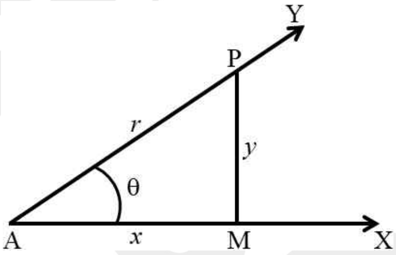
MATHEMATICS

CLASS NOTES FOR CBSE

Chapter 23. Introduction to Trigonometry

01. Trigonometric Ratios



Consider an acute angle $\angle YAX = \theta$ with initial side AX and terminal side AY. Let P be any point on the terminal side AY. Draw PM perpendicular from P on AX to get the right angled triangle AMP in which $\angle PAM = \theta$.

In right angled triangle AMP, Base = AM = x, Perpendicular = PM = y, and Hypotenuse = AP = r.

We define the following six trigonometric ratios :

(i) $\text{Sin}\,\theta = \dfrac{\text{Perpendicular}}{\text{Hypotenuse}} = \dfrac{y}{r}$, and is written as $\sin\theta$

(ii) $\text{Cosin}\,\theta = \dfrac{\text{Base}}{\text{Hypotenuse}} = \dfrac{x}{r}$, and is written as $\cos\theta$

(iii) $\text{Tangent}\,\theta = \dfrac{\text{Perpendicular}}{\text{Base}} = \dfrac{y}{x}$, and is written as $\tan\theta$

(iv) $\text{Cosecant}\,\theta = \dfrac{\text{hypotenuse}}{\text{Perpendicular}} = \dfrac{r}{y}$, and is written as $\text{cossec}\theta$

(v) $\text{Secant}\,\theta = \dfrac{\text{Hypotenuse}}{\text{Base}} = \dfrac{r}{x}$, and is written as $\sec\theta$

(vi) $\text{Cotangent}\,\theta = \dfrac{\text{Base}}{\text{Perpendicular}} = \dfrac{x}{y}$, and is written as $\cot\theta$

Remark : It is clear from the definitions of the trigonometric ratios that for any acute angleθ. we have

(i) $\text{cosec}\,\theta = \dfrac{1}{\sin\theta}$ or, $\sin\theta = \dfrac{1}{\text{cosec}\,\theta}$

(ii) $\sec\theta = \dfrac{1}{\cos\theta}$ or, $\cos\theta = \dfrac{1}{\sec\theta}$

(iii) $\cot\theta = \dfrac{1}{\tan\theta}$ or, $\tan\theta = \dfrac{1}{\cot\theta}$

(iv) $\cot\theta = \dfrac{\cos\theta}{\sin\theta}$

(v) $\tan\theta \,.\, \cot\theta = 1$

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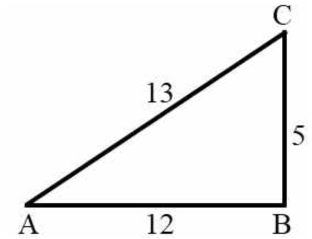
Example : In *a* ΔABC, right angled at B, if AB = 12 and BC = 5. find:

(i) sin A and tan A

(ii) cos C and cot C

Solution : By pythagoras theorem, we have



$AC^2 = AB^2 + BC^2$

$\Rightarrow \quad AC^2 = 12^2 + 5^2$

$\Rightarrow \quad AC^2 = 169$

$\Rightarrow \quad AC = 13$

(i) When we consider *t*-ratios of ∠A, we have

Base = AB = 12, Perpendicular = AB = 12 and Hypotenuse = AC = 13

$\therefore \quad \sin A = \frac{Perpendicular}{Hypotenuse} = \frac{5}{13}$ and, $\tan A = \frac{Perpendicular}{Base} = \frac{5}{12}$

(ii) When we consider *t*-ratios of ∠C, we have

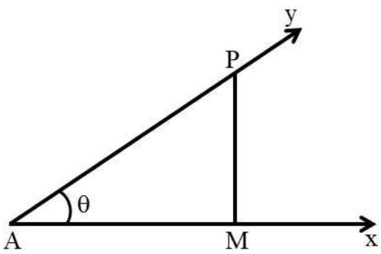
Base = BC = 5, Perpendicular = AB = 12 and Hypotenuse = AC = 13

$\therefore \quad \cos C = \frac{Base}{Hypotenuse} = \frac{5}{13}$ and, $\cot C = \frac{Base}{Perpendicular} = \frac{5}{12}$

02. Trigonometric Ratios of Some Specific Angles

Trigonometric Ratios of 0° and 90° :

Let ∠XAY = θ be an acute angle and let P be a point on its terminal side AY. Draw perpendicular PM from P on AX.



In ΔAMP, we have

$$\sin\theta = \frac{PM}{AP},\ \cos\theta = \frac{AM}{AP} \text{ and } \tan\theta = \frac{PM}{AM}$$

It is evident from ΔAMP that as θ becomes smaller and smaller, line segment PM also becomes smaller and smaller; and finally when θ becomes 0°; the point P will coincide with M. Consequently, we have

PM = 0 and AP = AM

$\therefore \quad \sin 0^\circ = \frac{PM}{AP} = \frac{0}{AP} = 0, \quad \cos 0^\circ = \frac{AM}{AP} = \frac{AP}{AP} = 1$

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