

TRIGONOMETRIC FORMULAE

Range of Trigonometric functions:

$$-1 \leq \sin \theta \leq 1$$

$$-1 \leq \cos \theta \leq 1$$

$$-\infty < \tan \theta < \infty$$

$$-\infty < \cot \theta < \infty$$

$$\operatorname{cosec} \theta \geq 1 \text{ or } \operatorname{cosec} \theta \leq -1$$

$$\sec \theta \geq 1 \text{ or } \sec \theta \leq -1$$

Trigonometric Identities:

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

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

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

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

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

$$\cos(A + B) = \cos A \cos B - \sin A \sin B$$

$$\cos(A - B) = \cos A \cos B + \sin A \sin B$$

$$2 \sin A \cos B = \sin(A + B) + \sin(A - B)$$

$$2 \cos A \sin B = \sin(A + B) - \sin(A - B)$$

$$2 \cos A \cos B = \cos(A + B) + \cos(A - B)$$

$$2 \sin A \sin B = \cos(A - B) - \cos(A + B)$$

$$\sin C + \sin D = 2 \sin \frac{C+D}{2} \cdot \cos \frac{C-D}{2}$$

$$\sin C - \sin D = 2 \cos \frac{C+D}{2} \cdot \sin \frac{C-D}{2}$$

$$\cos C + \cos D = 2 \cos \frac{C+D}{2} \cdot \cos \frac{C-D}{2}$$

$$\cos C - \cos D = 2 \sin \frac{C+D}{2} \cdot \sin \frac{D-C}{2}$$

$$\sin(A+B) \cdot \sin(A-B) = \sin^2 A - \sin^2 B$$

$$\cos(A+B) \cdot \cos(A-B) = \cos^2 A - \sin^2 B$$

$$\sin(A+B+C) = \sin A \cos B \cos C + \cos A \sin B \cos C + \cos A \cos B \sin C - \sin A \sin B \sin C$$

$$\cos(A+B+C) = \cos A \cos B \cos C - \cos A \sin B \sin C - \sin A \cos B \sin C - \sin A \sin B \cos C$$

$$\tan(A+B+C) = \frac{\tan A + \tan B + \tan C - \tan A \tan B \tan C}{1 - \tan A \tan B - \tan B \tan C - \tan C \tan A}$$

$$\sin 2A = 2 \sin A \cos A$$

$$\sin 2A = \frac{2 \tan A}{1 + \tan^2 A}$$

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

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

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

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

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

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

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

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

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

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

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

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

$$\cos \frac{A}{2} = \pm \sqrt{\frac{1 + \cos A}{2}}$$

$$\sin \frac{A}{2} = \pm \sqrt{\frac{1 - \cos A}{2}}$$

$$\tan \frac{A}{2} = \pm \sqrt{\frac{1 - \cos A}{1 + \cos A}}$$

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

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

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

$$\sin A = 3 \sin\left(\frac{A}{3}\right) - 4 \sin^3\left(\frac{A}{3}\right)$$

$$\cos A = 4 \sin^3\left(\frac{A}{3}\right) - 3 \cos\left(\frac{A}{3}\right)$$

$$\tan A = \frac{3 \tan\left(\frac{A}{3}\right) - \tan^3\left(\frac{A}{3}\right)}{1 - 3 \tan^2\left(\frac{A}{3}\right)}$$

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