

Identities derived through a parallelogram diagram on two concentric circles.

$$\cos \theta + r \cos(\theta + \alpha) = \sqrt{1 + 2r \cos \alpha + r^2} \cos \left(\theta + \cos^{-1} \left(\frac{1 + r \cos \alpha}{\sqrt{1 + 2r \cos \alpha + r^2}} \right) \right)$$

$$\cos \theta + r \cos(\theta + \alpha) = (1 + r \cos \alpha) \cos \theta - r \sin \alpha \sin \theta$$

which implies a more fundamental trig identity,

$$\cos(\theta + \alpha) = \cos \alpha \cos \theta - \sin \alpha \sin \theta.$$

(Angle sum formulas are more easily derived by composition of rotation matrices.)