1. **Double Angle Formulas**

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

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

$$\begin{aligned}\cos(2u) &= \cos^2 u - \sin^2 u\\ &= 2\cos^2 u - 1\\ &= 1 - 2\sin^2 u\end{aligned}$$

2. **EXAMPLE: Solving a Multiple Angle Equation**

Find all solutions of $2\cos x + \sin 2x = 0$

3. **EXAMPLE: Using double-angle formulas**

(a) If $x = 4\sin\theta$, $0 < \theta < \dfrac{\pi}{2}$, express $\sin 2\theta$ in terms of x.

(b) Use the following to find $\sin 2\theta$, $\cos 2\theta$, and $\tan 2\theta$.

$$\cos\theta = \frac{5}{13}, \qquad \frac{3\pi}{2} < \theta < 2\pi$$

4. **EXAMPLE: Using double-angle formulas to prove an identity**

   Prove the identity $\sin 3x = 3\sin x - 4\sin^3 x$

5. **Power-Reducing Formulas**

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

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

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

6. **EXAMPLE: Reducing a power**

Rewrite $\sin^4 x$ as a sum of first powers of the cosines of multiple angles.

7. **Half-Angle Formulas**

$$\sin\frac{u}{2} = \pm\sqrt{\frac{1-\cos u}{2}}$$

$$\cos\frac{u}{2} = \pm\sqrt{\frac{1+\cos u}{2}}$$

$$\tan\frac{u}{2} = \frac{1-\cos u}{\sin u} = \frac{\sin u}{1+\cos u}$$

8. **EXAMPLE: Using a Half-Angle Formula**

Evaluate $\cos 105^\circ$ using a half-angle formula.