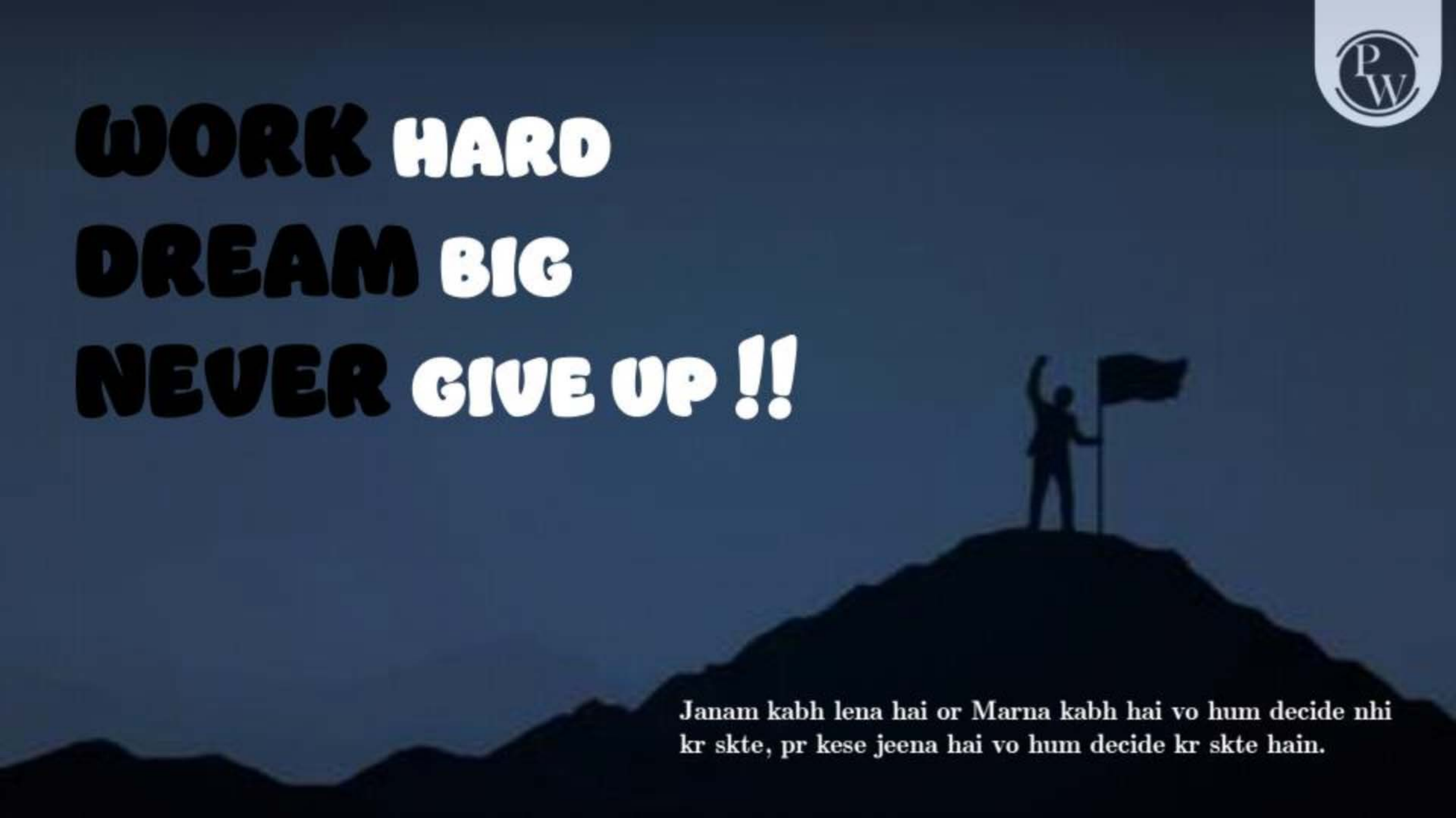
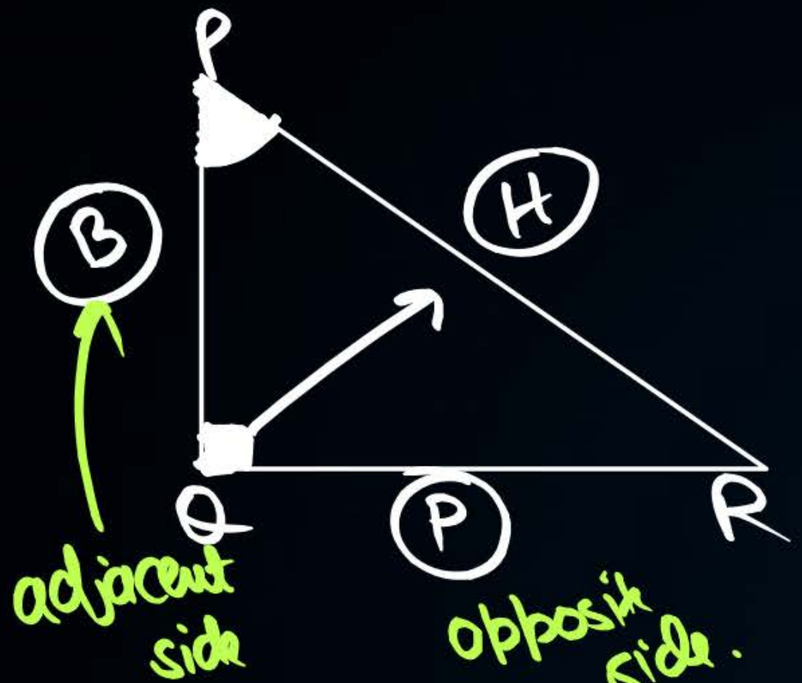
Topics *to be covered*

1. Questions on Trigonometric Ratios
2. Trigonometric Ratios for some Specific Angles
3. Proof of Trigonometric Ratios for some Specific Angles

WORK HARD
DREAM BIG
NEVER GIVE UP !!



Janam kabh lena hai or Marna kabh hai vo hum decide nhi kr skte, pr kese jeena hai vo hum decide kr skte hain.



cosecθ Pandit sinθ

secθ Badri cosθ

cotθ Prasad Bole. tanθ

Har

Har

cosine θ

tangent θ

$\sin\theta \neq \sin x\theta$

P B P

H H B

H.w

Pyaar Babuq Pyaar

Hanax Haman Babua.

P B P

H H B

Topic : T Ratios

#Q. If 8 tan A = 15, find sin A – cos A.

$\tan A = \frac{15}{8}$

$\frac{P}{B} = \frac{15}{8}$

$P = 15x$

$B = 8x$

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

$(H)^2 = (15x)^2 + (8x)^2$

$= 225x^2 + 64x^2$

$H^2 = 289x^2$

$H = \pm\sqrt{289x^2}$

$H = +17x$

$= \sin A - \cos A$

$= \frac{P}{H} - \frac{B}{H}$

$= \frac{15x}{17x} - \frac{8x}{17x}$

$= \frac{7x}{17x}$

$= \frac{7}{17}$

Q $\sin\theta = \frac{7}{3}$ $= \frac{P}{H}$ $P = 7x$, $H = 3x$

A) True

~~B) False.~~

C) —

D) —

Q $\sin\theta > 1$

A) True

~~B) False~~

C) —

D)

$\sin\theta = \frac{P}{H}$

$H > P$

$D > N$

$2, 3, 5, 9, 4\frac{5}{9}$

$0 - 1$

Topic : T Ratios

#Q. State whether the following are true or false. Justify your answer.

(i) sec A = 12/5 for some value of angle A. True.

(ii) cos A is the abbreviation used for the cosecant of angle A. F

(iii) cot A is the product of cot and A. F

(iv) Sin θ = 4/3 for some angle . F

Topic : T Ratios

#Q. If $\sin B = \frac{1}{2}$, then $3\cos B - 4\cos^3 B =$

$\sqrt{3} \times \sqrt{3} \times \sqrt{3} = 3\sqrt{3}$

[DPP Question]

$\sin^3 B = (\sin B)^3$

$= \sin B \times \sin B \times \sin B$

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

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

$P = 1x$

$H = 2x$

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

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

$4x^2 = 1x^2 + B^2$

$3x^2 = B^2$

$\pm\sqrt{3x^2} = B$

$\sqrt{3}x = B$

$\cos B = \frac{B}{H}$

$= \frac{\sqrt{3}x}{2x}$

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

$= 3\cos B - 4(\cos B)^3$

$= 3\left(\frac{\sqrt{3}}{2}\right) - 4\left(\frac{\sqrt{3}}{2}\right)^3$

$= \frac{3\sqrt{3}}{2} - 4\left(\frac{3\sqrt{3}}{8}\right)$

$= \frac{3\sqrt{3}}{2} - \frac{3\sqrt{3}}{2} = 0$

$$x^2 = 4$$

$$x = \pm\sqrt{4}$$

$$\boxed{x = +2, -2}$$

Topic : T Ratios

#Q. In a right triangle ABC right angled at B, $\angle ACB = \theta$, AB = 2 cm and BC = 1 cm. Find the value of $\sin^2\theta + \tan^2\theta$.

[DPP Type Question]

$\sin^2\theta + \tan^2\theta = 9$

$(\sin\theta)^2 + (\tan\theta)^2 = 9$

$\sin\theta = \frac{P}{H} = \frac{2}{\sqrt{5}}$

$\tan\theta = \frac{P}{B} = \frac{2}{1}$

$(AC)^2 = (AB)^2 + (BC)^2$

$(AC)^2 = (2)^2 + (1)^2$

$AC^2 = 5$

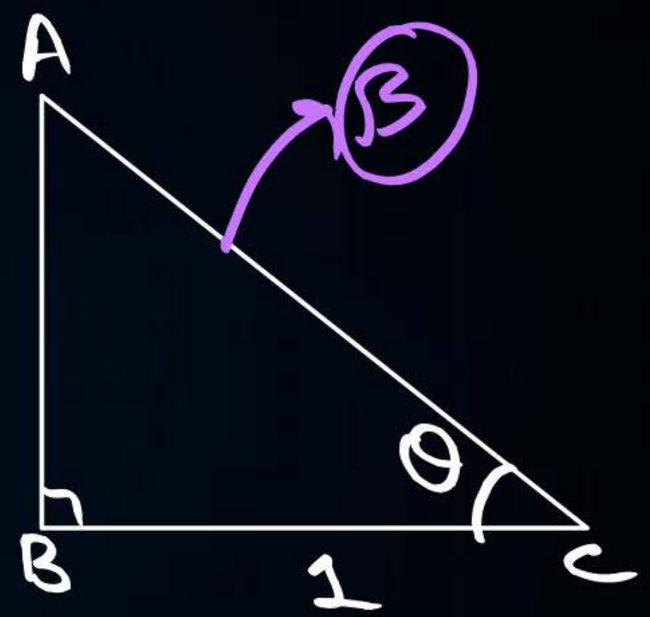
$AC = \pm\sqrt{5}$

$AC = \sqrt{5}$

$= \left(\frac{2}{\sqrt{5}}\right)^2 + \left(\frac{2}{1}\right)^2$

$= \frac{4}{5} + 4$

$= \frac{24}{5}$



Topic : T Ratios

#Q. In ΔOPQ right angled at P, OP = 7 cm, OQ – PQ = 1 cm. Determined the values of sin Q and cos Q. [NCERT]

$OQ = 1 + PQ$

$OQ = 25$

$(OQ)^2 = (OP)^2 + (PQ)^2$

$(OQ)^2 = 49 + (PQ)^2$

$(1+PQ)^2 = 49 + (PQ)^2$

$1^2 + PQ^2 + 2(1)(PQ) = 49 + PQ^2$

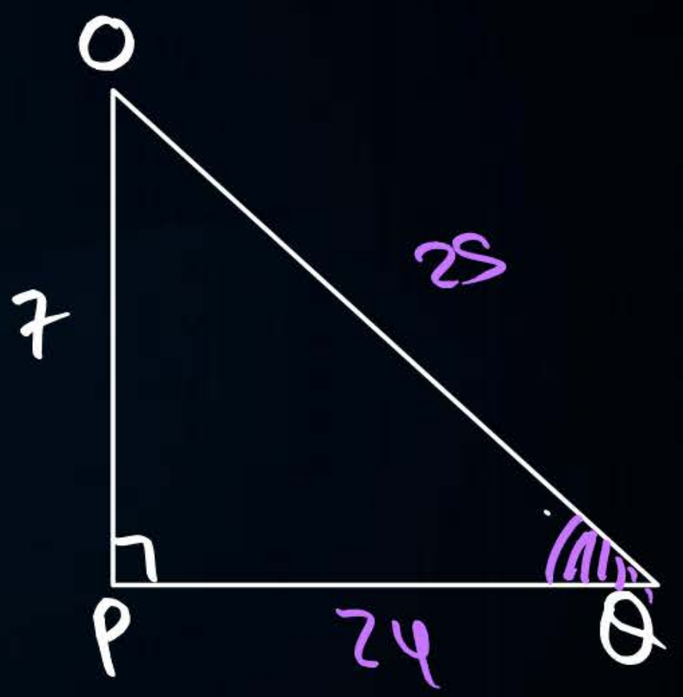
$1 + 2PQ = 49$

$2PQ = 48$

$PQ = 24$

$\sin\theta = \frac{P}{H} = \frac{7}{25}$

$\cos\theta = \frac{B}{H} = \frac{24}{25}$



Topic : T Ratios

#Q. In ΔPQR, right angled at Q, $PR + QR = 25$ cm and $PQ = 5$ cm. Determine the values of sin P, cos P and tan P. [NCERT]

$PR = 25 - QR$

$(PR)^2 = (QR)^2 + (PQ)^2$

$(PR)^2 = (QR)^2 + 25$

$(25 - QR)^2 = QR^2 + 25$

$(25)^2 + QR^2 - 2(25)(QR) = QR^2 + 25$

$625 - 50QR = 25$

$625 - 25 = 50QR$

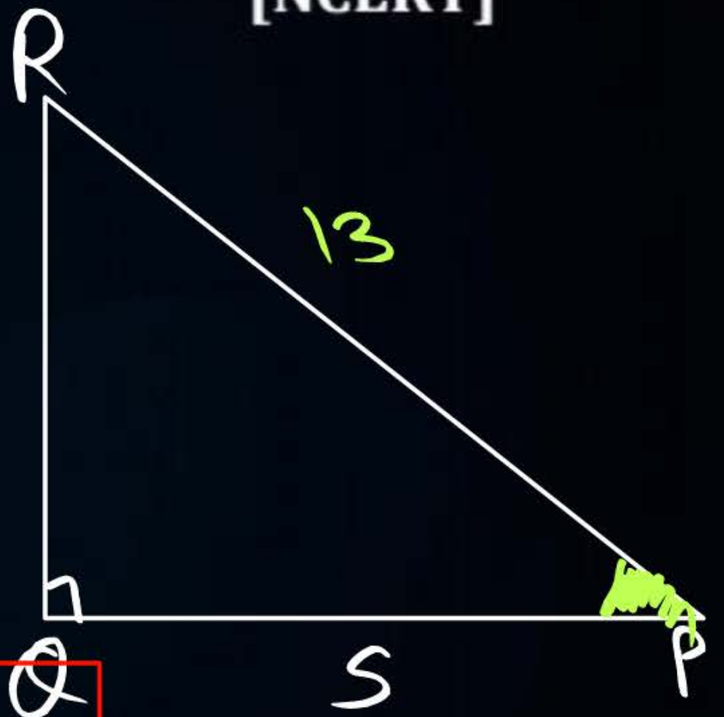
$600 = 50QR$

$PR = 25 - 12$

$\star$ $PR = 13$

$\frac{60}{50} = QR$

$\star$ $12 = QR$



$\tan P = \frac{P}{B} = \frac{12}{5}$ $\cos P = \frac{5}{13}$

$\sin P = \frac{P}{H} = \frac{12}{13}$

Reciprocal.

$\frac{P}{H}$ $\sin\theta \longleftrightarrow \operatorname{cosec}\theta$ $\frac{H}{P}$

$\frac{B}{H}$ $\cos\theta \longleftrightarrow \sec\theta$ $\frac{H}{B}$

$\frac{P}{B}$ $\tan\theta \longleftrightarrow \cot\theta$ $\frac{B}{P}$

① $\sin\theta = \frac{1}{\operatorname{cosec}\theta}$ or $\operatorname{cosec}\theta = \frac{1}{\sin\theta}$

② $\cos\theta = \frac{1}{\sec\theta}$ or $\sec\theta = \frac{1}{\cos\theta}$

③ $\tan\theta = \frac{1}{\cot\theta}$ or $\cot\theta = \frac{1}{\tan\theta}$

$\sin\theta = \frac{2}{3}$ $\cos\theta = \frac{\sqrt{3}}{2}$

Q. $\frac{1}{\cos\theta}$

$= \frac{1}{H/B}$

$= \frac{1}{\frac{1}{H/P}}$

$= \frac{P}{H}$

$= \sin\theta$

Q. $\frac{\frac{2}{\sqrt{3}}}{\left[1-\frac{1}{3}\right]} = \frac{2}{12}$ $\left(\frac{1}{6}\right)$

Q. $\frac{2}{\sin\theta}$

$\frac{2}{\frac{1}{\sqrt{10}}}$ $\left(2\sqrt{10}\right)$

Quotient Relation.

(1) $\frac{\sin\theta}{\cos\theta} = \frac{\frac{P}{H}}{\frac{B}{H}} = \frac{P \times \cancel{H}}{B \times \cancel{H}} = \frac{P}{B} = \tan\theta$

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

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

Topic: Trigonometric Ratios of some specific Angles

$\frac{1}{0}$ = not defined.

$\frac{1}{n.d} = 0$

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

$\tan 30^\circ = \frac{\sin 30^\circ}{\cos 30^\circ}$

$\tan 60^\circ = \frac{\sin 60^\circ}{\cos 60^\circ}$

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

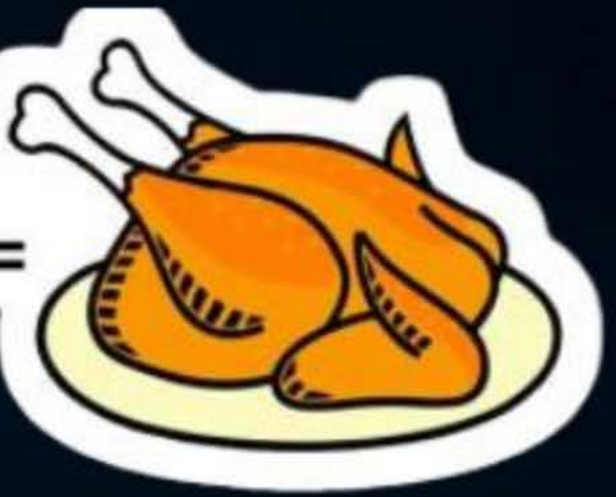
Topic: Trigonometric Ratios of some specific Angles

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	$\sqrt{3}$	Not defined
cosec θ	Not defined	2	$\sqrt{2}$	$\frac{2}{\sqrt{3}}$	1
sec θ	1	$\frac{2}{\sqrt{3}}$	$\sqrt{2}$	2	Not defined
cot θ	Not defined	$\sqrt{3}$	1	$\frac{1}{\sqrt{3}}$	0

Tisinic

$\frac{\text{Sin}}{\text{Cos}}$

$\frac{\text{Sin Doori}}{\text{Cos Doori}} =$



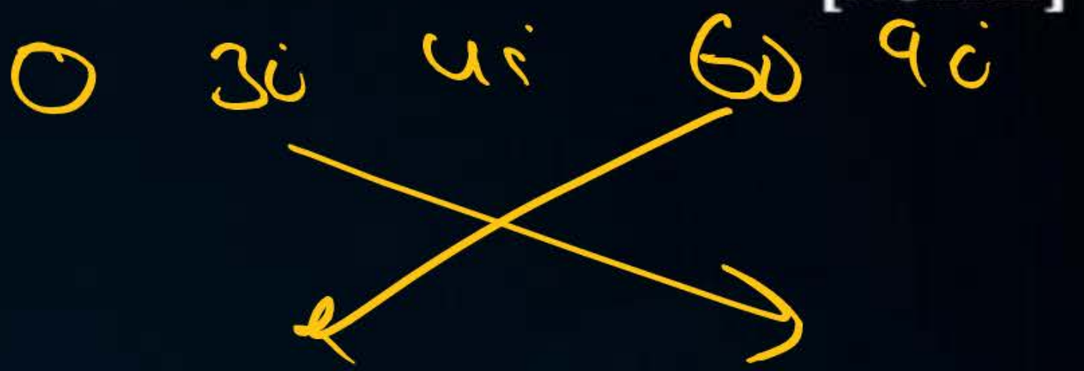
Topic : T Rations for some specific angles

#Q. Evaluate each of the following in the simplest form:
$\sin 60° \cos 30° + \cos 60° \sin 30°$ **[NCERT]**

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

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

$= 1$



Topic : T Rations for some specific angles

#Q. Evaluate the following expressions:

$2\sin^2 30° \tan 60° - 3\cos^2 60° \sec^2 30°$

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

$= 2\left(\frac{1}{4}\right) \times \sqrt{3} - 3\left(\frac{1}{4}\right)\left(\frac{4}{3}\right)$

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

$= \boxed{\frac{\sqrt{3}-2}{2}}$

$\tan 60° = \frac{\sin 60°}{\cos 60°}$

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

$= \sqrt{3}$

Topic : T Rations for some specific angles

#Q. Prove that : $\frac{\cos 30°+\sin 60°}{1+\cos 60°+\sin 30°} = \frac{\sqrt{3}}{2}$

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

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

$$= \frac{\frac{2\sqrt{3}}{2}}{\frac{4}{2}}$$

$$= \frac{2\sqrt{3}\times 2}{2\times 4}$$

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

H.P

Topic : T Rations for some specific angles

#Q. Evaluate : $\frac{3\tan^2 30° + \tan^2 60° + \text{cosec}30° - \tan 45°}{\cot^2 45°}$

[Board Term – I, 2016]

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

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

$$= 1 + 3 + 2 - 1$$

$$= 5$$

$\tan 30° = \frac{\sin 30°}{\cos 30°}$

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

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

$\tan 60° = \frac{\sin 60°}{\cos 60°}$

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

$= \sqrt{3}$

When a 10th Class student solves Trigonometry problem without converting
Tan into Sin and Cos :

Topic :

#Q. If $(x-2)\sin^2 30° + (x-3)\tan^2 60° - x\cos^2 45° = 17/4$, find the value of x.

$$(x-2)\left(\frac{1}{2}\right)^2 + (x-3)(\sqrt{3})^2 - x\left(\frac{1}{\sqrt{2}}\right)^2 = \frac{17}{4}$$

$$(x-2)\left(\frac{1}{4}\right) + (x-3)(3) - x\left(\frac{1}{2}\right) = \frac{17}{4}$$

$$\frac{x-2}{4} + \frac{3x-9}{1} - \frac{x}{2} = \frac{17}{4}$$

$$\frac{1(x-2)+4(3x-9)-2(x)}{4} = \frac{17}{4}$$

$$\rightarrow x-2+12x-36-2x = \frac{17}{4}\times 4$$

$$11x-38 = 17$$

$$11x = 17+38$$

$$11x = 55$$

$$x = 5$$

Topic :

Low Qiscussion

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

#Q. If $\tan\theta = \frac{2x(x+1)}{2x+1}$ find $\sin\theta$ and $\cos\theta$.

$\tan\theta = \frac{P}{B}$

$P = 2x(x+1)$

$B = 2x+1$

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

$H^2 = [2x(x+1)]^2 + (2x+1)^2$

$= 4x^2(x+1)^2 + 4x^2 + 1 + 4x$

$= 4x^2(x^2+1+2x) + 4x^2 + 1 + 4x$

$H^2 = 4x^4 + 4x^2 + 8x^3 + 4x^2 + 1 + 4x$

$= 4x^4 + 4x^2 + 1 + 8x^3 + 4x^2 + 4x.$

$H^2 = (x+2)^2$

$H = \pm\sqrt{(x+2)^2}$

$H = x+2$

$$H^2 = 4x^4 + 4x^2 + 1 + 8x^3 + 4x^2 + 4x$$

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

$$a \qquad b \qquad c \qquad 2(a)(b) \qquad 2(b)(c) \qquad 2(a)(c)$$

$$(a+b+c)^2 = (a)^2 + (b)^2 + (c)^2 + 2ab + 2bc + 2ac$$

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

$$H = \pm\sqrt{(2x^2 + 2x + 1)^2}$$

$$H = 2x^2 + 2x + 1$$

Homework

DPP

THANK YOU