

CHAPTER 3

Trigonometric Functions

CBSE · Mathematics · Class 11

WHAT THIS CHAPTER DOES

Boards prep that builds confidence, not anxiety.

TODAY'S MISSION

What you will own by the end of this chapter

WHY THIS MATTERS

Why this chapter unlocks calculus, physics, and engineering

TOPIC

A

Part A — Angles, Radians, Arc and Sector

TOPIC

Measuring angles — degrees vs radians

POINT 1

POINT 2

POINT 3

POINT 4

WORKED EXAMPLE

Worked example — radian, arc, and sector on a number line



TOPIC

Common angle conversion table

TOPIC

Quick checkpoint — angles and arc

TOPIC

B

Part B — Generalised Trig Ratios on the Unit Circle

TOPIC

Trig ratios for ANY angle — the unit-circle definition

POINT 1	POINT 2	POINT 3	POINT 4

TOPIC

ASTC — signs of trig ratios by quadrant

WORKED EXAMPLE

Worked example — find remaining ratios given $\sin$ and quadrant

TRY IT · SOLVE BEFORE YOU PEEK

30-second check — Part B

Work it out before you flip the answer.

SOLUTION

TOPIC

C

Part C — Identities and Sum/Difference Formulas

THEOREM · LOAD-BEARING RESULT

Theorem — the three Pythagorean identities



For every real x where the expressions are defined: (i) $\sin^2 x + \cos^2 x = 1$; (ii) $1 + \tan^2 x = \sec^2 x$; (iii) $1 + \cot^2 x = \operatorname{cosec}^2 x$.

STATEMENT

For every real x where the expressions are defined: (i) $\sin^2 x + \cos^2 x = 1$; (ii) $1 + \tan^2 x = \sec^2 x$; (iii) $1 + \cot^2 x = \operatorname{cosec}^2 x$.

WHY THIS MATTERS

- On the unit circle, the point $(\cos x, \sin x)$ satisfies $x^2 + y^2 = 1$ by Pythagoras
- Identity (i) is exactly this
- Dividing (i) by $\cos^2 x$ gives (ii)

TOPIC

Sum and difference formulas

POINT 1

POINT 2

POINT 3

POINT 4

WORKED EXAMPLE

Worked example — evaluate $\sin 75^\circ$ using sum formula

TOPIC

Double-angle, triple-angle, and product-sum

POINT 1

POINT 2

POINT 3

POINT 4

WORKED EXAMPLE

Worked example — prove $(\cos 7x + \cos 5x)/(\sin 7x - \sin 5x) = \cot x$

TOPIC

D

Part D — General Solutions of Trig Equations

TOPIC

General-solution formulas — memorise the three

WORKED EXAMPLE

Worked example — solve $\sin 2x = \sqrt{3}/2$

TOPPER TEMPLATE · MARK-BY-MARK

Topper template — '3-mark prove a trig identity'

PYQ PATTERNS

Top-5 PYQ patterns — what comes from this chapter

MARKS DISTRIBUTION

Where the marks come from — sub-topic weightage

TOPPER TEMPLATE · MARK-BY-MARK

Convert degrees $\leftrightarrow$ radians / arc-length / sector area (2 marks)

1 **CONVERT**
0.5 m

Given $\theta = 15^\circ$. $1^\circ = \pi/180 \text{ rad} \Rightarrow \theta = 15 \times \pi/180 = \pi/12 \text{ rad}$.

2 **FORMULA**
0.5 m

Arc length $s = r\theta$ (θ in radians). Here $r = 5 \text{ cm}$.

3 **SUBSTITUTE**
0.5 m

$s = 5 \times \pi/12 = 5\pi/12 \text{ cm}$.

4 **ANSWER**
0.5 m

$s \approx 5 \times 3.1416 / 12 \approx 1.31 \text{ cm}$. Final answer: $5\pi/12 \text{ cm} \approx 1.31 \text{ cm}$.

TOPPER TEMPLATE · MARK-BY-MARK

Find remaining trig ratios from one ratio + quadrant (3 marks)

1 **IDENTITY**
0.5 m

Given $\sin x = 3/5$. Use $\sin^2 x + \cos^2 x = 1 \Rightarrow 9/25 + \cos^2 x = 1 \Rightarrow \cos^2 x = 16/25$.

2 **SQUARE ROOT + ASTC**
1.0 m

$|\cos x| = 4/5$. x is in Q2 where $\cos$ is NEGATIVE (ASTC: only $\sin$ positive in Q2). Hence $\cos x = -4/5$.

3 **BUILD**
1.0 m

$\tan x = \sin x / \cos x = (3/5)/(-4/5) = -3/4$. $\cot x = -4/3$. $\sec x = 1/\cos x = -5/4$. $\operatorname{cosec} x = 1/\sin x = 5/3$.

4 **STATE**
0.5 m

$\cos x = -4/5$, $\tan x = -3/4$, $\cot x = -4/3$, $\sec x = -5/4$, $\operatorname{cosec} x = 5/3$.

TOPPER TEMPLATE · MARK-BY-MARK

Prove a trigonometric identity (3 marks)

1 PLAN

0.5 m

Start from LHS = $(\cos 7x + \cos 5x)/(\sin 7x - \sin 5x)$, the more complex side, and reduce to $\cot x$.

2 TRANSFORM

1.5 m

$\cos C + \cos D = 2 \cos((C+D)/2) \cos((C-D)/2)$. So num = $2 \cos 6x \cos x$. $\sin C - \sin D = 2 \cos((C+D)/2) \sin((C-D)/2)$. So den = $2 \cos 6x \sin x$.

3 SIMPLIFY

1.0 m

LHS = $(2 \cos 6x \cos x)/(2 \cos 6x \sin x) = \cos x / \sin x = \cot x = \text{RHS}$. $\therefore$ LHS = RHS, proved.

PYQ PATTERNS

Top PYQ patterns to drill

#1	Convert between degrees and radians; arc-length / sector-area numerical with $s = r\theta$ and $A = \frac{1}{2}r^2\theta$. (2 marks)	88%
#2	Find values of remaining trig ratios when ONE ratio and the quadrant are given. (3 marks)	82%
#3	Prove a trig identity using sum/difference, double-angle or product-to-sum formulas. (3 marks)	78%
#4	Find the general solution of a trig equation ($\sin x = k$, $\cos x = k$, $\tan x = k$, or a combined form). (3 marks)	70%
#5	Compute a numerical value using double / triple-angle or sum-difference (e.g. $\sin 75^\circ$, $\cos 15^\circ$, $\tan 75^\circ$). (4 marks)	65%

RECAP · MEMORISE THESE

Chapter 3 summary — one screen

WHAT'S NEXT

What comes next



Action items

readyforboards.com

Helpline: Stuck on a concept? Call +91 70330 05444 — our faculty replies in 30 min.

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