

Trig Identities You Need To Know

Reciprocal Identities: $\csc \theta = \frac{1}{\sin \theta}$ $\sec \theta = \frac{1}{\cos \theta}$ $\cot \theta = \frac{1}{\tan \theta}$

Quotient Identities: $\tan \theta = \frac{\sin \theta}{\cos \theta}$ $\tan^2 \theta = \frac{\sin^2 \theta}{\cos^2 \theta}$ $\cot \theta = \frac{\cos \theta}{\sin \theta}$

Pythagorean Identities: $\sin^2 \theta + \cos^2 \theta = 1$ $1 + \tan^2 \theta = \sec^2 \theta$ $1 + \cot^2 \theta = \csc^2 \theta$
 $(1 - \cos^2 \theta = \sin^2 \theta)$
 $(1 - \sin^2 \theta = \cos^2 \theta)$

Odd/Even Functions: $-\sin \theta = \sin(-\theta)$ $\cos \theta = \cos(-\theta)$ $-\tan \theta = \tan(-\theta)$

Cofunction Identities:

Quadrant I

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

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

$$\tan\left(\frac{\pi}{2} - \theta\right) = \cot \theta$$

$$\csc\left(\frac{\pi}{2} - \theta\right) = \sec \theta$$

$$\sec\left(\frac{\pi}{2} - \theta\right) = \csc \theta$$

$$\cot\left(\frac{\pi}{2} - \theta\right) = \tan \theta$$

Quadrant II

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

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

$$\tan\left(\frac{\pi}{2} + \theta\right) = -\cot \theta$$

$$\csc\left(\frac{\pi}{2} + \theta\right) = \sec \theta$$

$$\sec\left(\frac{\pi}{2} + \theta\right) = -\csc \theta$$

$$\cot\left(\frac{\pi}{2} + \theta\right) = -\tan \theta$$

Quadrant III

$$\sin\left(\frac{3\pi}{2} - \theta\right) = -\cos \theta$$

$$\cos\left(\frac{3\pi}{2} - \theta\right) = -\sin \theta$$

$$\tan\left(\frac{3\pi}{2} - \theta\right) = \cot \theta$$

$$\csc\left(\frac{3\pi}{2} - \theta\right) = -\sec \theta$$

$$\sec\left(\frac{3\pi}{2} - \theta\right) = -\csc \theta$$

$$\cot\left(\frac{3\pi}{2} - \theta\right) = \tan \theta$$

Quadrant IV

$$\sin\left(\frac{3\pi}{2} + \theta\right) = -\cos \theta$$

$$\cos\left(\frac{3\pi}{2} + \theta\right) = \sin \theta$$

$$\tan\left(\frac{3\pi}{2} + \theta\right) = -\cot \theta$$

$$\csc\left(\frac{3\pi}{2} + \theta\right) = -\sec \theta$$

$$\sec\left(\frac{3\pi}{2} + \theta\right) = \csc \theta$$

$$\cot\left(\frac{3\pi}{2} + \theta\right) = -\tan \theta$$

Related Acute Angles:

Quadrant II

$$\sin \theta = \sin(\pi - \theta)$$

$$\cos \theta = -\cos(\pi - \theta)$$

$$\tan \theta = -\tan(\pi - \theta)$$

Quadrant III

$$\sin \theta = -\sin(\pi + \theta)$$

$$\cos \theta = -\cos(\pi + \theta)$$

$$\tan \theta = \tan(\pi + \theta)$$

Quadrant IV

$$\sin \theta = -\sin(2\pi - \theta)$$

$$\cos \theta = \cos(2\pi - \theta)$$

$$\tan \theta = -\tan(2\pi - \theta)$$

Compound Angle Formulae:

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

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

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

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

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

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

Double Angle Formulae:

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

$$\begin{aligned} \cos 2A &= \cos^2 A - \sin^2 A \\ &= 1 - 2 \sin^2 A \\ &= 2 \cos^2 A - 1 \end{aligned}$$

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

Half Angle Formulae:

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

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

$$\begin{aligned} \tan \frac{A}{2} &= \pm \sqrt{\frac{1 - \cos A}{1 + \cos A}} \\ &= \frac{\sin A}{1 + \cos A} \\ &= \frac{1 - \cos A}{\sin A} \end{aligned}$$

