

# Trigonometry

## Reciprocal Identities

$$\begin{aligned}\sin u &= \frac{1}{\csc u} & \cos u &= \frac{1}{\sec u} & \tan u &= \frac{1}{\cot u} \\ \csc u &= \frac{1}{\sin u} & \sec u &= \frac{1}{\cos u} & \cot u &= \frac{1}{\tan u}\end{aligned}$$

## Quotient Identities

$$\tan u = \frac{\sin u}{\cos u} \quad \cot u = \frac{\cos u}{\sin u}$$

## Pythagorean Identities

$$\begin{aligned}\sin^2 u + \cos^2 u &= 1 & 1 + \tan^2 u &= \sec^2 u & 1 + \cot^2 u &= \csc^2 u \\ \sin^2 u &= 1 - \cos^2 u & \tan^2 u &= \sec^2 u - 1 & \cot^2 u &= \csc^2 u - 1 \\ \cos^2 u &= 1 - \sin^2 u & 1 &= \sec^2 u - \tan^2 u & 1 &= \csc^2 u - \cot^2 u\end{aligned}$$

## Cofunction Identities

$$\begin{aligned}\sin\left(\frac{\pi}{2} - u\right) &= \cos u & \cos\left(\frac{\pi}{2} - u\right) &= \sin u & \tan\left(\frac{\pi}{2} - u\right) &= \cot u \\ \sin(90^\circ - u) &= \cos u & \cos(90^\circ - u) &= \sin u & \tan(90^\circ - u) &= \cot u\end{aligned}$$

## Odd-Even Identities

$$\begin{aligned}\sin(-u) &= -\sin u & \cos(-u) &= \cos u & \tan(-u) &= -\tan u\end{aligned}$$

## Sum and Difference Formulas

$$\begin{aligned}\sin(u + v) &= \sin u \cos v + \cos u \sin v \\ \sin(u - v) &= \sin u \cos v - \cos u \sin v\end{aligned}$$

$$\begin{aligned}\cos(u + v) &= \cos u \cos v - \sin u \sin v \\ \cos(u - v) &= \cos u \cos v + \sin u \sin v\end{aligned}$$

$$\begin{aligned}\tan(u + v) &= \frac{\tan u + \tan v}{1 - \tan u \tan v} \\ \tan(u - v) &= \frac{\tan u - \tan v}{1 + \tan u \tan v}\end{aligned}$$

## Double-Angle Formulas

$$\sin 2u = 2 \sin u \cos u$$

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

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

# Trigonometry

## Half Angle Formulas

$$\sin \frac{u}{2} = \pm \sqrt{\frac{1 - \cos u}{2}} \quad \cos \frac{u}{2} = \pm \sqrt{\frac{1 + \cos u}{2}} \quad \tan \frac{u}{2} = \frac{1 - \cos u}{\sin u}$$

## Product Formulas

$$2 \sin u \cos v = \sin(u + v) + \sin(u - v)$$

$$2 \cos u \cos v = \cos(u + v) + \cos(u - v)$$

$$2 \cos u \sin v = \sin(u + v) - \sin(u - v)$$

$$2 \sin u \sin v = \cos(u - v) - \cos(u + v)$$

## Factoring Formulas

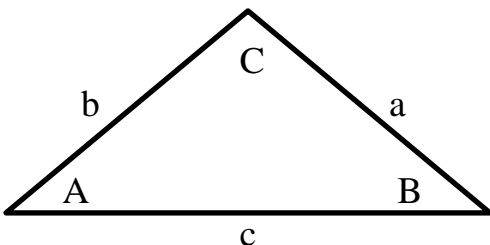
$$\sin u + \sin v = 2 \cos \frac{u-v}{2} \sin \frac{u+v}{2}$$

$$\cos u + \cos v = 2 \cos \frac{u+v}{2} \cos \frac{u-v}{2}$$

$$\sin u - \sin v = 2 \cos \frac{u+v}{2} \sin \frac{u-v}{2}$$

$$\cos u - \cos v = -2 \sin \frac{u+v}{2} \sin \frac{u-v}{2}$$

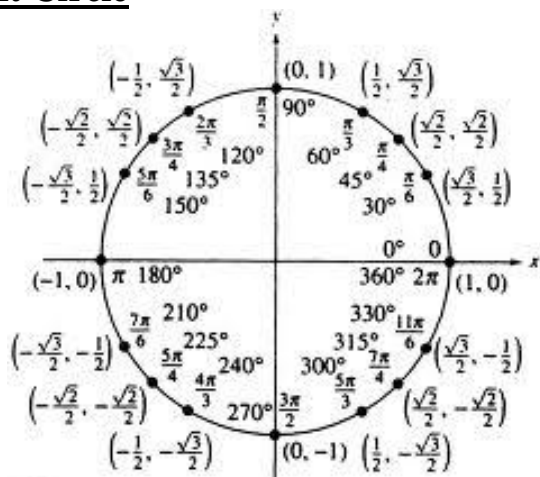
## Laws of Sines and Cosines



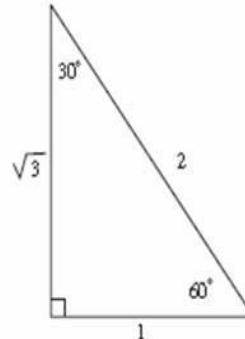
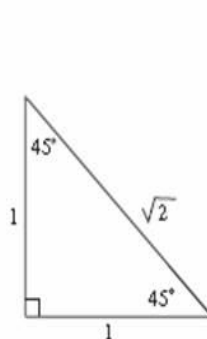
$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$

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

## Unit Circle



## SOH-CAH-TOA



$$\sin A = \frac{\text{opp}}{\text{hyp}} \quad \cos A = \frac{\text{adj}}{\text{hyp}} \quad \tan A = \frac{\text{opp}}{\text{adj}}$$