Trigonometrical Ratios

1. **Trigonometry** is the study of relationship between the sides and the angles of the triangle.

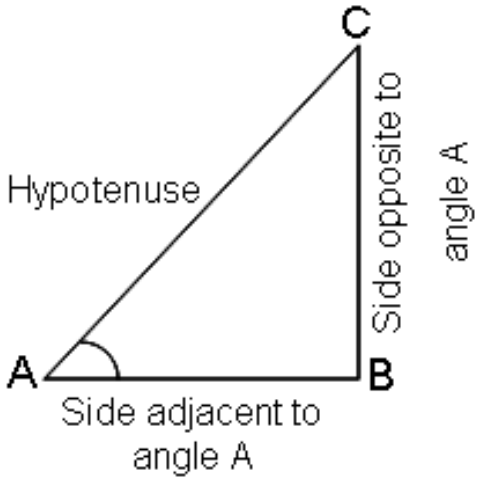
2. The word trigonometry is derived from the Greek words '*tri*' meaning three, '*gon*' meaning sides and 'metron' meaning measure.

3. Angle measured in anticlockwise direction is taken as positive angle.

4. Angle measured in clockwise direction is taken as negative angle.

5. Ratio of the sides of the right triangle with respect to the acute angles is called **trigonometric ratios** of the angle.

6. **Trigonometric ratios of acute angle** A in right triangle ABC:



i. $\sin A = \dfrac{\text{side opposite to } \angle A}{\text{hypotenuse}} = \dfrac{p}{h}$

ii. $\cos A = \dfrac{\text{side adjacent to } \angle A}{\text{hypotenuse}} = \dfrac{b}{h}$

iii. $\tan A = \dfrac{\text{side opposite to } \angle A}{\text{side adjacent to } \angle A} = \dfrac{p}{b}$

iv. $\operatorname{cosec} A = \dfrac{\text{hypotenuse}}{\text{side opposite to } \angle A} = \dfrac{h}{p}$

v. $\sec A = \dfrac{\text{hypotenuse}}{\text{side adjacent to } \angle A} = \dfrac{h}{b}$

vi. $\cot A = \dfrac{\text{side adjacent to } \angle A}{\text{side opposite to } \angle A} = \dfrac{b}{p}$

7. Each trigonometric ratio is a real number. It has no unit.

8. Only symbols cosine, sine, tangent, cotangent, sec and cosec have no meaning.

9. $(\sin\theta)^n$ is generally written as $\sin^n\theta$, *n* being *a* positive integer. Similarly, other trigonometric ratios can also be written.

10. The values of the trigonometric ratios of an angle do not vary with the length of the sides of the triangle, if the angles remain the same.

11. **Pythagoras theorem**: In a right triangle, square of the hypotenuse is equal to the sum of the square of the other two sides.

12. When any two sides of a right triangle are given, its third side can be obtained by using Pythagoras theorem.

13. **Relation between trigonometric ratios**:

i. $\tan\theta = \dfrac{\sin\theta}{\cos\theta}$

ii. $\operatorname{cosec}\theta = \dfrac{1}{\sin\theta}$

iii. $\sec\theta = \dfrac{1}{\cos\theta}$

iv. $\cot\theta = \dfrac{1}{\tan\theta} = \dfrac{\cos\theta}{\sin\theta}$

14. **Values of Trigonometric ratios** of some specific angles:

∠A	0°	30°	45°	60°	90°
sin A	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1
cos A	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0
tan A	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	Not defined
cosec A	Not defined	2	$\sqrt{2}$	$\frac{2}{\sqrt{3}}$	1
sec A	1	$\frac{2}{\sqrt{3}}$	$\sqrt{2}$	2	Not defined
cot A	Not defined	$\sqrt{3}$	1	$\frac{1}{\sqrt{3}}$	0

15. The value of sin *A* or cos A never exceeds 1, whereas the value of sec *A* or cosec *A* is always greater than 1 or equal to 1.

16. The value of $\sin\theta$ increases from 0 to 1 when θ increases from 0^0 to 90^0.

17. The value of $\cos\theta$ decreases from 1 to 0 when θ increases from 0^0 to 90^0.

18. **Trigonometric ratios of complementary angles**:
    i. $\sin(90^o - A) = \cos A$
    ii. $\cos(90^o - A) = \sin A$
    iii. $\tan(90^o - A) = \cot A$
    iv. $\cot(90^o - A) = \tan A$
    v. $\sec(90^o - A) = \operatorname{cosec} A$
    vi. $\operatorname{cosec}(90^o - A) = \sec A$

19. An equation involving trigonometric ratios of an angle, say θ, is termed as a **trigonometric identity** if it is satisfied by all values of θ.

20. **Basic trigonometric identities**:
    i. $\sin^2\theta + \cos^2\theta = 1$
    ii. $1 + \tan^2\theta = \sec^2\theta$
    iii. $1 + \cot^2\theta = \operatorname{cosec}^2\theta$