

**ACHARYA A. V. PATEL JUNIOR COLLEGE, SVKM**  
**EXCELLENCE PROGRAM - SYJC (SCIENCE)**  
**MATHEMATICS & STATISTICS – PART 2**  
**TRIGONOMETRIC FORMULAE**

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**I. Fundamental Identities :**

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

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

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

**II. Negative Angles :**

$$\cos(-\theta) = \cos \theta; \quad \sin(-\theta) = -\sin \theta$$

**III. Compound Angles :**

$$\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$$

$$\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$$

$$\tan(A \pm B) = \frac{\tan A \pm \tan B}{1 \mp \tan A \tan B}$$

**IV. Allied Angle :**

$$\text{Ratio} \left( n \frac{\pi}{2} \pm \theta \right) = \pm \text{Ratio}(\theta) \quad \text{if } n = \text{even}$$

$$\text{Ratio} \left( n \frac{\pi}{2} \pm \theta \right) = \pm \text{Co-Ratio}(\theta) \quad \text{if } n = \text{odd}$$

$\pm$  sign on RHS depends upon the given ratio lies in which quadrant.

**V. Multiple Angle :**

**(i) Double Angles:**

$$\sin 2\theta = 2 \sin \theta \cos \theta$$

$$= \frac{2 \tan \theta}{1 + \tan^2 \theta}$$

$$\cos 2\theta = \cos^2 \theta - \sin^2 \theta$$

$$= 2 \cos^2 \theta - 1$$

$$= 1 - 2 \sin^2 \theta$$

$$= \frac{1 - \tan^2 \theta}{1 + \tan^2 \theta}$$

$$\tan 2\theta = \frac{2 \tan \theta}{1 - \tan^2 \theta}$$

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

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

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

$$1 - \sin 2\theta = (\cos \theta - \sin \theta)^2$$

**(ii) Half Angles :**

$$\sin \theta = 2 \sin\left(\frac{\theta}{2}\right) \cos\left(\frac{\theta}{2}\right)$$

$$= \frac{2 \tan\left(\frac{\theta}{2}\right)}{1 + \tan^2\left(\frac{\theta}{2}\right)}$$

$$\cos \theta = \cos^2\left(\frac{\theta}{2}\right) - \sin^2\left(\frac{\theta}{2}\right)$$

$$= 2 \cos^2\left(\frac{\theta}{2}\right) - 1$$

$$= 1 - 2 \sin^2\left(\frac{\theta}{2}\right)$$

$$= \frac{1 - \tan^2\left(\frac{\theta}{2}\right)}{1 + \tan^2\left(\frac{\theta}{2}\right)}$$

$$\tan \theta = \frac{2 \tan\left(\frac{\theta}{2}\right)}{1 - \tan^2\left(\frac{\theta}{2}\right)}$$

$$1 + \cos \theta = 2 \cos^2\left(\frac{\theta}{2}\right)$$

$$1 - \cos \theta = 2 \sin^2\left(\frac{\theta}{2}\right)$$

$$1 + \sin \theta = \left(\cos\left(\frac{\theta}{2}\right) + \sin\left(\frac{\theta}{2}\right)\right)^2$$

$$1 - \sin \theta = \left(\cos\left(\frac{\theta}{2}\right) - \sin\left(\frac{\theta}{2}\right)\right)^2$$

**(iii) Triple Angles :**

$$\sin 3\theta = 3 \sin \theta - 4 \sin^3 \theta$$

$$\cos 3\theta = 4 \cos^3 \theta - 3 \cos \theta$$

$$\tan 3\theta = \frac{3 \tan \theta - \tan^3 \theta}{1 - 3 \tan^2 \theta}$$