

2.2 Sum and Difference Formulas

$$1. \cos\left(\frac{3\pi}{4} - \frac{\pi}{6}\right)$$

$$\cos\left(\frac{3\pi}{4}\right)\cos\left(\frac{\pi}{6}\right) + \sin\left(\frac{3\pi}{4}\right)\sin\left(\frac{\pi}{6}\right)$$

$$\left(\frac{-\sqrt{2}}{2}\right)\left(\frac{\sqrt{3}}{2}\right) + \left(\frac{\sqrt{2}}{2}\right)\left(\frac{1}{2}\right)$$

$$\frac{-\sqrt{6} + \sqrt{2}}{4} = \boxed{\frac{-\sqrt{6} + \sqrt{2}}{4}}$$

$$6. \cos\left(\frac{5\pi}{3} - \frac{7\pi}{6}\right)$$

$$\cos\left(\frac{5\pi}{3}\right)\cos\left(\frac{7\pi}{6}\right) + \sin\left(\frac{5\pi}{3}\right)\sin\left(\frac{7\pi}{6}\right)$$

$$\left(\frac{1}{2}\right)\left(\frac{-\sqrt{3}}{2}\right) + \left(\frac{-\sqrt{3}}{2}\right)\left(\frac{-1}{2}\right)$$

$$\frac{-\sqrt{3} + \sqrt{3}}{4} = \boxed{0}$$

$$2. \cos\left(\frac{2\pi}{3} - \frac{\pi}{6}\right)$$

$$\cos\left(\frac{2\pi}{3}\right)\cos\left(\frac{\pi}{6}\right) + \sin\left(\frac{2\pi}{3}\right)\sin\left(\frac{\pi}{6}\right)$$

$$\left(-\frac{1}{2}\right)\left(\frac{\sqrt{3}}{2}\right) + \left(\frac{\sqrt{3}}{2}\right)\left(\frac{1}{2}\right)$$

$$\frac{-\sqrt{3} + \sqrt{3}}{4} = \boxed{0}$$

$$7. \sin\left(\frac{5\pi}{12}\right)\cos\left(\frac{\pi}{4}\right) - \cos\left(\frac{5\pi}{12}\right)\sin\left(\frac{\pi}{4}\right)$$

$$\sin\left(\frac{5\pi}{12} - \frac{\pi}{4}\right)$$

$$\frac{5\pi}{12} - \frac{\pi}{4}$$

$$\frac{5\pi}{12} - \frac{3\pi}{12} = \frac{2\pi}{12} = \frac{\pi}{6}$$

$$3. \sin(60^\circ - \sin 45^\circ)$$

$$\sin 60^\circ \cos 45^\circ - \cos 60^\circ \sin 45^\circ$$

$$\left(\frac{\sqrt{3}}{2}\right)\left(\frac{\sqrt{2}}{2}\right) - \left(\frac{1}{2}\right)\left(\frac{\sqrt{2}}{2}\right)$$

$$\frac{\sqrt{6} - \sqrt{2}}{4} = \boxed{\frac{\sqrt{6} - \sqrt{2}}{4}}$$

$$\sin\left(\frac{5\pi}{12} - \frac{\pi}{4}\right) = \sin\left(\frac{\pi}{6}\right) = \boxed{\frac{1}{2}}$$

$$8. \sin\left(\frac{7\pi}{12}\right)\cos\left(\frac{\pi}{12}\right) - \cos\left(\frac{7\pi}{12}\right)\sin\left(\frac{\pi}{12}\right)$$

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

$$\sin\left(\frac{6\pi}{12}\right)$$

$$\sin\left(\frac{\pi}{2}\right) = \boxed{1}$$

$$4. \sin 105^\circ \text{ using } \sin(60^\circ + 45^\circ)$$

$$\sin 60^\circ \cos 45^\circ + \cos 60^\circ \sin 45^\circ$$

$$\left(\frac{\sqrt{3}}{2}\right)\left(\frac{\sqrt{2}}{2}\right) + \left(\frac{1}{2}\right)\left(\frac{\sqrt{2}}{2}\right)$$

$$\frac{\sqrt{6} + \sqrt{2}}{4} = \boxed{\frac{\sqrt{6} + \sqrt{2}}{4}}$$

$$5. \sin 75^\circ \text{ using } \sin(30^\circ + 45^\circ)$$

$$\sin 30^\circ \cos 45^\circ + \cos 30^\circ \sin 45^\circ$$

$$\left(\frac{1}{2}\right)\left(\frac{\sqrt{2}}{2}\right) + \left(\frac{\sqrt{3}}{2}\right)\left(\frac{\sqrt{2}}{2}\right)$$

$$\frac{\sqrt{2} + \sqrt{6}}{4} = \boxed{\frac{\sqrt{2} + \sqrt{6}}{4}}$$