



## Trigonometric Identities Cheat Sheet

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### Quotient Identities

- $\tan(\theta) = \frac{\sin(\theta)}{\cos(\theta)}$
- $\cot(\theta) = \frac{\cos(\theta)}{\sin(\theta)}$

### Co-function Identities

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

### Reciprocal Identities

- $\sin(\theta) = \frac{1}{\csc(\theta)}$
- $\cos(\theta) = \frac{1}{\sec(\theta)}$
- $\tan(\theta) = \frac{1}{\cot(\theta)}$

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

### Pythagorean Identities

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

### Double Angle Identities

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

### Negative Angle Identities

- $\sin(-\theta) = -\sin(\theta)$
- $\cos(-\theta) = \cos(\theta)$
- $\tan(-\theta) = -\tan(\theta)$
- $\csc(-\theta) = -\csc(\theta)$

### Supplement Angle Identities

- $\sin(\pi - \theta) = \sin(\theta)$
- $\cos(\pi - \theta) = -\cos(\theta)$
- $\tan(\pi - \theta) = -\tan(\theta)$
- $\csc(\pi - \theta) = \csc(\theta)$

- $\sec(-\theta) = \sec(\theta)$
- $\cot(-\theta) = -\cot(\theta)$

- $\sec(\pi - \theta) = -\sec(\theta)$
- $\cot(\pi - \theta) = -\cot(\theta)$

## Angle Sum & Difference Identities

- $\sin(\alpha \pm \beta) = \sin(\alpha)\cos(\beta) \mp \cos(\alpha)\sin(\beta)$
- $\cos(\alpha \pm \beta) = \cos(\alpha)\cos(\beta) \mp \sin(\alpha)\sin(\beta)$
- $\tan(\alpha \pm \beta) = \frac{\tan(\alpha)\tan(\beta)}{1 \mp \tan(\alpha)\tan(\beta)}$

## Half-Angle Identities

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

## Sum Identities

- $\sin(\alpha) + \sin(\beta) = 2 \sin\left(\frac{\alpha + \beta}{2}\right) \cos\left(\frac{\alpha - \beta}{2}\right)$
- $\sin(\alpha) - \sin(\beta) = 2 \cos\left(\frac{\alpha + \beta}{2}\right) \sin\left(\frac{\alpha - \beta}{2}\right)$
- $\cos(\alpha) + \cos(\beta) = 2 \cos\left(\frac{\alpha + \beta}{2}\right) \cos\left(\frac{\alpha - \beta}{2}\right)$
- $\cos(\alpha) - \cos(\beta) = -2 \sin\left(\frac{\alpha + \beta}{2}\right) \cos\left(\frac{\alpha - \beta}{2}\right)$

## Product Identities

- $\sin(\alpha)\cos(\beta) = \frac{1}{2}(\sin(\alpha + \beta) + \sin(\alpha - \beta))$
- $\cos(\alpha)\sin(\beta) = \frac{1}{2}(\sin(\alpha + \beta) - \sin(\alpha - \beta))$
- $\cos(\alpha)\cos(\beta) = \frac{1}{2}(\cos(\alpha - \beta) + \cos(\alpha + \beta))$
- $\sin(\alpha)\sin(\beta) = \frac{1}{2}(\cos(\alpha - \beta) - \cos(\alpha + \beta))$