

# Trigonometry

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## Relationships Among Trigonometric Functions

$$\tan A = \frac{\sin A}{\cos A}$$

$$\sec A = \frac{1}{\cos A}$$

$$\cot A = \frac{1}{\tan A} = \frac{\cos A}{\sin A}$$

$$\csc A = \frac{1}{\sin A}$$

## Pythagorean Identities

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

$$1 + \tan^2 A = \sec^2 A$$

$$1 + \cot^2 A = \csc^2 A$$

## Even/Odd Identities

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

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

## Sum and Difference formulas

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

$$\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$$

$$\tan(A \pm B) = \frac{\tan A \pm \tan B}{1 \mp \tan A \tan B}$$

## Double Angle Formulas

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

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

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

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

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

**Half Angle Formulas**

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

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

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

**Formulas for Reducing Powers**

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

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

**Graphing Trigonometric Functions**

$$y = A \sin(Bx + C)$$

$$y = A \cos(Bx + C)$$

$$\text{Amplitude} = |A|$$

$$\text{Period} = \frac{2\pi}{B}$$

$$\text{Phase Shift} = \frac{-C}{B}$$

The **Law of Sines** is the relationship between sides and angles in any triangle.

$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$

**Law of Cosines**

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$b^2 = a^2 + c^2 - 2ac \cos B$$

$$c^2 = a^2 + b^2 - 2ab \cos C$$