Angle Formulas for Sum, Difference, Double, and Half Angles

Sum and Difference Angle Formulas

$$\sin(a+b) = \sin(a)\cos(b) + \cos(a)\sin(b)$$
$$\sin(a-b) = \sin(a)\cos(b) - \cos(a)\sin(b)$$

$$\cos(a+b) = \cos(a)\cos(b) - \sin(a)\sin(b)$$
$$\cos(a-b) = \cos(a)\cos(b) + \sin(a)\sin(b)$$

$$\tan(a+b) = \frac{\tan(a) + \tan(b)}{1 - \tan(a)\tan(b)} \qquad \tan(a-b) = \frac{\tan(a) - \tan(b)}{1 + \tan(a)\tan(b)}$$

Double Angle Formulas

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

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

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

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

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

Half Angle Formulas

$$\sin\left(\frac{a}{2}\right) = \pm\sqrt{\frac{1-\cos(a)}{2}}$$

$$\cos\left(\frac{a}{2}\right) = \pm\sqrt{\frac{1+\cos(a)}{2}}$$

$$\tan\left(\frac{a}{2}\right) = \pm\sqrt{\frac{1 - \cos(a)}{1 + \cos(a)}} \qquad \tan\left(\frac{a}{2}\right) = \frac{\sin(a)}{1 + \cos(a)} \qquad \tan\left(\frac{a}{2}\right) = \frac{1 - \cos(a)}{\sin(a)}$$