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# Trigonometry

Grade 10 , Topic : 6 , Mathematics II

## Here we are

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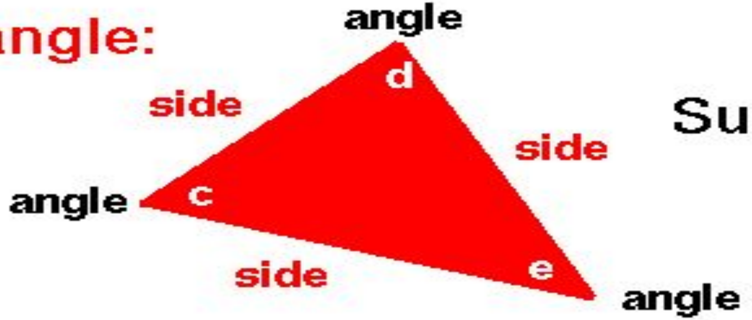
# TRIGONOMETRY

- The word ‘**trigonometry**’ is derived from the Greek words ‘**tri**’(meaning three), ‘**gon**’ (meaning sides) and ‘**metron**’ (meaning measure).
- *Trigonometry is the study of relationships between the sides and angles of a triangle.*
- Early astronomers used it to find out the distances of the stars and planets from the Earth.
- Even today, most of the technologically advanced methods used in Engineering and Physical Sciences are based on trigonometrical concepts.

# Here we are



**Triangle:**

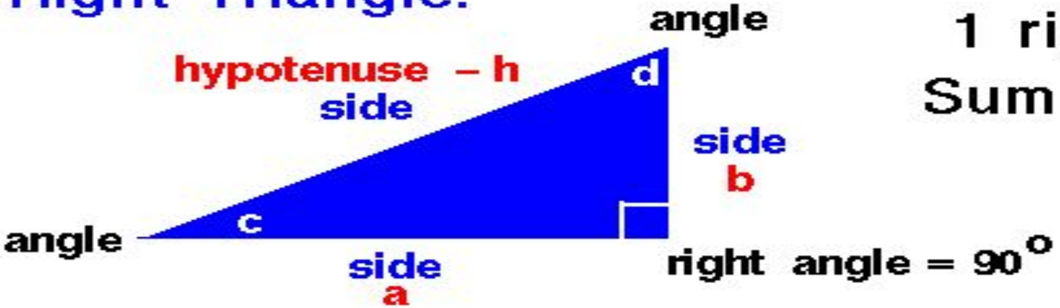



3 sides 3 angles

Sum of 3 angles = 180 degrees

c + d + e = 180 degrees

**Right Triangle:**




1 right angle (90 degrees)

Sum of 2 remaining angles = 90 degrees

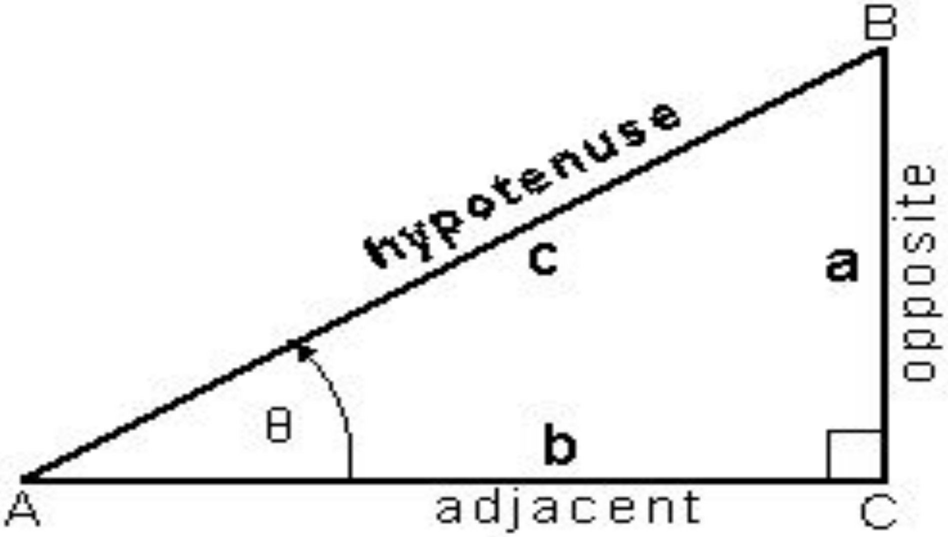
c + d = 90 degrees

Longest side is called the hypotenuse.

$$\sin\theta = \frac{a}{c} = \frac{opposite}{hypotenuse}$$

$$\cos\theta = \frac{b}{c} = \frac{adjacent}{hypotenuse}$$

$$\tan\theta = \frac{a}{b} = \frac{opposite}{adjacent}$$

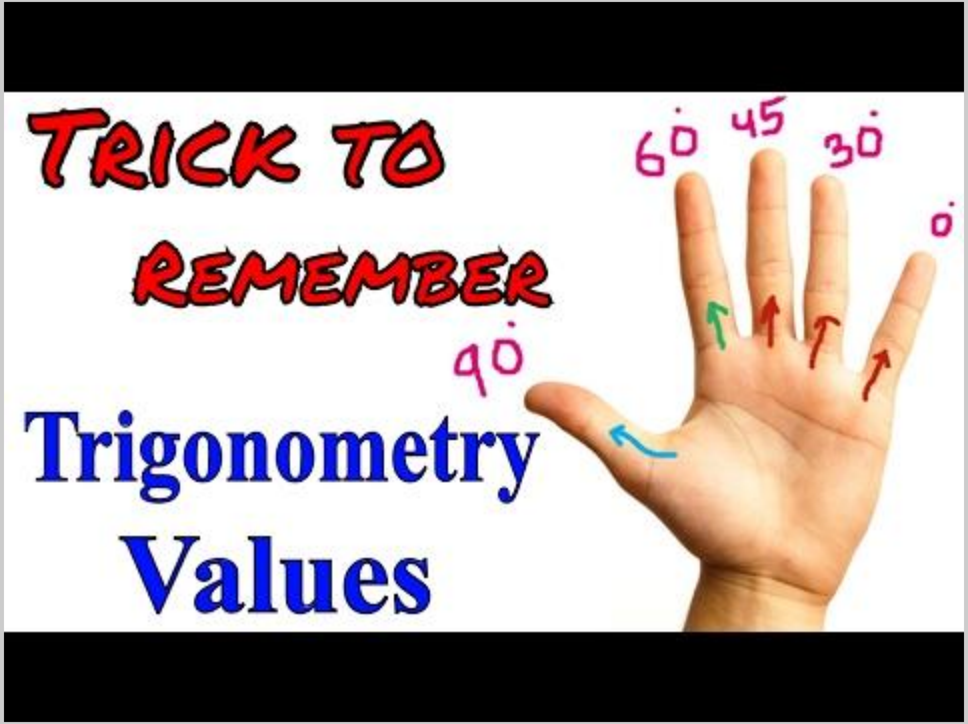



$$\csc\theta = \frac{1}{\sin\theta} \qquad \sec\theta = \frac{1}{\cos\theta} \qquad \cot\theta = \frac{1}{\tan\theta}$$

| $\theta°$ | 0° | 30° | 45° | 60° | 90° |
|---|---|---|---|---|---|
| $\sin\theta$ | 0 | $\frac{1}{2}$ | $\frac{\sqrt{2}}{2}$ | $\frac{\sqrt{3}}{2}$ | 1 |
| $\cos\theta$ | 1 | $\frac{\sqrt{3}}{2}$ | $\frac{\sqrt{2}}{2}$ | $\frac{1}{2}$ | 0 |
| $\tan\theta$ | 0 | $\frac{\sqrt{3}}{3}$ | 1 | $\sqrt{3}$ | undefined |

# How to remember






# To understand

| TRIGONOMETRIC FUNCTIONS | |
|---|---|
| *Function (abbreviation)* | *Definition* |
| sine (sin) | $\frac{\text{opposite}}{\text{hypotenuse}}$ $\sin A = \frac{a}{c}$ |
| cosine (cos) | $\frac{\text{adjacent}}{\text{hypotenuse}}$ $\cos A = \frac{b}{c}$ |
| tangent (tan) | $\frac{\text{opposite}}{\text{adjacent}}$ $\tan A = \frac{a}{b}$ |
| cotangent (cot or ctn) | $\frac{\text{adjacent}}{\text{opposite}}$ $\cot A = \frac{b}{a}$ |
| secant (sec) | $\frac{\text{hypotenuse}}{\text{adjacent}}$ $\sec A = \frac{c}{b}$ |
| cosecant (csc) | $\frac{\text{hypotenuse}}{\text{opposite}}$ $\csc A = \frac{c}{a}$ |

# To remember

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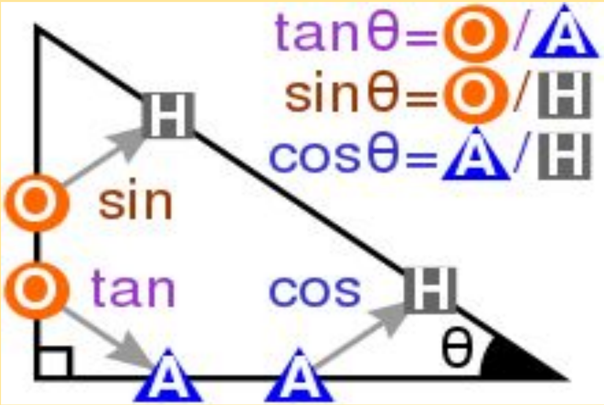
| Angles / Ratios | 0° | 30° | 45° | 60° | 90° |
|---|---|---|---|---|---|
| $\sin\theta$ | 0 | $\frac{1}{2}$ | $\frac{1}{\sqrt{2}}$ | $\frac{\sqrt{3}}{2}$ | 1 |
| $\cos\theta$ | 1 | $\frac{\sqrt{3}}{2}$ | $\frac{1}{\sqrt{2}}$ | $\frac{1}{2}$ | 0 |
| $\tan\theta$ | 0 | $\frac{1}{\sqrt{3}}$ | 1 | $\sqrt{3}$ | Not defined |
| $\text{cosec}\,\theta$ | Not defined | 2 | $\sqrt{2}$ | $\frac{2}{\sqrt{3}}$ | 1 |
| $\sec\theta$ | 1 | $\frac{2}{\sqrt{3}}$ | $\sqrt{2}$ | 2 | Not defined |
| $\cot\theta$ | Not defined | $\sqrt{3}$ | 1 | $\frac{1}{\sqrt{3}}$ | 0 |




**S**ine = **O**pposite ÷ **H**ypotenuse

**C**osine = **A**djacent ÷ **H**ypotenuse

**T**angent = **O**pposite ÷ **A**djacent

SOH-CAH-TOA

# TRIGONOMETRIC IDENTITIES

**Complementary angles**

$\sin\theta = \cos(90^\circ - \theta)$ $\rightarrow \sin 40^\circ = \cos 50^\circ$

$\cos\theta = \sin(90^\circ - \theta)$ $\rightarrow \cos 15^\circ = \sin 75^\circ$

$\tan\theta = \cot(90^\circ - \theta)$ $\rightarrow \tan 30^\circ = \cot 60^\circ$

$$\sec\theta = \frac{1}{\cos\theta}$$

$$\operatorname{cosec}\theta = \frac{1}{\sin\theta}$$

$$\cot\theta = \frac{1}{\tan\theta}$$

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

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

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

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

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

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

$$\frac{\sin^2\theta}{\cos^2\theta} + \frac{\cos^2\theta}{\cos^2\theta} = \frac{1}{\cos^2\theta} \qquad (\div \cos^2\theta)$$

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

$$\frac{\sin^2\theta}{\sin^2\theta} + \frac{\cos^2\theta}{\sin^2\theta} = \frac{1}{\sin^2\theta} \qquad (\div \sin^2\theta)$$

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

# This will help you solve

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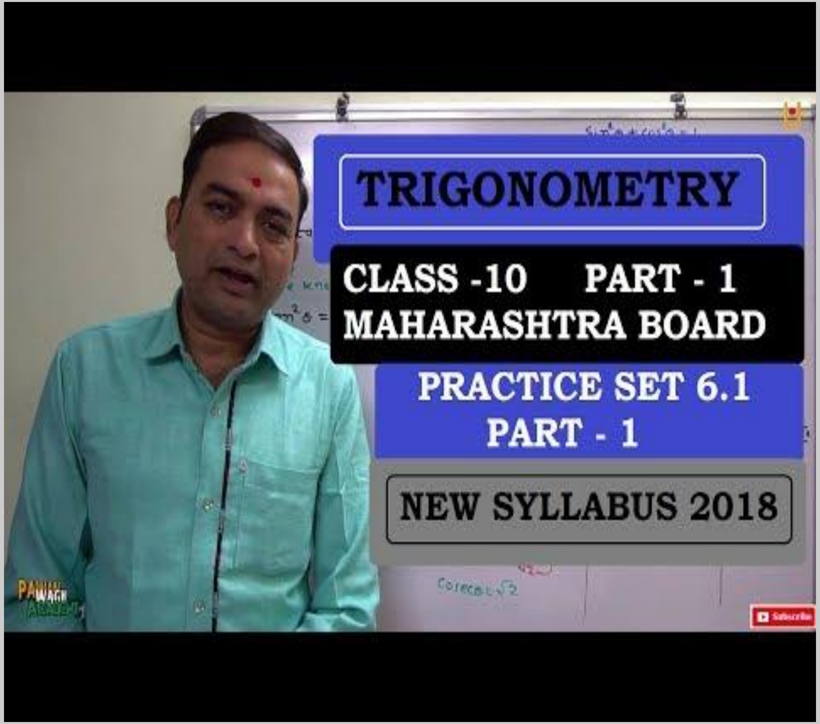


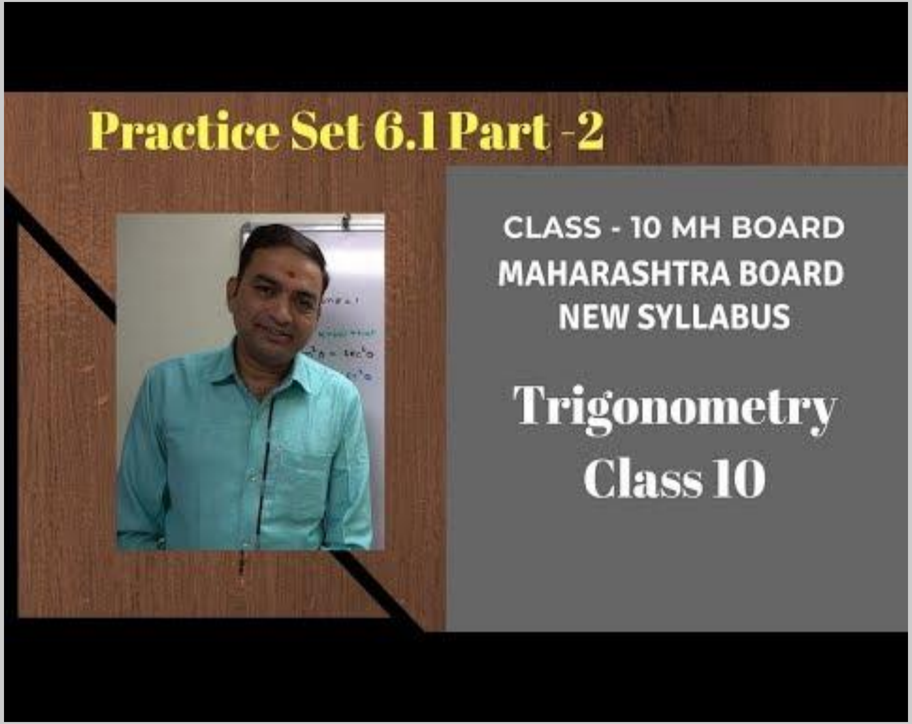

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# Thank you