TRIGONOMETRY

Right Triangle Definitions

$$\sin\theta = \frac{opp}{hyp} \quad \cos\theta = \frac{adj}{hyp}$$
$$\tan\theta = \frac{opp}{adj} \quad cot\theta = \frac{adj}{opp}$$
$$\sec\theta = \frac{hyp}{adj} \quad \csc\theta = \frac{hyp}{opp}$$

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

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

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

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

Derivative Rules

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

$$\frac{d}{dx}\arcsin x = \frac{1}{\sqrt{1 - x^2}}$$
$$\frac{d}{dx}\arctan x = \frac{1}{x^2 + 1}$$
$$\frac{d}{dx}\operatorname{arc\,sec} x = \frac{1}{x\sqrt{x^2 - 1}}$$

$$\frac{d}{dx}\ln x = \frac{1}{x} \quad \frac{d}{dx}a^x = \ln a \cdot a^x$$
$$\frac{d}{dx}\cosh x = \sinh x \quad \frac{d}{dx}x^n = n \cdot x^{n-1}$$
$$\frac{d}{dx}\sinh x = \cosh x$$