

Find the exact value of each expression.

1. $\sin\left(\frac{7\pi}{6} - \frac{\pi}{3}\right)$

$$\begin{aligned} & \sin\left(\frac{7\pi}{6}\right)\cos\left(\frac{\pi}{3}\right) - \cos\left(\frac{7\pi}{6}\right)\sin\left(\frac{\pi}{3}\right) \\ & = \left(-\frac{1}{2}\right)\left(\frac{1}{2}\right) - \left(-\frac{\sqrt{3}}{2}\right)\left(\frac{\sqrt{3}}{2}\right) \\ & = -\frac{1}{4} + \frac{3}{4} = \frac{2}{4} = \boxed{\frac{1}{2}} \end{aligned}$$

2. $\sin\frac{7\pi}{6} - \sin\frac{\pi}{3}$

$$= -\frac{1}{2} - \frac{\sqrt{3}}{2} = \boxed{\frac{-1-\sqrt{3}}{2}}$$

Use the sum and difference formulas to find the exact values of the sine of the angle.

3. $75^\circ = 30^\circ + 45^\circ$

$$\begin{aligned} \sin 75^\circ &= \sin(30^\circ + 45^\circ) \\ &= \sin 30^\circ \cos 45^\circ + \cos 30^\circ \sin 45^\circ \\ &= \left(\frac{1}{2}\right)\left(\frac{\sqrt{2}}{2}\right) + \left(\frac{\sqrt{3}}{2}\right)\left(\frac{\sqrt{2}}{2}\right) \\ &= \frac{\sqrt{2}}{4} + \frac{\sqrt{6}}{4} = \boxed{\frac{\sqrt{2} + \sqrt{6}}{4}} \end{aligned}$$

4. $105^\circ = 60^\circ + 45^\circ$

$$\begin{aligned} \sin 105^\circ &= \sin(60^\circ + 45^\circ) \\ &= \sin 60^\circ \cos 45^\circ + \cos 60^\circ \sin 45^\circ \\ &= \left(\frac{\sqrt{3}}{2}\right)\left(\frac{\sqrt{2}}{2}\right) + \left(\frac{1}{2}\right)\left(\frac{\sqrt{2}}{2}\right) \\ &= \frac{\sqrt{6}}{4} + \frac{\sqrt{2}}{4} = \boxed{\frac{\sqrt{6} + \sqrt{2}}{4}} \end{aligned}$$

5. $195^\circ = 225^\circ - 30^\circ$

$$\begin{aligned} \sin 195^\circ &= \sin(225^\circ - 30^\circ) \\ &= \sin 225^\circ \cos 30^\circ - \cos 225^\circ \sin 30^\circ \\ &= \left(-\frac{\sqrt{2}}{2}\right)\left(\frac{\sqrt{3}}{2}\right) - \left(-\frac{\sqrt{2}}{2}\right)\left(\frac{1}{2}\right) \\ &= -\frac{\sqrt{6}}{4} + \frac{\sqrt{2}}{4} = \boxed{\frac{\sqrt{2} - \sqrt{6}}{4}} \end{aligned}$$

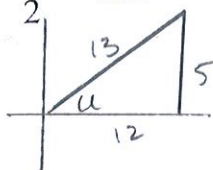
6. $\frac{11\pi}{12} = \frac{3\pi}{4} + \frac{\pi}{6}$

$$\begin{aligned} \sin \frac{11\pi}{12} &= \sin\left(\frac{3\pi}{4} + \frac{\pi}{6}\right) \\ &= \sin \frac{3\pi}{4} \cos \frac{\pi}{6} + \cos \frac{3\pi}{4} \sin \frac{\pi}{6} \\ &= \left(\frac{\sqrt{2}}{2}\right)\left(\frac{\sqrt{3}}{2}\right) + \left(-\frac{\sqrt{2}}{2}\right)\left(\frac{1}{2}\right) \\ &= \frac{\sqrt{6}}{4} - \frac{\sqrt{2}}{4} = \boxed{\frac{\sqrt{6} - \sqrt{2}}{4}} \end{aligned}$$

Find the exact value of the trigonometric function given the following:

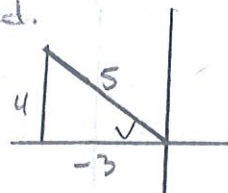
$$\sin u = \frac{5}{13}, \quad 0 < u < \frac{\pi}{2} \text{ 1st Quad.} \quad \text{and} \quad \cos v = -\frac{3}{5}, \quad \frac{\pi}{2} < v < \pi \text{ 2nd Quad.}$$

7. $\sin(u+v)$



$$\begin{aligned} &= \sin u \cos v + \cos u \sin v \\ &= \left(\frac{5}{13}\right)\left(-\frac{3}{5}\right) + \left(\frac{12}{13}\right)\left(\frac{4}{5}\right) \\ &= -\frac{15}{65} + \frac{48}{65} = \boxed{\frac{33}{65}} \end{aligned}$$

8. $\sin(u-v)$



$$\begin{aligned} &= \sin u \cos v - \cos u \sin v \\ &= \left(\frac{5}{13}\right)\left(-\frac{3}{5}\right) - \left(\frac{12}{13}\right)\left(\frac{4}{5}\right) \\ &= -\frac{15}{65} - \frac{48}{65} = \boxed{-\frac{63}{65}} \end{aligned}$$