

# TRIGONOMETRIC IDENTITIES *Reference*

Reciprocal Identities	Quotient Identities
$\sin \theta = \frac{1}{\csc \theta} \quad \cos \theta = \frac{1}{\sec \theta} \quad \tan \theta = \frac{1}{\cot \theta}$ $\csc \theta = \frac{1}{\sin \theta} \quad \sec \theta = \frac{1}{\cos \theta} \quad \cot \theta = \frac{1}{\tan \theta}$	$\tan \theta = \frac{\sin \theta}{\cos \theta} \quad \cot \theta = \frac{\cos \theta}{\sin \theta}$
Pythagorean Identities	
$\sin^2 \theta + \cos^2 \theta = 1$	$\tan^2 \theta + 1 = \sec^2 \theta$
$\cot^2 \theta + 1 = \csc^2 \theta$	
Cofunction Identities	Even-Odd Identities
$\sin \theta = \cos \left( \frac{\pi}{2} - \theta \right) \quad \cos \theta = \sin \left( \frac{\pi}{2} - \theta \right)$	$\sin(-\theta) = -\sin \theta \quad \csc(-\theta) = -\csc \theta$
$\csc \theta = \sec \left( \frac{\pi}{2} - \theta \right) \quad \sec \theta = \csc \left( \frac{\pi}{2} - \theta \right)$	$\cos(-\theta) = \cos \theta \quad \sec(-\theta) = \sec \theta$
$\tan \theta = \cot \left( \frac{\pi}{2} - \theta \right) \quad \cot \theta = \tan \left( \frac{\pi}{2} - \theta \right)$	$\tan(-\theta) = -\tan \theta \quad \cot(-\theta) = -\cot \theta$
Sum of Angles Identities	Difference of Angles Identities
$\sin(A + B) = \sin A \cdot \cos B + \cos A \cdot \sin B$	$\sin(A - B) = \sin A \cdot \cos B - \cos A \cdot \sin B$
$\cos(A + B) = \cos A \cdot \cos B - \sin A \cdot \sin B$	$\cos(A - B) = \cos A \cdot \cos B + \sin A \cdot \sin B$
$\tan(A + B) = \frac{\tan A + \tan B}{1 - \tan A \cdot \tan B}$	$\tan(A - B) = \frac{\tan A - \tan B}{1 + \tan A \cdot \tan B}$
Double-Angle Identities	
$\sin 2\theta = 2 \sin \theta \cdot \cos \theta$	$\cos 2\theta = \cos^2 \theta - \sin^2 \theta$
	$\cos 2\theta = 1 - 2 \sin^2 \theta$
	$\cos 2\theta = 2 \cos^2 \theta - 1$
	$\tan 2\theta = \frac{2 \tan \theta}{1 - \tan^2 \theta}$
Half-Angle Identities	
$\sin \frac{\theta}{2} = \pm \sqrt{\frac{1 - \cos \theta}{2}}$	$\cos \frac{\theta}{2} = \pm \sqrt{\frac{1 + \cos \theta}{2}}$
$\tan \frac{\theta}{2} = \pm \sqrt{\frac{1 - \cos \theta}{1 + \cos \theta}}$	$\tan \frac{\theta}{2} = \frac{1 - \cos \theta}{\sin \theta}$
	$\tan \frac{\theta}{2} = \frac{\sin \theta}{1 + \cos \theta}$
Power-Reducing Identities	
$\sin^2 \theta = \frac{1 - \cos 2\theta}{2}$	$\cos^2 \theta = \frac{1 + \cos 2\theta}{2}$
	$\tan^2 \theta = \frac{1 - \cos 2\theta}{1 + \cos 2\theta}$
Product-to-Sum Identities	Sum-to-Product Identities
$\sin A \cdot \sin B = \frac{1}{2} [\cos(A - B) - \cos(A + B)]$	$\sin A + \sin B = 2 \cdot \sin \left( \frac{A + B}{2} \right) \cdot \cos \left( \frac{A - B}{2} \right)$
$\cos A \cdot \cos B = \frac{1}{2} [\cos(A - B) + \cos(A + B)]$	$\cos A + \cos B = 2 \cdot \cos \left( \frac{A + B}{2} \right) \cdot \cos \left( \frac{A - B}{2} \right)$
$\sin A \cdot \cos B = \frac{1}{2} [\sin(A + B) + \sin(A - B)]$	$\sin A - \sin B = 2 \cdot \cos \left( \frac{A + B}{2} \right) \cdot \sin \left( \frac{A - B}{2} \right)$
$\cos A \cdot \sin B = \frac{1}{2} [\sin(A + B) - \sin(A - B)]$	$\cos A - \cos B = -2 \cdot \sin \left( \frac{A + B}{2} \right) \cdot \sin \left( \frac{A - B}{2} \right)$