- **Meaning**

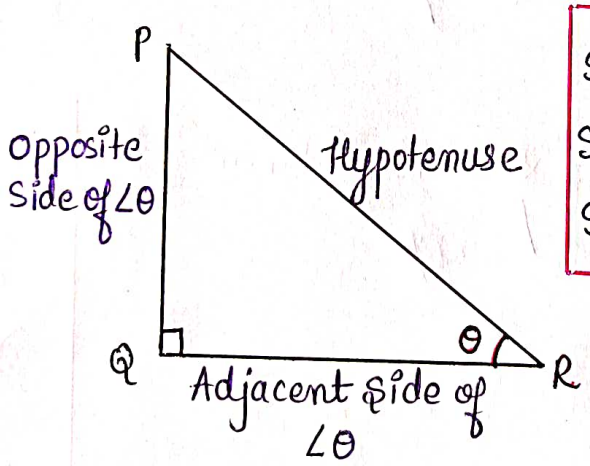
Trigonometry

Tri → Three
gona → sides
metron → measure.

Thus, Trigonometry means measurement of a triangle i.e. it is the study of relation between sides and angles of a triangles.

- **Terms related to right-angled triangle.**

In right angled ΔPQR, $\angle Q = 90°$, $\angle R = \theta$, $\angle P$ and $\angle R$ are acute angles



Seg PQ is the opposite side of $\angle\theta$
Seg QR is the adjacent side of $\angle\theta$
Seg PR is hypotenuse.

Note:

θ → known as theta is a Greek letter used in math as a variable to represent a measured angle.

• Trigonometric ratios.

→ There are 6 (six) Trigonometric ratios they are:

1] sine → 1] sin

2] cosine → 2] cos

3] tangent → 3] tan

4] cotangent → 4] cot

5] secant → 5] sec

6] cosecant → 6] cosec

→ In a right-angled triangle PQR, for any acute angle θ, the trigonometric ratios can be defined as follows.

1] $\sin\theta = \frac{\text{opposite side of } \angle\theta}{\text{Hypotenuse}} = \frac{PQ}{PR}$

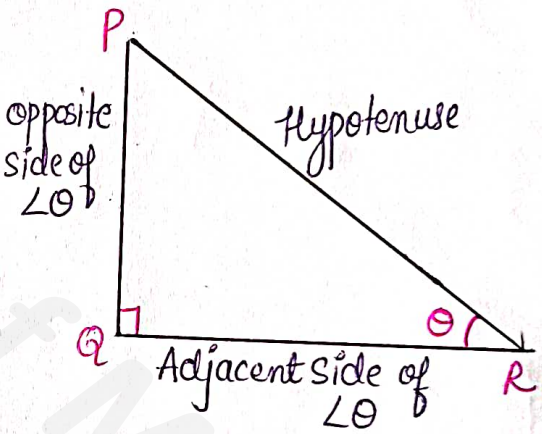
2] $\cos\theta = \frac{\text{Adjacent side of } \angle\theta}{\text{Hypotenuse}} = \frac{QR}{PR}$

3] $\tan\theta = \frac{\text{Opposite side of } \angle\theta}{\text{Adjacent side of } \angle\theta} = \frac{PQ}{QR}$

4] $\cot\theta = \frac{\text{Adjacent side of } \angle\theta}{\text{Opposite side of } \angle\theta} = \frac{QR}{PQ}$

5] $\sec\theta = \frac{\text{Hypotenuse}}{\text{Adjacent side of } \angle\theta} = \frac{PR}{QR}$

6] $\text{cosec}\,\theta = \frac{\text{Hypotenuse}}{\text{Opposite side of } \angle\theta} = \frac{PR}{PQ}$



Note: The measures of acute angles of a triangle can be written using Greek letters θ (theta), α (alpha), β (beta) etc or letters A, B etc

- The relation between the trigonometric ratios: [Imp]

• $\sin\theta = \frac{1}{\operatorname{cosec}\theta} \Rightarrow$	$\operatorname{cosec}\theta = \frac{1}{\sin\theta} \Rightarrow$	$\sin\theta \times \operatorname{cosec}\theta = 1$ or $\operatorname{cosec}\theta \times \sin\theta = 1$
• $\cos\theta = \frac{1}{\sec\theta} \Rightarrow$	$\sec\theta = \frac{1}{\cos\theta} \Rightarrow$	$\cos\theta \times \sec\theta = 1$ or $\sec\theta \times \cos\theta = 1$
• $\tan\theta = \frac{1}{\cot\theta} \Rightarrow$	$\cot\theta = \frac{1}{\tan\theta} \Rightarrow$	$\tan\theta \times \cot\theta = 1$ $\cot\theta \times \tan\theta = 1$

[VVImp]

- $\tan\theta = \frac{\sin\theta}{\cos\theta}$
- $\cot\theta = \frac{\cos\theta}{\sin\theta}$

- The table of the values of trigonometric ratios of angles $0°, 30°, 45°, 60°$ and $90°$. [Imp]

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

Relation among Trigonometric Ratios. [Imp]

Some more formulae.

1] $\sin\theta = \cos(90-\theta)$

2] $\cos\theta = \sin(90-\theta)$

3] $\tan\theta \times \tan(90-\theta) = 1$.

Trigonometric Identities [VVImp]

1]	$\sin^2\theta + \cos^2\theta = 1$	$\Rightarrow$	$\sin^2\theta = 1-\cos^2\theta$	$\Rightarrow$	$\cos^2\theta = 1-\sin^2\theta$
2]	$1 + \tan^2\theta = \sec^2\theta$	$\Rightarrow$	$\tan^2\theta = \sec^2\theta - 1$	$\Rightarrow$	$\sec^2\theta - \tan^2\theta = 1$
3]	$1 + \cot^2\theta = \operatorname{cosec}^2\theta$	$\Rightarrow$	$\cot^2\theta = \operatorname{cosec}^2\theta - 1$	$\Rightarrow$	$\operatorname{cosec}^2\theta - \cot^2\theta = 1$

*** Remember this ***

1] $\sin^2\theta + \cos^2\theta = 1$

2] $1 + \tan^2\theta = \sec^2\theta$

3] $1 + \cot^2\theta = \operatorname{cosec}^2\theta$

MCQ (Imp)

$0 \le \sin\theta \le 1$
$0 \le \cos\theta \le 1$
when $0° \le \theta \le 90°$ $\Rightarrow$ [Imp]

$\Rightarrow$ The minimum value of $\sin\theta$ and $\cos\theta$ is 0

$\Rightarrow$ The maximum value of $\sin\theta$ and $\cos\theta$ is 1.

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