Trigonometric Identities

Pythagorean Identities

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

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

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

Co-function Identities

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

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

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

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

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

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

Even Odd Identities

$$sin(-u) = -sin(u)$$

$$cos(-u) = cos(u)$$

$$csc(-u) = -csc(u)$$

$$sec(-u) = sec(u)$$

$$cot(-u) = -cot(u)$$

Sum Difference Identities

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

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

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

Double Angle Identities

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

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

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

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

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

Half Angle Identities

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

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

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

Sum to Product Identities

$$\sin(u) + \sin(v) = 2 \sin\left(\frac{u+v}{2}\right) \cos\left(\frac{u-v}{2}\right)$$

$$\sin(u) - \sin(v) = 2 \cos\left(\frac{u+v}{2}\right) \sin\left(\frac{u-v}{2}\right)$$

$$cos(u) + cos(v) = 2 cos\left(\frac{u+v}{2}\right) cos\left(\frac{u-v}{2}\right)$$

$$cos(u) - cos(v) = -2 sin\left(\frac{u+v}{2}\right) sin\left(\frac{u-v}{2}\right)$$

Product to Sum Identities

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

$$\cos(u)\cos(v) = \frac{1}{2}[\cos(u-v) + \cos(u+v)]$$

$$\sin(u)\cos(v) = \frac{1}{2} \left[\sin(u+v) + \sin(u-v) \right]$$

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