

Theorem: Sum-to-Product Formulas

- $\sin u + \sin v = 2 \sin \left(\frac{u+v}{2} \right) \cos \left(\frac{u-v}{2} \right)$

- $\cos u + \cos v = 2 \cos \left(\frac{u+v}{2} \right) \cos \left(\frac{u-v}{2} \right)$

- $\sin u - \sin v = 2 \cos \left(\frac{u+v}{2} \right) \sin \left(\frac{u-v}{2} \right)$

- $\cos u - \cos v = -2 \sin \left(\frac{u+v}{2} \right) \sin \left(\frac{u-v}{2} \right)$

4. Rewrite the sum $\cos(3\theta) + \cos(11\theta)$ as a product.

5. Find the *exact* value of each of the following. *Do not give a decimal approximation.*

(a) $\sin \left(\frac{\pi}{12} \right) + \sin \left(\frac{7\pi}{12} \right)$

(b) $\cos(165^\circ) + \cos(75^\circ)$

6. Simplify the expression

$$\frac{\cos x - \cos(3x)}{\sin(3x) - \sin x}$$