

### Reciprocal Identities

$$\sin \theta = \frac{1}{\csc \theta} \quad \csc \theta = \frac{1}{\sin \theta}$$

$$\cos \theta = \frac{1}{\sec \theta} \quad \sec \theta = \frac{1}{\cos \theta}$$

$$\tan \theta = \frac{1}{\cot \theta} \quad \cot \theta = \frac{1}{\tan \theta}$$

### Quotient Identities

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

$$\frac{\cos \theta}{\sin \theta} = \cot \theta$$

### Pythagorean Identities

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

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

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

### Co-function Identities

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

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

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

### Opposite Angle Identities

$$\sin(-\theta) = -\sin \theta$$

$$\cos(-\theta) = \cos \theta$$

$$\tan(-\theta) = -\tan \theta$$

### Sum and Difference Identities

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

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

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

### Double-Angle Identities

$$\sin 2\theta = 2 \sin \theta \cos \theta$$

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

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

### Power reduction formulae

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

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

### Half-Angle Identities

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

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

$$\tan \frac{\theta}{2} = \pm \sqrt{\frac{1 - \cos \theta}{1 + \cos \theta}}, \quad \cos \theta \neq -1$$

### Product-Sum Identities

$$\sin A \cos B = \frac{1}{2} [\sin(A + B) + \sin(A - B)]$$

$$\cos A \sin B = \frac{1}{2} [\sin(A + B) - \sin(A - B)]$$

$$\sin A \sin B = \frac{1}{2} [\cos(A - B) - \cos(A + B)]$$

$$\cos A \cos B = \frac{1}{2} [\cos(A + B) + \cos(A - B)]$$

### Basic Integration Formulae

$$1. \int x^n dx = \frac{x^{n+1}}{n+1} + C \quad (n \neq -1)$$

$$2. \int \frac{1}{x} dx = \ln|x| + C$$

$$3. \int e^x dx = e^x + C$$

$$4. \int a^x dx = \frac{a^x}{\ln a} + C$$

$$5. \int \sin x dx = -\cos x + C$$

$$6. \int \cos x dx = \sin x + C$$

$$7. \int \sec^2 x dx = \tan x + C$$

$$8. \int \csc^2 x dx = -\cot x + C$$

$$9. \int \sec x \tan x dx = \sec x + C$$

$$10. \int \csc x \cot x dx = -\csc x + C$$

$$11. \int \sec x dx = \ln|\sec x + \tan x| + C$$

$$12. \int \csc x dx = \ln|\csc x - \cot x| + C$$

$$13. \int \tan x dx = \ln|\sec x| + C$$

$$14. \int \cot x dx = \ln|\sin x| + C$$

$$15. \int \frac{dx}{x^2 + a^2} = \frac{1}{a} \tan^{-1} \left( \frac{x}{a} \right) + C$$

$$16. \int \frac{dx}{\sqrt{a^2 - x^2}} = \sin^{-1} \left( \frac{x}{a} \right) + C, \quad a > 0$$