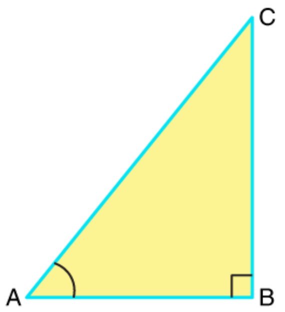
CLASS – 10

CHAPTER -8 Trigonometry

Trigonometry Ratios

Opposite & Adjacent Sides in a Right Angled Triangle

In the ΔABC right-angled at B, BC is the side opposite to ∠A, AC is the hypotenuse and AB is the side adjacent to ∠A.



Trigonometric Ratios

For the right ΔABC, right-angled at ∠B, the trigonometric ratios of the ∠A are as follows:

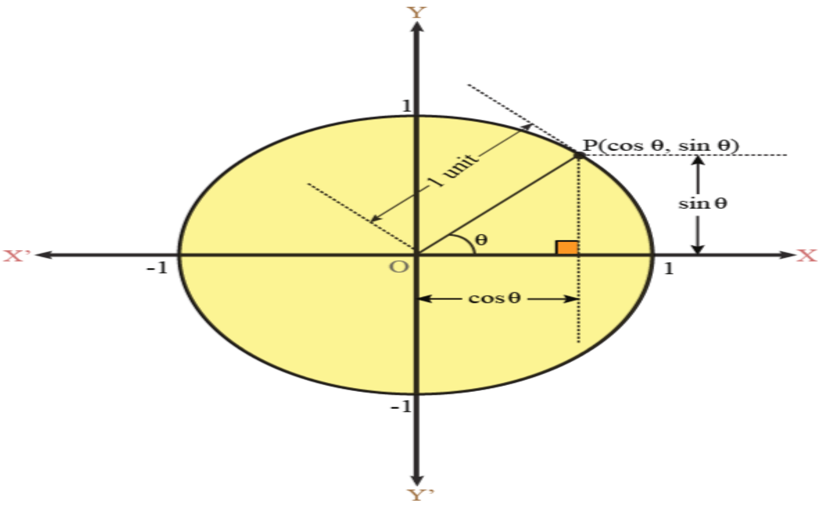
- sin A=opposite side/hypotenuse=BC/AC
- cos A=adjacent side/hypotenuse=AB/AC
- tan A=opposite side/adjacent side=BC/AB
- cosec A=hypotenuse/opposite side=AC/BC
- sec A=hypotenuse/adjacent side=AC/AB
- cot A=adjacent side/opposite side=AB/BC

Visualization of Trigonometric Ratios Using a Unit Circle

Draw a circle of the unit radius with the origin as the centre. Consider a line segment OP joining a point P on the circle to the centre which makes an angle θ with the x-axis. Draw a perpendicular from P to the x-axis to cut it at Q.

- sinθ=PQ/OP=PQ/1=PQ
- cosθ=OQ/OP=OQ/1=OQ

- tanθ=PQ/OQ=sinθ/cosθ
- cosecθ=OP/PQ=1/PQ
- secθ=OP/OQ=1/OQ
- cotθ=OQ/PQ=cosθ/sinθ



Visualisation of Trigonometric Ratios Using a Unit Circle

Relation between Trigonometric Ratios

- cosec θ =1/sin θ
- sec θ = 1/cos θ
- tan θ = sin θ/cos θ
- cot θ = cos θ/sin θ=1/tan θ

Trigonometric Ratios of Specific Angles

Range of Trigonometric Ratios from 0 to 90 degrees

For $0^\circ \leq \theta \leq 90^\circ$,

- $0 \leq \sin\theta \leq 1$
- $0 \leq \cos\theta \leq 1$
- $0 \leq \tan\theta < \infty$
- $1 \leq \sec\theta < \infty$
- $0 \leq \cot\theta < \infty$
- $1 \leq \operatorname{cosec}\theta < \infty$

tanθ and secθ are not defined at 90°.
cotθ and cosecθ are not defined at 0°.

Variation of trigonometric ratios from 0 to 90 degrees

As θ increases from 0° to 90°

- sin θ increases from 0 to 1
- cos θ decreases from 1 to 0
- tan θ increases from 0 to ∞
- cosec θ decreases from ∞ to 1
- sec θ increases from 1 to ∞
- cot θ decreases from ∞ to 0

Standard values of Trigonometric ratios

∠A	0^o	30^o	45^o	60^o	90^o
sin A	0	1/√2	1/√2	√3/2	1
cos A	1	√3/2	1/√2	1/2	0
tan A	0	1/√3	1	√3	not defined
cosec A	not defined	2	√2	2/√3	1
sec A	1	2/√3	√2	2	not defined
cot A	not defined	√3	1	1/√3	0

Trigonometric Ratios of Complementary Angles

Complementary Trigonometric ratios

If θ is an acute angle, its complementary angle is $90^\circ - θ$. The following relations hold true for trigonometric ratios of complementary angles.

- $\sin(90^\circ - \theta) = \cos\theta$
- $\cos(90^\circ - \theta) = \sin\theta$
- $\tan(90^\circ - \theta) = \cot\theta$
- $\cot(90^\circ - \theta) = \tan\theta$
- $\text{cosec}(90^\circ - \theta) = \sec\theta$
- $\sec(90^\circ - \theta) = \text{cosec}\,\theta$

Trigonometric Identities

- $\sin^2\theta+\cos^2\theta=1$
- $1+\cot^2\theta=\text{coesc}^2\theta$
- $1+\tan^2\theta=\sec^2\theta$