

Class 10 Maths

Chapter 8: Introduction to Trigonometry

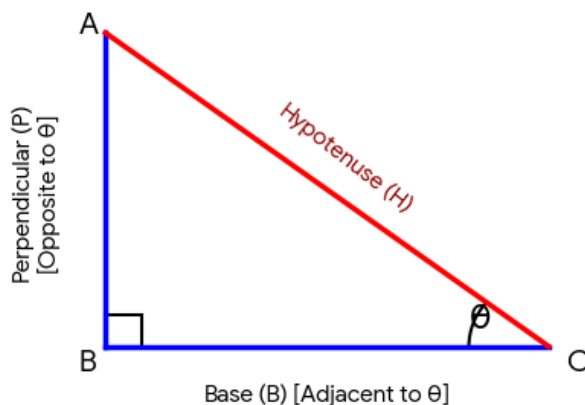
1. Introduction

Trigonometry is the study of relationships between the sides and angles of a triangle. The word is derived from the Greek words "tri" (meaning three), "gon" (meaning sides), and "metron" (meaning measure).

2. Trigonometric Ratios

The trigonometric ratios of an acute angle in a right triangle express the relationship between the angle and the lengths of its sides.

Trigonometric Ratios in a Right-Angled Triangle



For angle θ (at vertex C) in right-angled $\triangle ABC$, the 6 trigonometric ratios are defined as:

- sine θ ($\sin \theta$) = Perpendicular / Hypotenuse = $AB / AC = P / H$
- cosine θ ($\cos \theta$) = Base / Hypotenuse = $BC / AC = B / H$
- tangent θ ($\tan \theta$) = Perpendicular / Base = $AB / BC = P / B$

The remaining three are reciprocals of the above:

- cosecant θ ($\operatorname{cosec} \theta$) = $1 / \sin \theta$ = Hypotenuse / Perpendicular = H / P
- secant θ ($\sec \theta$) = $1 / \cos \theta$ = Hypotenuse / Base = H / B
- cotangent θ ($\cot \theta$) = $1 / \tan \theta$ = Base / Perpendicular = B / P

Important Relation:

$$\tan \theta = \sin \theta / \cos \theta$$

$$\cot \theta = \cos \theta / \sin \theta$$

3. Trigonometric Ratios of Specific Angles

Below is the deeply structured table of values for standard angles (0° , 30° , 45° , 60° , 90°):

Ratio / Angle (θ)	0°	30°	45°	60°	90°
$\sin \theta$	0	$1/2$	$1/\sqrt{2}$	$\sqrt{3}/2$	1
$\cos \theta$	1	$\sqrt{3}/2$	$1/\sqrt{2}$	$1/2$	0
$\tan \theta$	0	$1/\sqrt{3}$	1	$\sqrt{3}$	Not defined (∞)
$\operatorname{cosec} \theta$	Not defined (∞)	2	$\sqrt{2}$	$2/\sqrt{3}$	1
$\sec \theta$	1	$2/\sqrt{3}$	$\sqrt{2}$	2	Not defined (∞)
$\cot \theta$	Not defined (∞)	$\sqrt{3}$	1	$1/\sqrt{3}$	0

4. Trigonometric Identities

An equation involving trigonometric ratios of an angle is called a trigonometric identity if it is true for all values of the angle(s) involved.

The three fundamental Pythagorean identities are:

1. **$\sin^2\theta + \cos^2\theta = 1$** (True for $0^\circ \leq \theta \leq 90^\circ$)

Derived forms: $\sin^2\theta = 1 - \cos^2\theta$ | $\cos^2\theta = 1 - \sin^2\theta$

2. **$1 + \tan^2\theta = \sec^2\theta$** (True for $0^\circ \leq \theta < 90^\circ$)

Derived forms: $\sec^2\theta - \tan^2\theta = 1$ | $\tan^2\theta = \sec^2\theta - 1$

3. **$1 + \cot^2\theta = \operatorname{cosec}^2\theta$** (True for $0^\circ < \theta \leq 90^\circ$)

Derived forms: $\operatorname{cosec}^2\theta - \cot^2\theta = 1$ | $\cot^2\theta = \operatorname{cosec}^2\theta - 1$