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

Power-Reducing

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

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

EXAMPLE **Establishing an Identity**

Write an equivalent expression for $\cos^4 \theta$ that does not involve any powers of sine or cosine greater than 1.

$$\cos^4\theta = \cos^2\theta \cdot \cos^2\theta$$

$$= \frac{1+\cos(2\theta)}{2} \cdot \frac{1+\cos(2\theta)}{2}$$

$$= \frac{1+2\cos(2\theta) + (\cos(2\theta))^2}{4}$$

$$= \frac{1+2\cos(2\theta) + \frac{1+\cos(4\theta)}{2}}{4}$$

$$= \frac{1}{4} + \frac{1}{2}\cos(2\theta) + \frac{1}{8} + \frac{1}{8}\cos(4\theta)$$

$$= \frac{3}{8} + \frac{1}{2}\cos(2\theta) + \frac{1}{8}\cos(4\theta)$$

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

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

$$\sin(3\theta) = \sin(2\theta + \theta)$$

$$= \sin(2\theta)\cos\theta + \cos(2\theta)\sin\theta$$

$$= (2\cos\theta\sin\theta)\cos\theta + (\cos^2\theta - \sin^2\theta)\sin\theta$$

$$= 2\cos^2\theta\sin\theta + \cos^2\theta\sin\theta - \sin^3\theta$$

$$= 3\cos^2\theta\sin\theta - \sin^3\theta$$