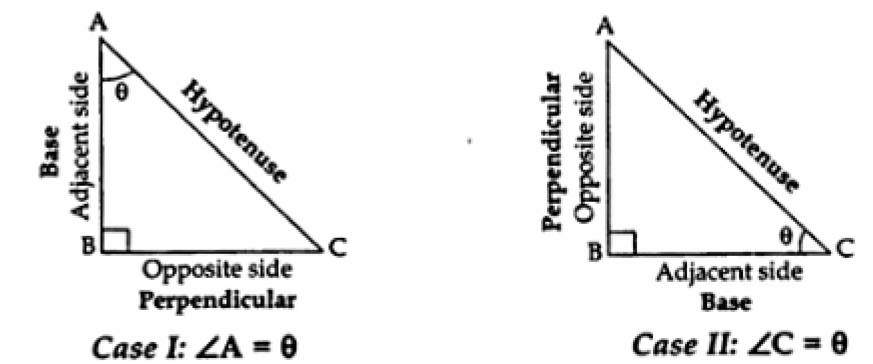
- Position of a point P in the Cartesian plane with respect to co-ordinate axes is represented by the ordered pair (x, y).
- Trigonometry is the science of relationships between the sides and angles of a right-angled triangle.
- Trigonometric Ratios: Ratios of sides of right triangle are called trigonometric ratios. Consider triangle ABC right-angled at B. These ratios are always defined with respect to acute angle ‘A’ or angle ‘C.
- If one of the trigonometric ratios of an acute angle is known, the remaining trigonometric ratios of an angle can be easily determined.
- How to identify sides: Identify the angle with respect to which the t-ratios have to be calculated. Sides are always labelled with respect to the ‘θ’ being considered.

Let us look at both cases:



In a right triangle ABC, right-angled at B. Once we have identified the sides, we can define six t-Ratios with respect to the sides.

case I	case II
(i) sine A = *perpendicularhypotenuse*=*BCAC*	(i) sine C = *perpendicularhypotenuse*=*ABAC*
(ii) cosine A = *basehypotenuse*=*ABAC*	(ii) cosine C = *basehypotenuse*=*BCAC*
(iii) tangent A = *perpendicularbase*=*BCAB*	(iii) tangent C = *perpendicularbase*=*ABBC*
(iv) cosecant A = *hypotenuseperpendicular*=*ACBC*	(iv) cosecant C = *hypotenuseperpendicular*=*ACAB*
(v) secant A = *hypotenusebase*=*ACAB*	(v) secant C = *hypotenusebase*=*ACBC*
(v) cotangent A = *baseperpendicular*=*ABBC*	(v) cotangent C = *baseperpendicular*=*BCAB*

Note from above six relationships:

cosecant A = 1*sinA*, secant A = 1*cosineA*, cotangent A = 1*tanA*,

However, it is very tedious to write full forms of t-ratios, therefore the abbreviated notations are:
sine A is sin A
cosine A is cos A
tangent A is tan A

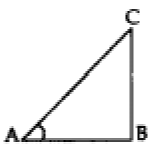
cosecant A is cosec A
secant A is sec A
cotangent A is cot A

TRIGONOMETRIC IDENTITIES

An equation involving trigonometric ratio of angle(s) is called a trigonometric identity, if it is true for all values of the angles involved. These are:
tan θ = *sinθcosθ*
cot θ = *cosθsinθ*

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

ALERT:
A t-ratio only depends upon the angle ‘θ’ and stays the same for same angle of different sized right triangles.

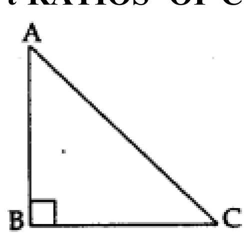


Value of t-ratios of specified angles:

∠A	**0°**	**30°**	**45°**	**60°**	**90°**
sin A	0	12	12√	3√2	1
cos A	1	3√2	12√	12	0
tan A	0	13√	1	√3	not defined
cosec A	not defined	2	√2	23√	1
sec A	1	23√	√2	2	not defined
cot A	not defined	√3	1	13√	0

The value of sin θ and cos θ can never exceed 1 (one) as opposite side is 1. Adjacent side can never be greater than hypotenuse since hypotenuse is the longest side in a right-angled Δ.

‘t-RATIOS’ OF COMPLEMENTARY ANGLES



If ΔABC is a right-angled triangle, right-angled at B, then
$\angle A + \angle C = 90°$ [$\because \angle A + \angle B + \angle C = 180°$ angle-sum-property]
or $\angle C = (90° – \angle A)$

Thus, ∠A and ∠C are known as complementary angles and are related by the following relationships:
sin (90° -A) = cos A; cosec (90° – A) = sec A
cos (90° – A) = sin A; sec (90° – A) = cosec A
tan (90° – A) = cot A; cot (90° – A) = tan A