Addition and Subtraction and Double- and Half-Angle Formulas

Addition and Subtraction Formulas for the Sine

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

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

Hint: remember these by the pattern – "SCCS same."

Addition and Subtraction Formulas for the Cosine

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

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

Hint: remember these by the pattern – "CCSS opposite."

Double-Angle Formula for the Sine

$$\sin 2a = 2 \sin a \cos a$$

Double-Angle Formulas for the Cosine

$$\cos 2a = \cos^2 a - \sin^2 a$$
$$\text{or}$$
$$\cos 2a = 2 \cos^2 a - 1$$
$$\text{or}$$
$$\cos 2a = 1 - 2 \sin^2 a$$

Half-Angle Formulas for the Sine and Cosine

$$\sin^2 \frac{a}{2} = \frac{1 - \cos a}{2}, \quad \text{which can be solved as:}$$
$$\sin \frac{a}{2} = \pm\sqrt{\frac{1 - \cos a}{2}},$$
but only one of the plus or minus will be correct, depending on the quadrant of the terminal point of $\frac{a}{2}$.

$$\cos^2 \frac{a}{2} = \frac{1 + \cos a}{2}, \quad \text{which can be solved as:}$$
$$\cos \frac{a}{2} = \pm\sqrt{\frac{1 + \cos a}{2}},$$
but only one of the plus or minus will be correct, depending on the quadrant of the terminal point of $\frac{a}{2}$.