1 *Find* $\sin \frac{17\pi}{12}$ *exactly. Show at least one intermediate step showing your usage of a sum or difference formula.*

First,

$$\frac{17\pi}{12} = \frac{8\pi}{12} + \frac{9\pi}{12} = \frac{2\pi}{3} + \frac{3\pi}{4},$$

so

$$\sin \frac{17\pi}{12} = \sin\left(\frac{2\pi}{3} + \frac{3\pi}{4}\right) = \sin\frac{2\pi}{3}\cos\frac{3\pi}{4} + \cos\frac{2\pi}{3}\sin\frac{3\pi}{4}$$
$$= \left(\frac{\sqrt{3}}{2}\right)\left(-\frac{\sqrt{2}}{2}\right) + \left(-\frac{1}{2}\right)\left(\frac{\sqrt{2}}{2}\right) = -\frac{\sqrt{6}}{4} - \frac{\sqrt{2}}{4} = -\frac{\sqrt{2}+\sqrt{6}}{4}.$$

2 *Suppose that you have angles* α *and* β *with these properties:*

- $\tan\alpha = -4/3$,
- $\pi/2 < \alpha < \pi$,
- $\cos\beta = 1/2$, *and*
- $0 < \beta < \pi/2$.

Find the following.

a $\tan\beta$

Since $0 \leq \beta \leq \pi$,

$$\sin\beta = \sqrt{1-\cos^2\beta} = \sqrt{1-\left(\frac{1}{2}\right)^2} = \frac{\sqrt{3}}{2},$$

so

$$\tan\beta = \frac{\sin\beta}{\cos\beta} = \frac{\sqrt{3}/2}{1/2} = \sqrt{3}.$$

b $\tan(\alpha-\beta)$

Since I know $\tan\alpha$ and $\tan\beta$, I'll use the formula for a difference of tangents:

$$\tan(\alpha-\beta) = \frac{\tan\alpha - \tan\beta}{1+\tan\alpha\tan\beta} = \frac{\left(-\frac{4}{3}\right)-\left(\sqrt{3}\right)}{1+\left(-\frac{4}{3}\right)\left(\sqrt{3}\right)} = \frac{-4-3\sqrt{3}}{3-4\sqrt{3}} = \frac{-48-25\sqrt{3}}{-39} = \frac{48+25\sqrt{3}}{39}.$$