



Trigonometric Ratios of multiple and Sub multiple Angles Ex 9.1 Q 29

$\therefore x$ lies in IInd quad.

$$\Rightarrow \frac{\pi}{2} < x < \pi$$

$$\Rightarrow \frac{\pi}{4} < \frac{x}{2} < \frac{\pi}{2}$$

Which means $\frac{x}{2}$ lies in first quad.

$$\text{Now, } \sin x = \frac{\sqrt{5}}{3} = \frac{p}{h} \Rightarrow \begin{matrix} p = \sqrt{5} \\ h = 3 \end{matrix} \Rightarrow b = 2$$

$$\text{so, } \cos x = \frac{b}{h} = \frac{-2}{3} \quad (\text{-ve due to II}^{\text{nd}} \text{ quad})$$

Thus,

$$\cos \frac{x}{2} = \sqrt{\frac{1 + \cos x}{2}} = \sqrt{\frac{1 - 2/3}{2}} = \frac{1}{\sqrt{6}}$$

$$\sin \frac{x}{2} = \sqrt{\frac{1 - \cos x}{2}} = \sqrt{\frac{1 + 2/3}{2}} = \sqrt{\frac{5}{6}}$$

$$\tan \frac{x}{2} = \frac{\sin \frac{x}{2}}{\cos \frac{x}{2}} = \frac{\sqrt{\frac{5}{6}}}{\frac{1}{\sqrt{6}}} = \sqrt{5}$$

Trigonometric Ratios of multiple and Sub multiple Angles Ex 9.1
Q30(i)

Since x lies in IInd quadrant

$$\Rightarrow \frac{\pi}{2} < x < \pi$$

$$\Rightarrow \frac{\pi}{4} < \frac{x}{2} < \frac{\pi}{2}, \text{ which means } \frac{x}{2} \text{ lies in I}^{\text{st}} \text{ quad.}$$

Now,

$$\sin x = \frac{1}{4} = \frac{p}{h} \Rightarrow p = 1 \quad \Rightarrow b = \sqrt{15}$$

$$h = 4$$

$$\text{so, } \cos x = \frac{b}{h} = \frac{-\sqrt{15}}{4} \quad (-\text{ve due to II}^{\text{nd}} \text{ quad})$$

Thus,

$$\cos \frac{x}{2} = \sqrt{\frac{1 + \cos x}{2}} = \sqrt{\frac{1 - \frac{\sqrt{15}}{4}}{2}} = \frac{\sqrt{4 - \sqrt{15}}}{8}$$

$$\sin \frac{x}{2} = \sqrt{\frac{1 - \cos x}{2}} = \sqrt{\frac{1 + \frac{\sqrt{15}}{4}}{2}} = \frac{\sqrt{4 + \sqrt{15}}}{8}$$

$$\tan \frac{x}{2} = \frac{\sin \frac{x}{2}}{\cos \frac{x}{2}} = \frac{\frac{\sqrt{4 + \sqrt{15}}}{8}}{\frac{\sqrt{4 - \sqrt{15}}}{8}} = \frac{\sqrt{4 + \sqrt{15}}}{\sqrt{4 - \sqrt{15}}}$$

$$= \frac{\sqrt{(4 + \sqrt{15})(4 + \sqrt{15})}}{\sqrt{(4 - \sqrt{15})(4 + \sqrt{15})}}$$

$$= 4 + \sqrt{15}$$

Trigonometric Ratios of multiple and Sub multiple Angles Ex 9.1 Q 30(ii)

Since θ is acute, so $0 \leq 2\theta < \pi$

$$\text{Now, } \cos \theta = \frac{4}{5} = \frac{b}{h} \Rightarrow b = 4 \quad \Rightarrow p = 3$$

$$h = 5$$

$$\therefore \sin \theta = \frac{p}{h} = \frac{3}{5}$$

$$\tan \theta = \frac{p}{b} = \frac{3}{4}$$

$$\text{so, } \tan 2\theta = \frac{2 \tan \theta}{1 - \tan^2 \theta} = \frac{2 \cdot \frac{3}{4}}{1 - \left(\frac{3}{4}\right)^2}$$

$$= \frac{\frac{6}{4}}{\frac{7}{16}} = \frac{24}{7}$$

Trigonometric Ratios of multiple and Sub multiple Angles Ex 9.1 Q 30(iii)

$$\sin \theta = \frac{4}{5} = \frac{p}{h} \Rightarrow p = 4 \quad \Rightarrow b = 3$$

$$h = 5$$

$$\therefore \cos \theta = \frac{b}{h} = \frac{3}{5}$$

$$\text{Now, } \sin 2\theta = 2 \sin \theta \cdot \cos \theta = 2 \cdot \frac{4}{5} \cdot \frac{3}{5} = \frac{24}{25}$$

$$\cos 2\theta = \cos^2 \theta - \sin^2 \theta = \left(\frac{3}{5}\right)^2 - \left(\frac{4}{5}\right)^2 = \frac{-7}{25}$$

$$\text{so, } \sin 4\theta = \sin 2 \cdot 2\theta = 2 \sin 2\theta \cdot \cos 2\theta$$

$$= 2 \cdot \frac{24}{25} \cdot \left(\frac{-7}{25}\right)$$

$$= \frac{-336}{625}$$

***** END *****