

Common Trigonometric Identities

These are some of the most commonly used identities in trigonometry. They can be used to simplify expressions, solve equations, verify identities, and establish new relationships.

Fundamental Identities

Reciprocal	$\csc(x) = \frac{1}{\sin(x)}$	$\sec(x) = \frac{1}{\cos(x)}$	$\cot(x) = \frac{1}{\tan(x)}$
Quotient	$\tan(x) = \frac{\sin(x)}{\cos(x)}$	$\cot(x) = \frac{\cos(x)}{\sin(x)}$	
Pythagorean	$\sin^2(x) + \cos^2(x) = 1$	$1 + \tan^2(x) = \sec^2(x)$	$1 + \cot^2(x) = \csc^2(x)$

Co-Function , Even and Odd Identities

Co-Function	Even and Odd
$\sin\left(\frac{\pi}{2} - x\right) = \cos(x)$	$\sin(-x) = -\sin(x)$
$\cos\left(\frac{\pi}{2} - x\right) = \sin(x)$	$\cos(-x) = \cos(x)$
$\tan\left(\frac{\pi}{2} - x\right) = \cot(x)$	$\tan(-x) = -\tan(x)$
$\cot\left(\frac{\pi}{2} - x\right) = \tan(x)$	$\csc(-x) = -\csc(x)$
$\sec\left(\frac{\pi}{2} - x\right) = \csc(x)$	$\sec(-x) = \sec(x)$
$\csc\left(\frac{\pi}{2} - x\right) = \sec(x)$	$\cot(-x) = -\cot(x)$

Sum and Difference Identities

$$\sin(x + y) = \sin(x) \cos(y) + \cos(x) \sin(y)$$

$$\sin(x - y) = \sin(x) \cos(y) - \cos(x) \sin(y)$$

$$\cos(x + y) = \cos(x) \cos(y) - \sin(x) \sin(y)$$

$$\cos(x - y) = \cos(x) \cos(y) + \sin(x) \sin(y)$$

$$\tan(x + y) = \frac{\tan(x) + \tan(y)}{1 - \tan(x) \tan(y)}$$

$$\tan(x - y) = \frac{\tan(x) - \tan(y)}{1 + \tan(x) \tan(y)}$$

Double-Angle Identities

$$\sin(2x) = 2 \sin(x) \cos(x)$$

$$\begin{aligned} \cos(2x) &= \cos^2(x) - \sin^2(x) & \cos(2x) &= 2 \cos^2(x) - 1 \\ \cos(2x) &= 1 - 2 \sin^2(x) \end{aligned}$$

$$\tan(2x) = \frac{2 \tan(x)}{1 - \tan^2(x)}$$

Half-Angle Identities

$$\sin\left(\frac{x}{2}\right) = \pm \sqrt{\frac{1 - \cos(x)}{2}} \quad \left\| \quad \cos\left(\frac{x}{2}\right) = \pm \sqrt{\frac{1 + \cos(x)}{2}} \quad \left\| \quad \tan\left(\frac{x}{2}\right) = \pm \sqrt{\frac{1 - \cos(x)}{1 + \cos(x)}}$$

Product-to-Sum Identities

$$\sin(x) \sin(y) = \frac{1}{2} [\cos(x - y) - \cos(x + y)]$$

$$\cos(x) \cos(y) = \frac{1}{2} [\cos(x - y) + \cos(x + y)]$$

$$\sin(x) \cos(y) = \frac{1}{2} [\sin(x + y) + \sin(x - y)]$$

8. Sum-to-Product Identities

$$\sin(x) + \sin(y) = 2 \sin \left(\frac{x + y}{2} \right) \cos \left(\frac{x - y}{2} \right)$$

$$\sin(x) - \sin(y) = 2 \cos \left(\frac{x + y}{2} \right) \sin \left(\frac{x - y}{2} \right)$$

$$\cos(x) + \cos(y) = 2 \cos \left(\frac{x + y}{2} \right) \cos \left(\frac{x - y}{2} \right)$$

$$\cos(x) - \cos(y) = -2 \sin \left(\frac{x + y}{2} \right) \sin \left(\frac{x - y}{2} \right)$$