

TRIGONOMETRY

Right Triangle Definitions

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

$$\tan \theta = \frac{\text{opp}}{\text{adj}} \quad \cot \theta = \frac{\text{adj}}{\text{opp}}$$

$$\sec \theta = \frac{\text{hyp}}{\text{adj}} \quad \csc \theta = \frac{\text{hyp}}{\text{opp}}$$

Circular Definitions

$$\sin \theta = \frac{y}{r} \quad \cos \theta = \frac{x}{r}$$

$$\tan \theta = \frac{y}{x} \quad \cot \theta = \frac{x}{y}$$

$$\sec \theta = \frac{r}{x} \quad \csc \theta = \frac{r}{y}$$

Other Identities

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

$$\sec x = \frac{1}{\cos x} \quad \csc x = \frac{1}{\sin x}$$

Reduction Formulas

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

$$\tan(-x) = -\tan(x) \quad \cot(-x) = -\cot(x)$$

$$\sec(-x) = \sec(x) \quad \csc(-x) = -\csc(x)$$

Sum and Difference Formulas

$$\cos(u \pm v) = \cos u \cdot \cos v \mp \sin u \cdot \sin v$$

$$\sin(u \pm v) = \sin u \cdot \cos v \pm \cos u \cdot \sin v$$

$$\tan(u \pm v) = \frac{\tan u \pm \tan v}{1 \mp \tan u \cdot \tan v}$$

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 Formulas

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

$$\cos(2u) = \cos^2 u - \sin^2 u$$

$$\cos(2u) = 2 \cos^2 u - 1$$

$$\cos(2u) = 1 - 2 \sin^2 u$$

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

Power Reducing Formulas

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

$$\cos^2 u = \frac{1 + \cos(2u)}{2}$$

$$\tan^2 u = \frac{1 - \cos(2u)}{1 + \cos(2u)}$$

Cofunction Identities

$$\sin\left(\frac{\pi}{2} - x\right) = \cos x \quad \cos\left(\frac{\pi}{2} - x\right) = \sin x$$

$$\tan\left(\frac{\pi}{2} - x\right) = \cot x \quad \cot\left(\frac{\pi}{2} - x\right) = \tan x$$

$$\sec\left(\frac{\pi}{2} - x\right) = \csc x \quad \csc\left(\frac{\pi}{2} - x\right) = \sec x$$

$$\frac{d}{dx} \sin x = \cos x \quad \frac{d}{dx} \cos x = -\sin x$$

$$\frac{d}{dx} \tan x = \sec^2 x \quad \frac{d}{dx} \cot x = -\csc^2 x$$

$$\frac{d}{dx} \sec x = \sec x \tan x \quad \frac{d}{dx} \csc x = -\csc x \cot x$$

Derivative Rules

$$\frac{d}{dx} \arcsin x = \frac{1}{\sqrt{1-x^2}}$$

$$\frac{d}{dx} \arctan x = \frac{1}{x^2+1}$$

$$\frac{d}{dx} \operatorname{arcsec} x = \frac{1}{x\sqrt{x^2-1}}$$

$$\frac{d}{dx} \ln x = \frac{1}{x}$$

$$\frac{d}{dx} \cosh x = \sinh x$$

$$\frac{d}{dx} \sinh x = \cosh x$$

$$\frac{d}{dx} a^x = \ln a \cdot a^x$$

$$\frac{d}{dx} x^n = n \cdot x^{n-1}$$

Product to Sum Formulas

$$\sin u \sin v = 0.5[\cos(u-v) - \cos(u+v)]$$

$$\cos u \cos v = 0.5[\cos(u-v) + \cos(u+v)]$$

$$\sin u \cos v = 0.5[\sin(u+v) + \sin(u-v)]$$

$$\cos u \sin v = 0.5[\sin(u+v) - \sin(u-v)]$$

Special Angles

$$\cos 0 = 1 \quad \cos \frac{\pi}{6} = \frac{\sqrt{3}}{2} \quad \cos \frac{\pi}{4} = \frac{\sqrt{2}}{2} \quad \cos \frac{\pi}{3} = \frac{1}{2} \quad \cos \frac{\pi}{2} = 0$$

$$\sin 0 = 0 \quad \sin \frac{\pi}{6} = \frac{1}{2} \quad \sin \frac{\pi}{4} = \frac{\sqrt{2}}{2} \quad \sin \frac{\pi}{3} = \frac{\sqrt{3}}{2} \quad \sin \frac{\pi}{2} = 1$$