Compound Angles

$$\sin(\theta+\phi) = \sin\theta\ \cos\phi + \cos\theta\ \sin\phi$$
$$\cos(\theta+\phi) = \cos\theta\ \cos\phi - \sin\theta\ \sin\phi$$
$$\tan(\theta+\phi) = \frac{\tan\theta + \tan\phi}{1-\tan\theta\ \tan\phi}$$

$$\sin(\theta-\phi) = \sin\theta\ \cos\phi - \cos\theta\ \sin\phi$$
$$\cos(\theta-\phi) = \cos\theta\ \cos\phi + \sin\theta\ \sin\phi$$
$$\tan(\theta-\phi) = \frac{\tan\theta - \tan\phi}{1+\tan\theta\ \tan\phi}$$

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

$$\sin 3\,\theta = 3\ \sin\theta - 4\ \sin^3\theta$$
$$\cos 3\,\theta = 4\cos^3\theta - 3\cos\theta$$
$$\tan 3\,\theta = \frac{3\ \tan\theta - \tan^3\theta}{1-3\ \tan^2\theta}$$

$$\sin\theta\ \cos\phi = \tfrac{1}{2}\left[\sin(\theta+\phi) + \sin(\theta-\phi)\right]$$
$$\cos\theta\ \cos\phi = \tfrac{1}{2}\left[\cos(\theta+\phi) + \cos(\theta-\phi)\right]$$

$$\cos\theta\ \sin\phi = \tfrac{1}{2}\left[\sin(\theta+\phi) - \sin(\theta-\phi)\right]$$
$$\sin\theta\ \sin\phi = -\tfrac{1}{2}\left[\cos(\theta+\phi) - \cos(\theta-\phi)\right]$$

$$\sin(\alpha)+\sin(\beta) = 2\ \sin\left(\frac{\alpha+\beta}{2}\right)\ \cos\left(\frac{\alpha-\beta}{2}\right)$$
$$\cos(\alpha)+\cos(\beta) = 2\ \cos\left(\frac{\alpha+\beta}{2}\right)\ \cos\left(\frac{\alpha-\beta}{2}\right)$$

$$\sin(\alpha)-\sin(\beta) = 2\ \cos\left(\frac{\alpha+\beta}{2}\right)\ \sin\left(\frac{\alpha-\beta}{2}\right)$$
$$\cos(\alpha)-\cos(\beta) = -2\ \sin\left(\frac{\alpha+\beta}{2}\right)\ \sin\left(\frac{\alpha-\beta}{2}\right)$$

(Imagine $\alpha = \theta + \phi$ and $\beta = \theta - \phi$, then $\theta = \frac{\alpha+\beta}{2}$ and $\phi = \frac{\alpha-\beta}{2}$.)