Class 11 – Chapter: Trigonometric Functions

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1. Introduction

Trigonometry deals with the relationship between angles and sides of a triangle. In Class 11, this is extended using the concept of a unit circle to define trigonometric functions for all real numbers.

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2. Measurement of Angles

- Degree: Common unit, 360° in a full rotation.
- Radian: Based on the arc of a circle.
  - Conversion:

- 180° = π radians
- 1 radian ≈ 57.3°

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3. Trigonometric Functions

Defined using the unit circle:

- Basic functions:
  - sin θ = y

- cos θ = x
- tan θ = y/x, provided x □ 0
- Others: cosec θ, sec θ, cot θ

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4. Domain and Range

Function	Domain	Range
sin x	ℝ	[-1, 1]
cos x	ℝ	[-1, 1]
tan x	ℝ \ {π/2 + nπ}	ℝ
cot x	ℝ \ {nπ}	ℝ

sec x	ℝ \ {π/2 + nπ}	(–□, –1] □ [1, □)
cosec x	ℝ \ {nπ}	(–□, –1] □ [1, □)

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5. Graphs of Trigonometric Functions

- sin x & cos x: Periodic with period 2π
- tan x & cot x: Period π
- Graphs help understand amplitude, period, and zeroes

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6. Trigonometric Identities

- $\sin^2 x + \cos^2 x = 1$
- $1 + \tan^2 x = \sec^2 x$
- $1 + \cot^2 x = \operatorname{cosec}^2 x$

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7. Signs of Trigonometric Functions

Using the ASTC rule (All Students Take Calculus):

- I Quadrant: All positive

- II Quadrant: Sin, cosec positive
- III Quadrant: Tan, cot positive
- IV Quadrant: Cos, sec positive

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8. General Solutions of Trigonometric Equations

For angle x satisfying:

- sin x = a ⇒ x = nπ + (–1)^n arcsin a
- cos x = a ⇒ x = 2nπ ± arccos a

- tan x = a ⇒ x = nπ + arctan a

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9. Transformation Formulas

- sin(–x) = –sin x
- cos(–x) = cos x
- tan(–x) = –tan x

Sum and difference:

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- sin(a ± b) = sin a cos b ± cos a sin b
- cos(a ± b) = cos a cos b sin a sin b
- tan(a ± b) = (tan a ± tan b) / (1 tan a tan b)

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10. Applications

- Physics (wave motion, oscillations)
- Engineering (mechanical design, sound, etc.)
- Architecture and navigation

11. Tips for Exams

- Learn values of sin, cos, tan at standard angles (0°, 30°, 45°, 60°, 90°)
- Practice identities regularly
- Solve questions involving general solutions
- Focus on graphs and signs in all quadrants