

## Formula Sheet

### Pythagorean Identities

$$\sin^2 \theta + \cos^2 \theta = 1 \quad \tan^2 \theta + 1 = \sec^2 \theta \quad \cot^2 \theta + 1 = \csc^2 \theta$$

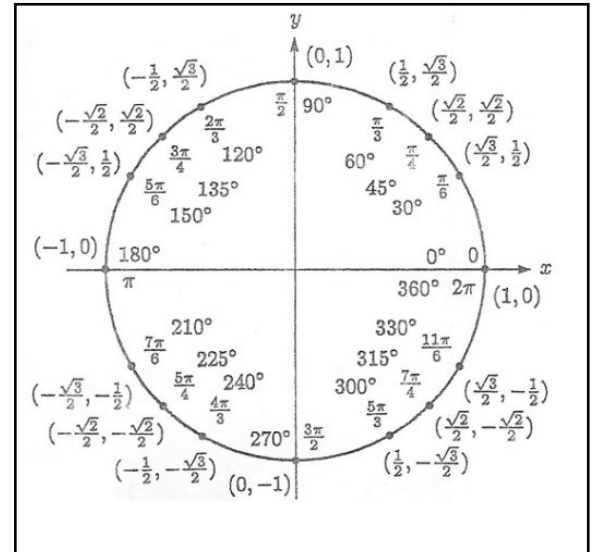
### Reciprocal Identities

$$\tan \theta = \frac{\sin \theta}{\cos \theta} \quad \cot \theta = \frac{\cos \theta}{\sin \theta} \quad \csc \theta = \frac{1}{\sin \theta} \quad \sec \theta = \frac{1}{\cos \theta}$$

### Double Angle Identities

$$\sin 2\theta = 2 \sin \theta \cos \theta \quad \cos 2\theta = \cos^2 \theta - \sin^2 \theta = 2 \cos^2 \theta - 1 = 1 - 2 \sin^2 \theta$$

$$\cos^2 \theta = \frac{1 + \cos 2\theta}{2} \quad \sin^2 \theta = \frac{1 - \cos 2\theta}{2}$$



**Derivative Quotient Rule:**  $\frac{d}{dx} \left( \frac{\text{HI}}{\text{LO}} \right) = \frac{(\text{LO}) \cdot \frac{d}{dx}(\text{HI}) - (\text{HI}) \cdot \frac{d}{dx}(\text{LO})}{(\text{LO})^2}$

**Derivative Product Rule:**  $\frac{d}{dx}(u \cdot v) = u \cdot v' + v \cdot u'$

**Chain Rule:**  $\frac{d}{dx} w(u) = w'(u) \cdot u'(x)$

Suppose  $u = f(x)$   $\Rightarrow w'(f(x)) \cdot f'(x) = \frac{dw}{du} \cdot \frac{du}{dx}$

**U-Substitution:**  $\left\{ \begin{array}{l} u = f(x) \\ du = f'(x) dx \end{array} \right\} \Rightarrow \int w'(f(x)) \cdot f'(x) dx = \int w'(u) \cdot du = w(u) + C$

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

$$\int u^n du = \frac{u^{n+1}}{n+1} + C, n \neq -1$$

$$\frac{d}{dx} e^u = e^u \cdot \frac{du}{dx}$$

$$\int e^u du = e^u + C$$

$$\frac{d}{dx} \ln u = \frac{1}{u} \cdot \frac{du}{dx}$$

$$\int \frac{1}{u} \cdot du = \int \frac{du}{u} = \ln |u| + C$$

$$\frac{d}{dx} \sin u = \cos u \cdot \frac{du}{dx}$$

$$\frac{d}{dx} \cos u = -\sin u \cdot \frac{du}{dx}$$

$$\int \sin u du = -\cos u + C$$

$$\int \cos u du = \sin u + C$$

$$\frac{d}{dx} \tan u = \sec^2 u \cdot \frac{du}{dx}$$

$$\frac{d}{dx} \cot u = -\csc^2 u \cdot \frac{du}{dx}$$

$$\int \sec^2 u du = \tan u + C$$

$$\int \csc^2 u du = -\cot u + C$$

$$\frac{d}{dx} \sec u = \sec u \tan u \cdot \frac{du}{dx}$$

$$\frac{d}{dx} \csc u = -\csc u \cot u \cdot \frac{du}{dx}$$

$$\int \sec u \tan u du = \sec u + C$$

$$\int \csc u \cot u du = -\csc u + C$$

$$\int \tan u du = \ln |\sec u| + C = -\ln |\cos u| + C$$

$$\int \cot u du = -\ln |\csc u| + C = \ln |\sin u| + C$$

$$\int \sec u du = \ln |\sec u + \tan u| + C$$

$$\int \csc u du = -\ln |\csc u + \cot u| + C$$

$$\frac{d}{dx} \sin^{-1} u = \frac{1}{\sqrt{1-u^2}} \cdot \frac{du}{dx}$$

$$\frac{d}{dx} \cos^{-1} u = -\frac{1}{\sqrt{1-u^2}} \cdot \frac{du}{dx}$$

$$\int \frac{1}{\sqrt{a^2-u^2}} du = \sin^{-1} \left( \frac{u}{a} \right) + C$$

$$\frac{d}{dx} \tan^{-1} u = \frac{1}{1+u^2} \cdot \frac{du}{dx}$$

$$\frac{d}{dx} \cot^{-1} u = -\frac{1}{1+u^2} \cdot \frac{du}{dx}$$

$$\int \frac{1}{a^2+u^2} du = \frac{1}{a} \tan^{-1} \left( \frac{u}{a} \right) + C$$

$$\frac{d}{dx} \sec^{-1} u = \frac{1}{|u| \sqrt{u^2-1}} \cdot \frac{du}{dx}$$

$$\frac{d}{dx} \csc^{-1} u = -\frac{1}{|u| \sqrt{u^2-1}} \cdot \frac{du}{dx}$$

$$\int \frac{1}{\sqrt{u^2-a^2}} du = \ln |u + \sqrt{u^2-a^2}| + C$$