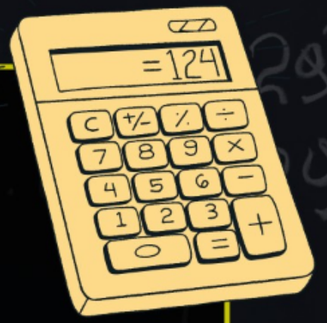
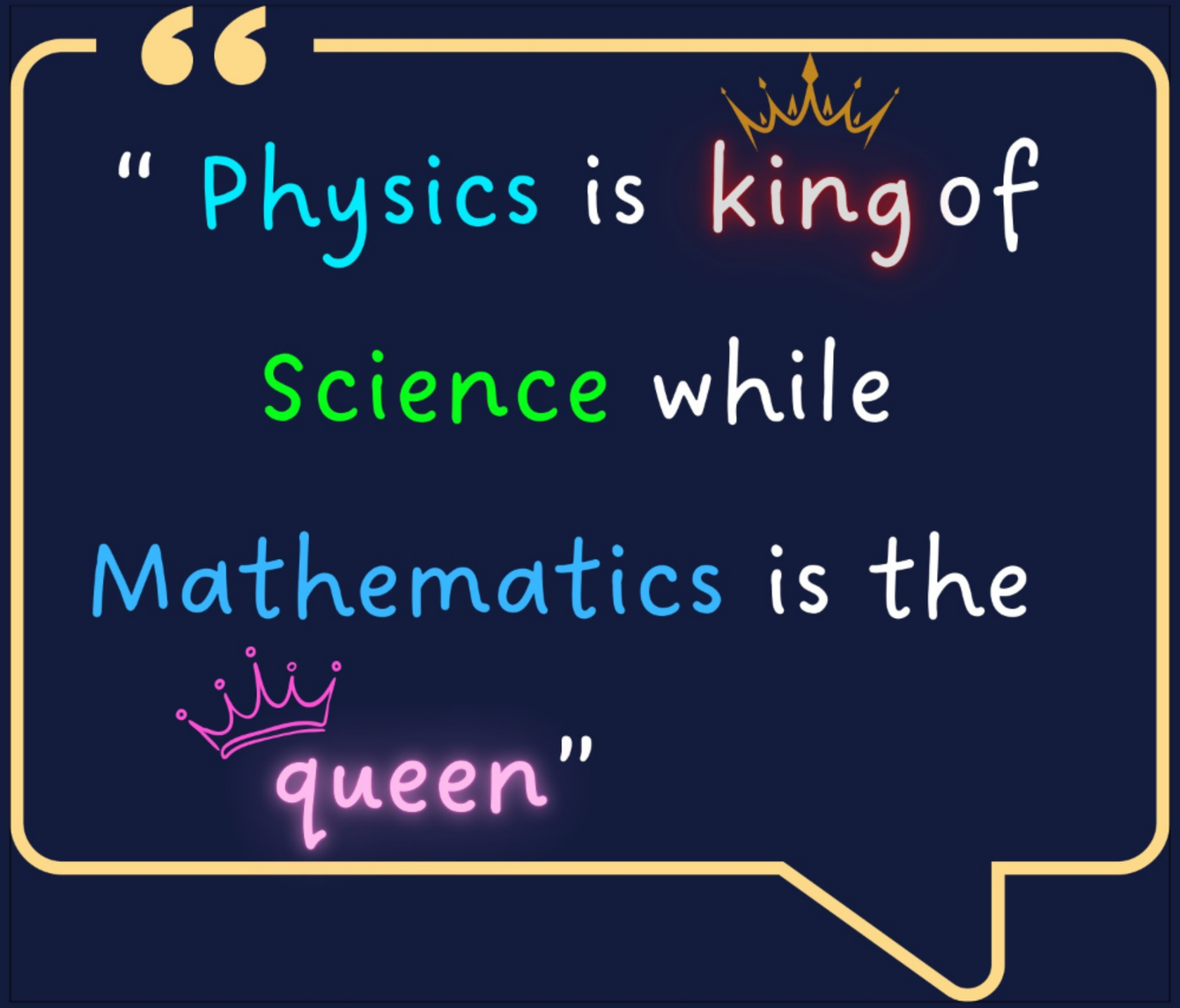
LECTURE 01

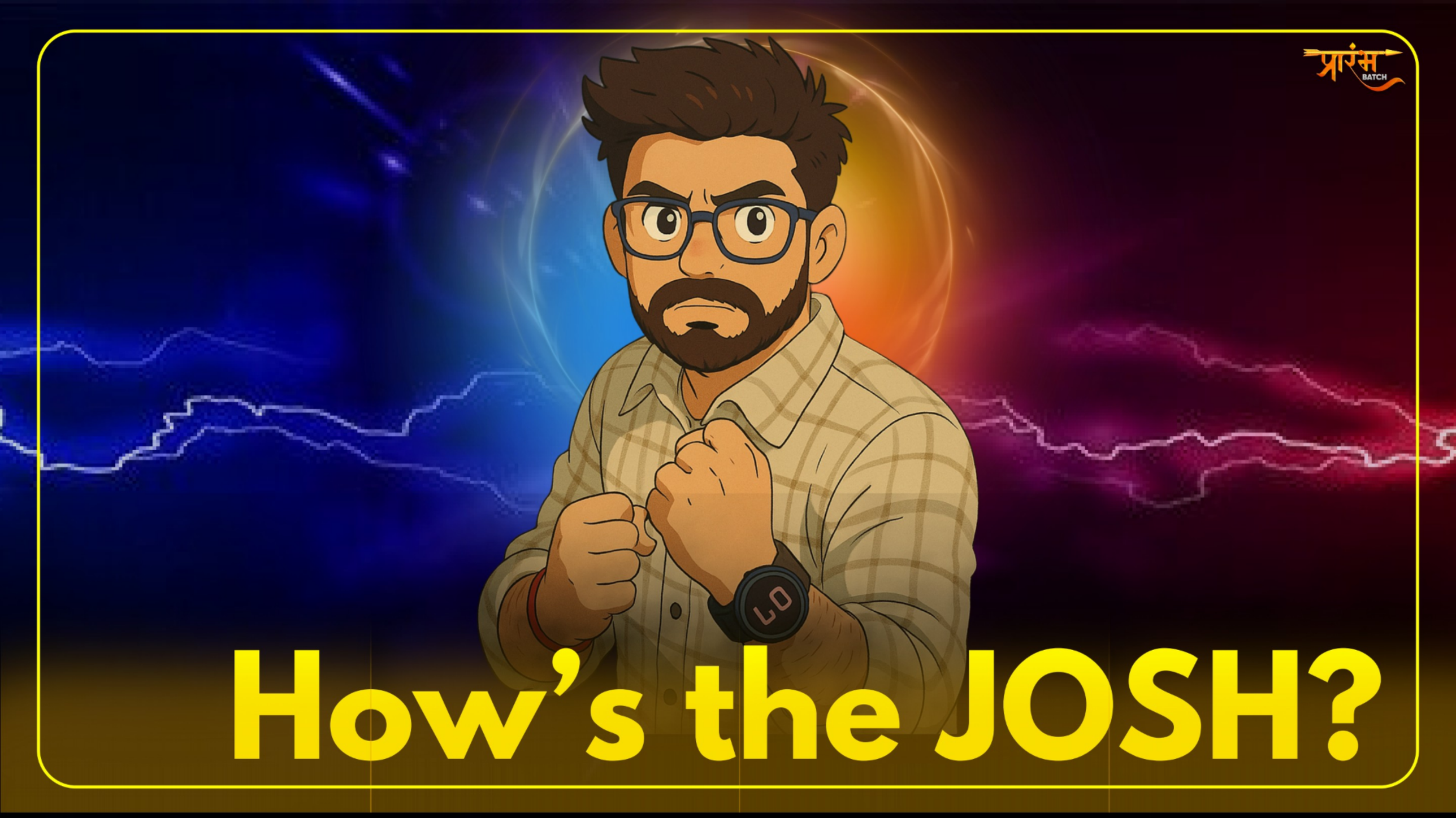
प्रारंभ BATCH

CLASS XI - PHYSICS

BASIC MATHS AND CALCULUS

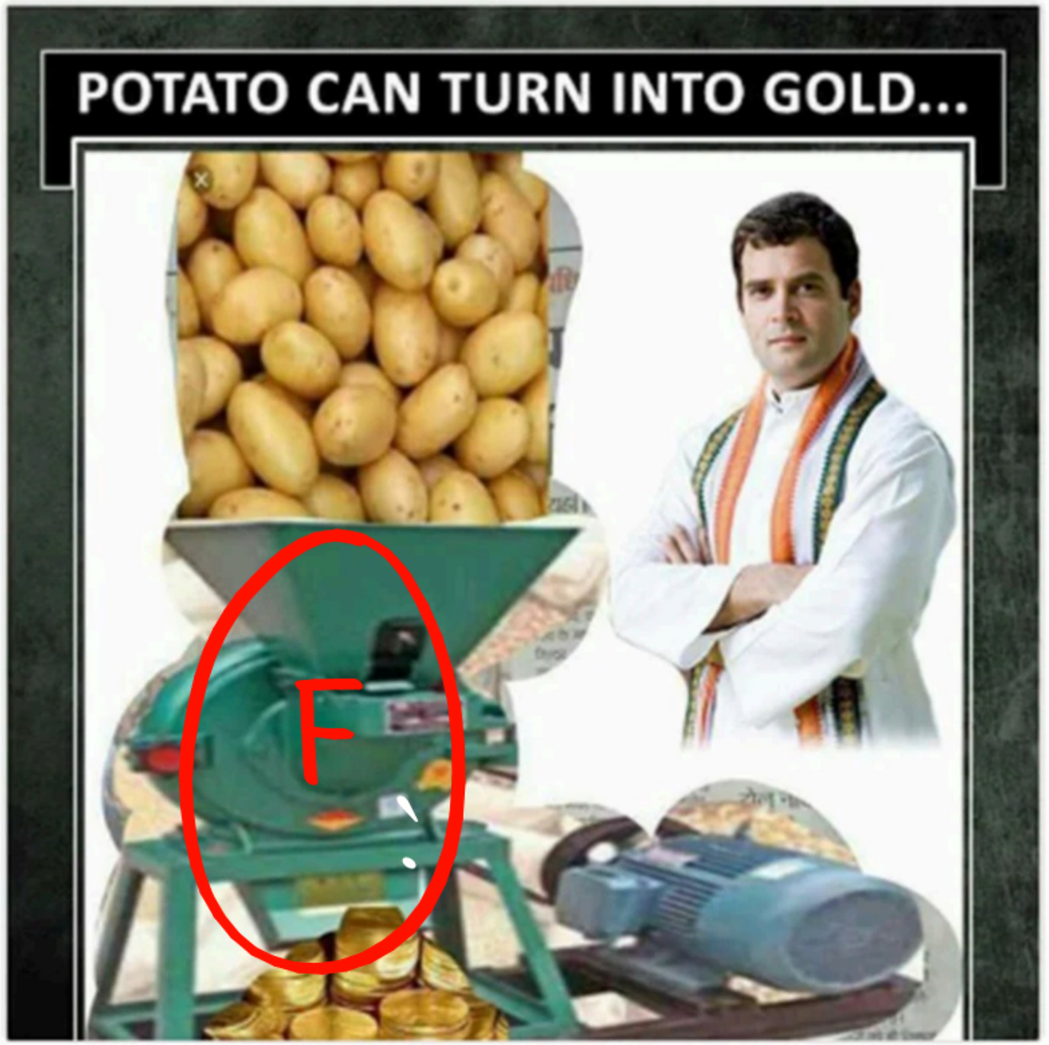



" Physics is king of
Science while
Mathematics is the
queen"


प्रारंभ
BATCH
How's the JOSH?

Topics to be Covered

- Trigonometric Functions
  - Relationship Between Radian and Degree
  - Trigonometric Ratios
  - Angle Transformation
  - Trigonometric Identities



$$y = f(x) = x^2$$

x	y
1	1
2	4
3	9

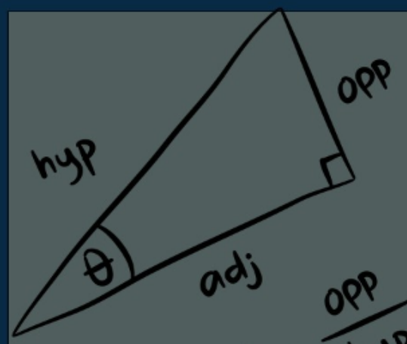
Functions

Functions

Today's Goal

1. Trigonometric Functions
2. Algebraic Function
3. Exponential Functions
4. Logarithmic Functions

TRIGONOMETRY



$$\sin(\theta) = \frac{opp}{hyp}$$

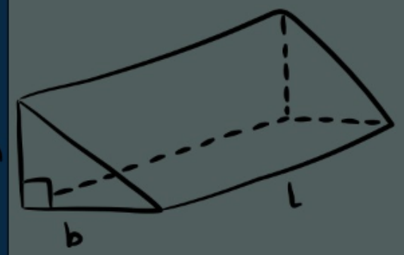
$$V = lwh$$

$$V = \pi r^2 h$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$y = mx + b$$

$$a = \frac{V_f - V_i}{t}$$



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

$$\frac{x}{a} + \frac{y}{b} = 1$$

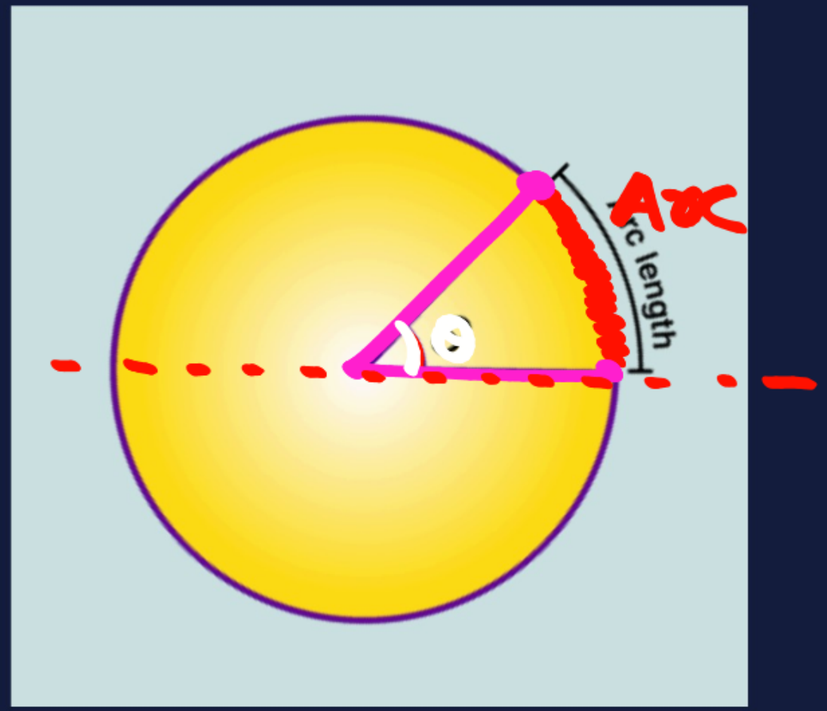
$$\frac{x}{a} + \frac{y}{b} = 1$$

$$ax^2 + bx + c = 0$$

$$V = \frac{4}{3}\pi r^3$$

$$V = \frac{4}{3}\pi r^3$$

Plane Angle



Arc = θ · radius

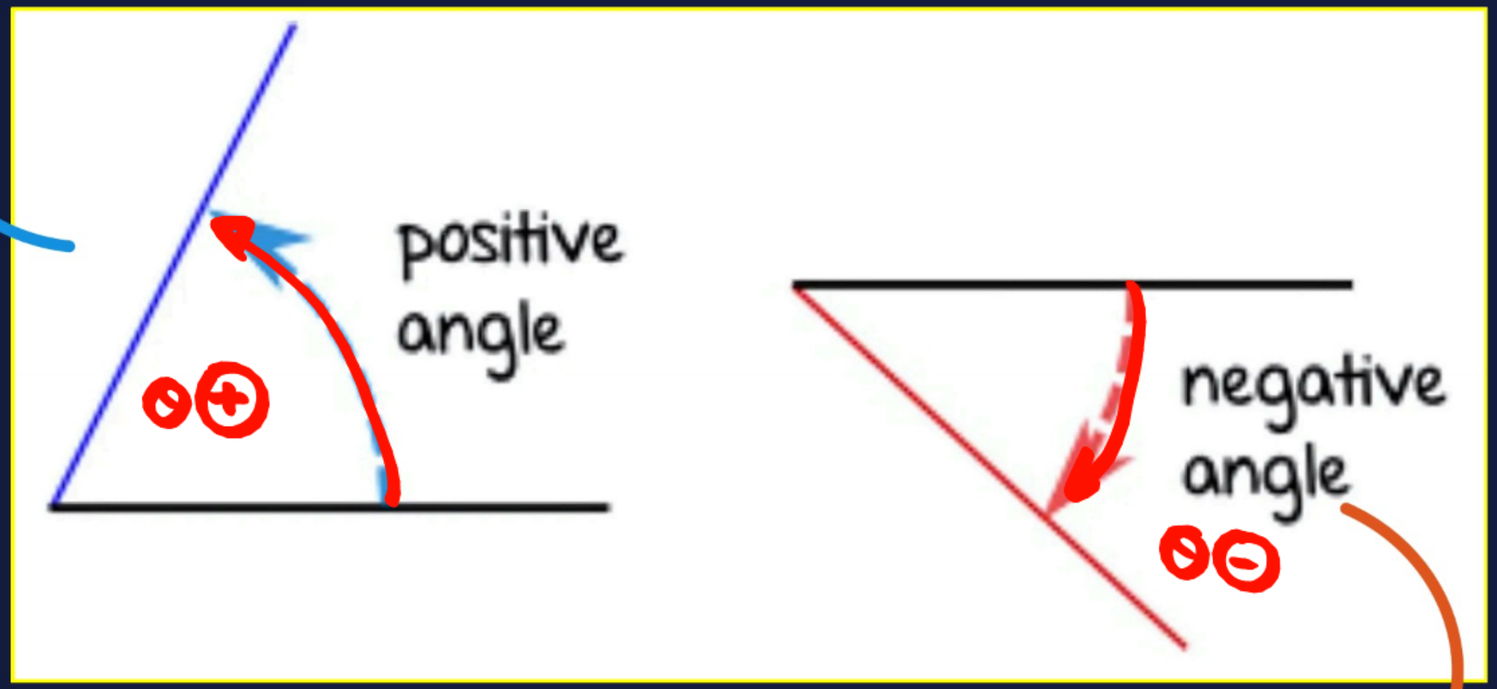
$$\theta = \frac{\text{Arc}}{R}$$

→ radian ✓

→ degree ✗

The angle(θ) must be in radians for this formula.

Anticlockwise Angle

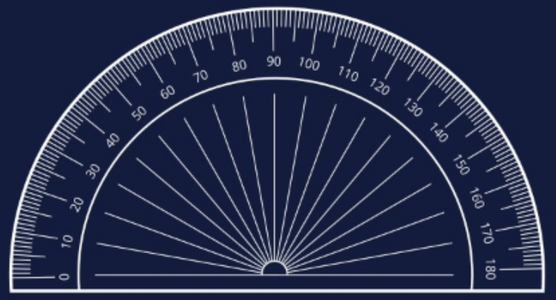


Clockwise Angle

Units of Angles

SI Unit: radian (Rad)

Other Units: Degree (°)
: Minute (′)
: Second (″)



NOTE :-
Conversions:

- 1 Degree (1°) = 60 Minutes (60′)
- 1 Minute (1′) = 60 Seconds (60″)

Relationship Between Radian and Degree

$$\pi \text{ rad} = 180^\circ$$

(i) degree (θ) $\longrightarrow$ rad

$180^\circ \rightleftharpoons \pi$ rad

$\theta^\circ = ?$ rad

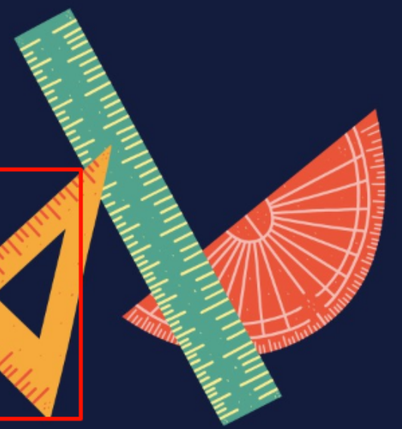
$\therefore \frac{\theta}{180} \times \pi \Rightarrow = \theta \times \frac{\pi}{180^\circ}$ rad

(ii) rad (θ) $\longrightarrow$ degree

π rad $= 180^\circ$

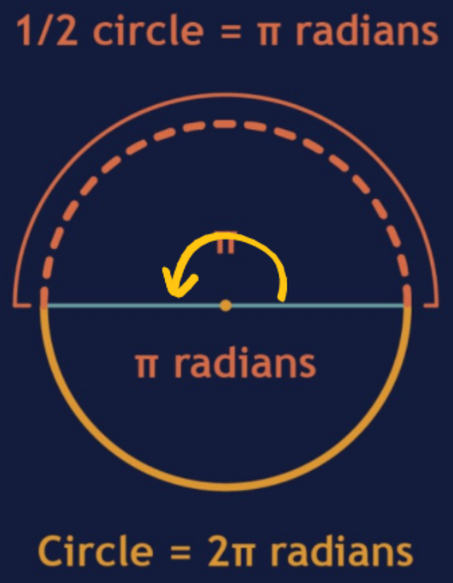
θ rad $= ?$

$\frac{\theta}{\pi} \times 180^\circ = \left(\theta \times \frac{180}{\pi}\right)^\circ$



Full Circle:

- 360° = 2π radians
- 1 cycle (full rotation): 360° = 2π radians



Half circle

π rad = 180°

Ques. Convert 60° to radians.

① degree → rad

$= \left(\theta \times \frac{\pi}{180}\right)$ rad

$= 60 \times \frac{\pi}{180_3}$

$60^\circ = \frac{\pi}{3}$ rad

② $30^\circ = ?$ rad

$= \left(\theta \times \frac{\pi}{180}\right)$ rad

$= \left(30^\circ \times \frac{\pi}{180}\right)$ rad

$30^\circ = \frac{\pi}{6}$ rad

③ $90^\circ = ?$ rad

Ans. → $\frac{\pi}{2}$ ✓✓

Ques. Convert 120° to radians.

A. $3\pi / 4$ rad

B. $\pi / 4$ rad

C. $2\pi / 3$ rad

D. $4\pi / 3$ rad

degree $\longrightarrow$ rad

$$= \left(\theta \times \frac{\pi}{180^\circ}\right) \text{rad}$$

$$= \left(\frac{\cancel{120^\circ}^{2} \times \pi}{\cancel{180^\circ}_{3}}\right) = \frac{2\pi}{3} \text{rad}$$

Ques. Convert $4\pi / 3$ to degree

A. 120°

B. 270°

C. 240°

D. None

SOLUTION

rad ⟶ degree

$$= \left(\theta \times \frac{180^\circ}{\pi}\right)$$

$$= \frac{4\pi}{3} \times \frac{180^\circ}{\pi} = 240^\circ$$

Common Angle Conversions:

Angle in Radian	Angle in Degree
0	0°
π/6	30°
π/4	45°
π/3	60°
π/2	90°
π	180°
(3π)/2	270°
2π	360°

NOTE :-

$1^\circ = 60'$

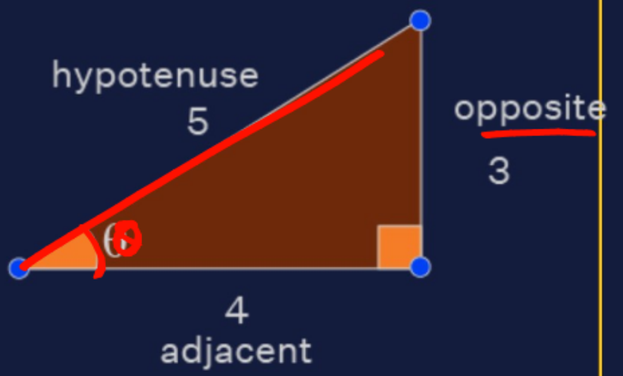
$1' = 60''$

Trigonometric Ratios

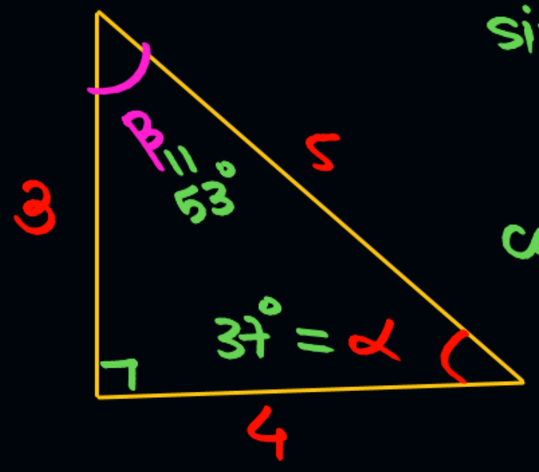
$$\sin(\theta) = \frac{\text{opposite}}{\text{hypotenuse}} = \frac{3}{5} \qquad \csc(\theta) = \frac{\text{hypotenuse}}{\text{opposite}} = \frac{5}{3}$$

$$\cos(\theta) = \frac{\text{adjacent}}{\text{hypotenuse}} = \frac{4}{5} \qquad \sec(\theta) = \frac{\text{hypotenuse}}{\text{adjacent}} = \frac{5}{4}$$

$$\tan(\theta) = \frac{\text{opposite}}{\text{adjacent}} = \frac{3}{4} \qquad \cot(\theta) = \frac{\text{adjacent}}{\text{opposite}} = \frac{4}{3}$$



Magic



$\sin 53^\circ = \sin\beta = \frac{4}{5}$

$\cos 53^\circ = \cos\beta = \frac{3}{5}$

$\sin\alpha = \frac{3}{5} = \sin 37^\circ$

$\cos\alpha = \frac{4}{5} = \cos 37^\circ$

$$\sin\theta = \frac{1}{\csc\theta} \quad , \quad \csc\theta = \frac{1}{\sin\theta}$$

$$\cos\theta = \frac{1}{\sec\theta} \quad , \quad \sec\theta = \frac{1}{\cos\theta}$$

$$\tan\theta = \frac{1}{\cot\theta} \quad , \quad \cot\theta = \frac{1}{\tan\theta}$$

RECIPROCAL IDENTITES

QUOTIENT IDENTITIES:

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

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

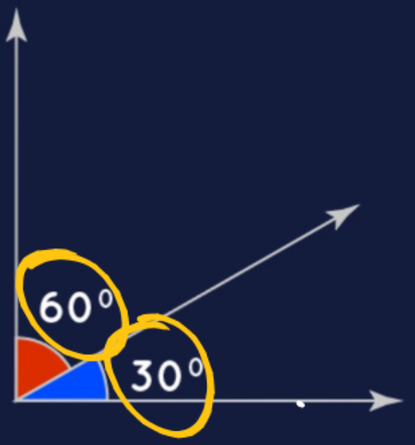
Trigonometric Values to Learn:

Angles (In Degrees)	0°	30°	45°	60°	90°	180°
Angles (In Radians)	0	π/6	π/4	π/3	π/2	π रेडियन
sin	0	1/2	1/√2	√3/2	1	0
cos	1	√3/2	1/√2	1/2	0	-1
tan	0	1/√3	1	√3	∞	0

Complementary Angles ⇒ $\alpha + \beta = 90^\circ$

Angles whose sum is 90°:

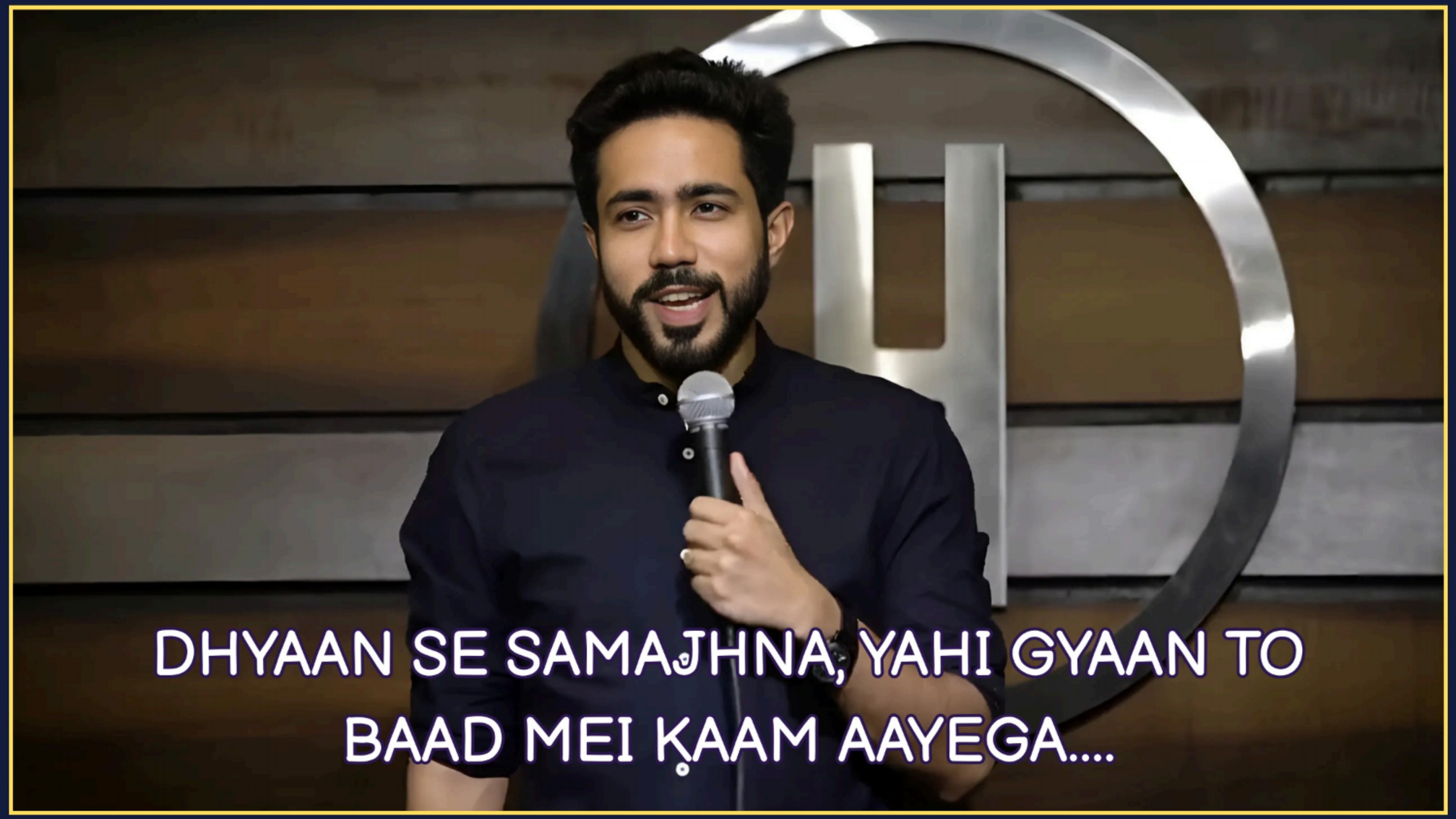
$x + y = 90^\circ$



eg. $\sin(90^\circ - 30^\circ) = \cos(30^\circ)$ (θ)

✓ $\sin 60^\circ = \cos 30^\circ$

$\sin(90^\circ - A) = \cos A$	$\cos(90^\circ - A) = \sin A$
$\tan(90^\circ - A) = \cot A$	$\cot(90^\circ - A) = \tan A$
$\sec(90^\circ - A) = \operatorname{cosec} A$	$\operatorname{cosec}(90^\circ - A) = \sec A$


DHYAAN SE SAMAJHNA, YAHI GYAAN TO
BAAD MEI KAAM AAYEGA....

Ques. if $\sin\theta = 1/3$, find $\tan\theta$

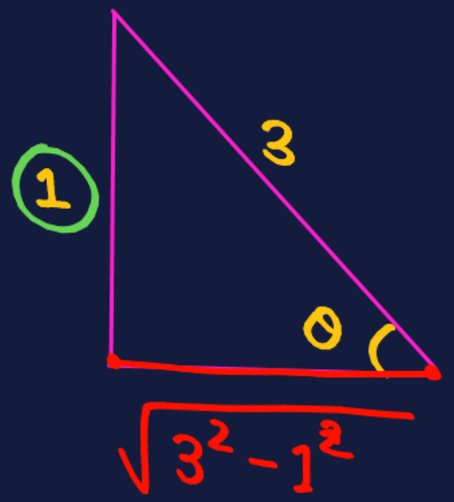
A. 2/3

B. 1/2 √2

C. 2√2

D. 3/2

SOLUTION



$\sqrt{3^2 - 1^2}$

$= \sqrt{8} = 2\sqrt{2}$

$= \sqrt{4 \times 2}$

$\sin\theta = \frac{1}{3}$

$\Rightarrow \tan\theta = \frac{1}{2\sqrt{2}}$

Ques. if $\tan\theta = \sqrt{5}/2$, find $\cos\theta$

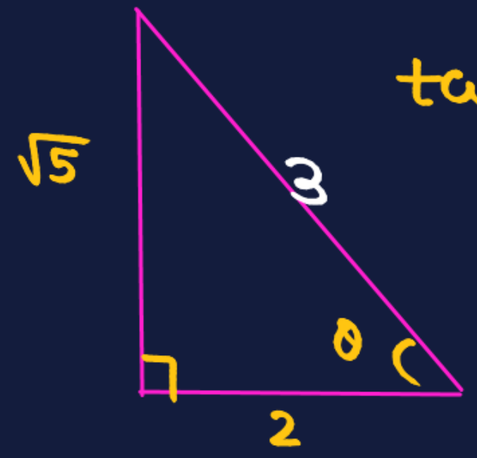
A. $2/\sqrt{5}$

B. $2/3$

C. $2\sqrt{2}$

D. $3/2$

SOLUTION



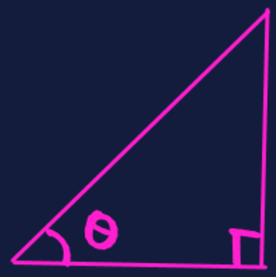
$$\tan\theta = \frac{\sqrt{5}}{2}$$

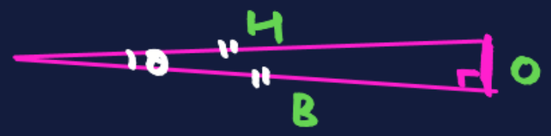
$$\cos\theta = \frac{2}{3}$$

$$H = \sqrt{5+4} = \sqrt{9} = 3$$

Small Angle Approximation

(YAAD RAKHANA)





$$\cos\theta = \frac{B}{H} \approx 1$$

$$B \approx H$$

θ is very very small

$$\sin\theta \approx \theta$$

$$\tan\theta \approx \theta$$

$$\cos\theta \approx 1$$

Range of Trigonometric Functions

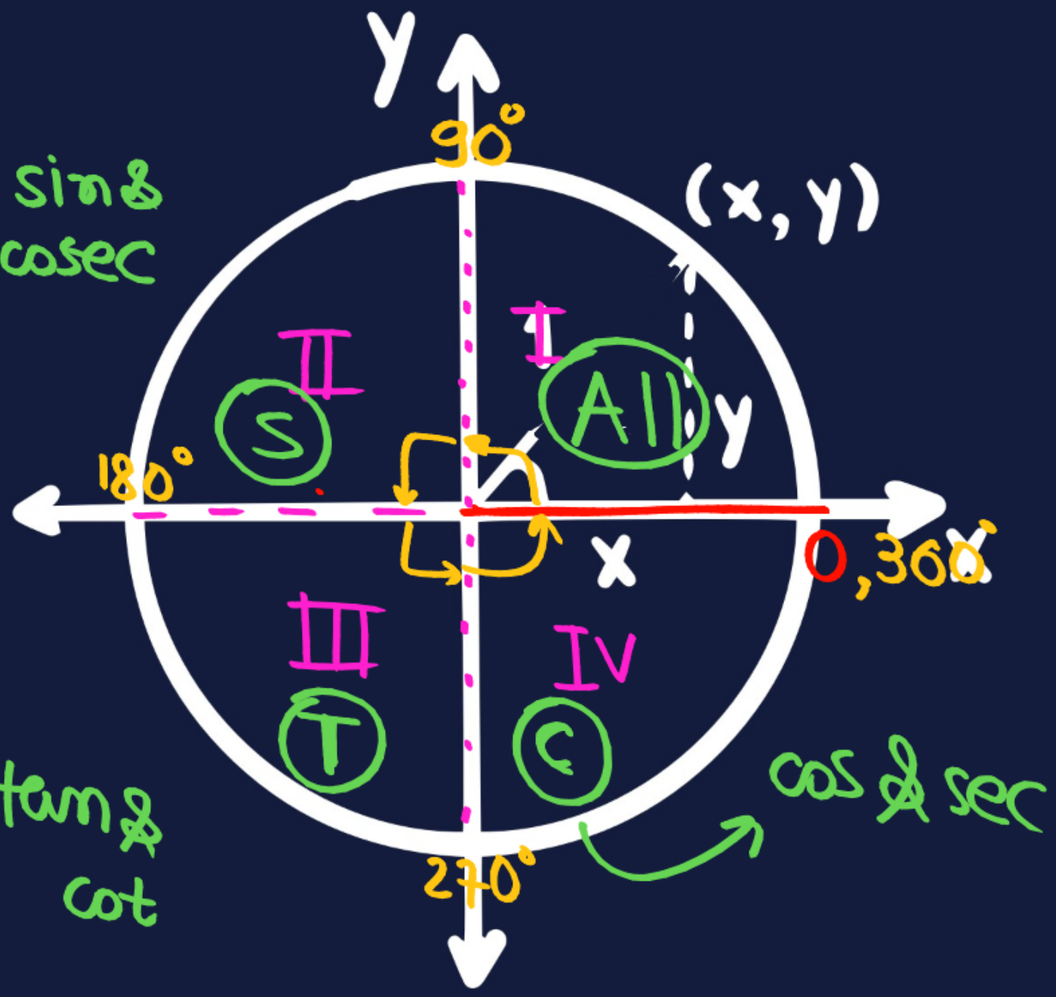
$-1 \leq \sin\theta \leq +1$

$-1 \leq \cos\theta \leq +1$

$-\infty < \tan\theta < +\infty$

Angle Transformation

Use
30°
45°
60°



Eg. $\cos 330° = ?$ (4th)

(i) S :- Samajadaari likho

(ii) S : Sign ⇒ Qud. & All S T C (1 2 3 4)

(iii) T : Transformation

90°, 270° : Sin ⇌ cos, tan ⇌ cot

0°; 180°; 360° : No change

$\Rightarrow 0, 90^\circ, 180^\circ, 270^\circ, 360^\circ$

$\Rightarrow 30^\circ, 45^\circ, 60^\circ$

} Summjadani

Q. $\cos 330^\circ = ?$

(i) $\cos(360^\circ - 30^\circ)$

$= + \cos 30^\circ$

$= + \sqrt{3}/2$

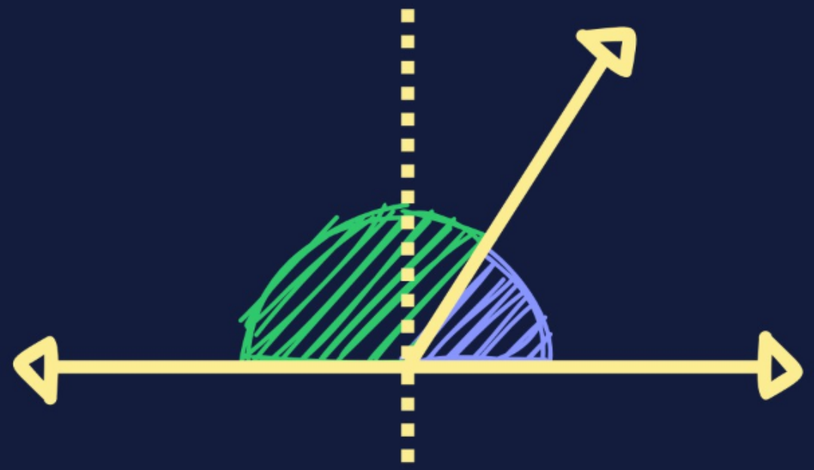
(i) $\cos(270^\circ + 60^\circ)$ (sin)

$= + \sin 60^\circ$

$= \sqrt{3}/2$

Angle Transformation Rules:

- Angles with 90° or 270° (like 90° ± θ) → Function changes
- Angles with 0°, 180°, or 360° (like 180° ± θ) → Function remains the same



Ques. $\sin 300° = ?$ $-\sqrt{3}/2$

SOLUTION

(S) $\sin(360° - 60°)$

(S & T) $-\sin 60°$

$= -\sqrt{3}/2$

(S) $\sin(270° + 30°)$ — cos

(S) $= -\cos 30°$

(T)

$= -\sqrt{3}/2$

find the value of cos(120°)

A. 1/√2

B. -1/2

C. -√3 /2

D. √3 /2

$\cos 120^\circ$

S $\cos(90^\circ + 30^\circ)$ — sin

S T $= -\sin 30^\circ = -1/2$

S $\cos(180^\circ - 60^\circ)$

S T $= -\cos 60^\circ = -1/2$

Trigonometric Identities

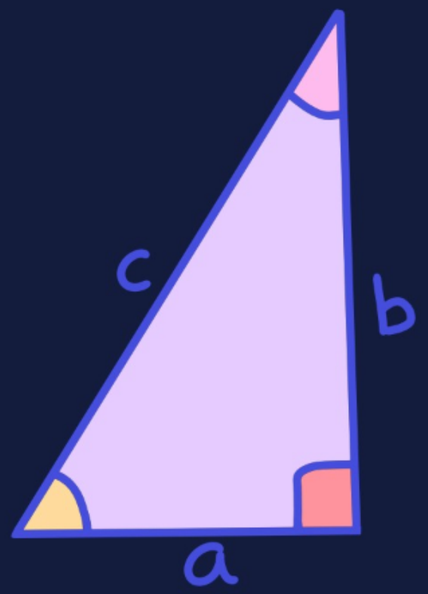
Pythagorean Identities: (ત્રિકોણમિતિ)

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

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

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

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



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

Trigonometric Addition & Subtraction Formulas:

Sine Formulas

$$\sin(A+B) = \sin A \cos B + \cos A \sin B$$

$$\sin(A-B) = \sin A \cos B - \cos A \sin B$$

Cosine Formulas

$$\cos(A+B) = \cos A \cos B - \sin A \sin B$$

$$\cos(A-B) = \cos A \cos B + \sin A \sin B$$

$$\sin(\alpha+\beta) = \sin\alpha\cos\beta + \cos\alpha\sin\beta$$

$$\sin(\alpha-\beta) = \sin\alpha\cos\beta - \cos\alpha\sin\beta$$

$$\cos(\alpha+\beta) = \cos\alpha\cos\beta - \sin\alpha\sin\beta$$

$$\cos(\alpha-\beta) = \cos\alpha\cos\beta + \sin\alpha\sin\beta$$

Ques. find value of sin 15°

Ques. find value of cos 75°

SOLUTION

Double Angle Formulae:

Sine Double Angle:

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

Cosine Double Angle:

$$\cos(2\theta) = \cos^2\theta - \sin^2\theta \quad (\text{primary})$$

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

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

HOME WORK

- Notes
- PCP
- Revise

Next Lecture's Goal

- Exponential Functions
- Logarithmic Functions
- Graphs

Thank you...

Murkh balak

Milte hai ki kal

Isse josh ke sath

Byy....

DESIGNED BY
ABHIGYAN MISHRA

SWAGAT HAI SABHI

LAAL BAAL GOPALON KA

AAJ KE ISS AMAZING SESSION ME!!!!


SWAHA

STAY CONNECTED

KEEP LEARNING

Thank You

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