

# Quiz 8 MATH 1540 Fall 2019

Compute  $\tan\left(\frac{9\pi}{8}\right)$ .

Soln:  $\frac{9\pi}{8} = \frac{\alpha}{2} \Rightarrow \alpha = \frac{9\pi}{4}$

in Q III  $\Rightarrow$   $\begin{matrix} \sin \frac{\alpha}{2} < 0 \\ \cos \frac{\alpha}{2} < 0 \end{matrix}$

So we may use the half-angle identities to compute

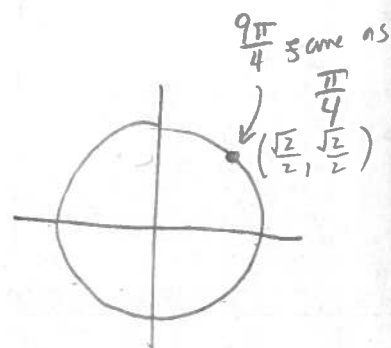
$$\sin\left(\frac{9\pi}{8}\right) = \sin\left(\frac{\alpha}{2}\right) = \frac{-\sqrt{1 - \cos\left(\frac{9\pi}{4}\right)}}{2}$$

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

and

$$\cos\left(\frac{9\pi}{8}\right) = \cos\left(\frac{\alpha}{2}\right) = \frac{-\sqrt{1 + \cos\left(\frac{9\pi}{4}\right)}}{2}$$

$$= \frac{-\sqrt{1 + \frac{\sqrt{2}}{2}}}{2}$$



Therefore,

$$\tan\left(\frac{9\pi}{8}\right) = \frac{\sin\left(\frac{9\pi}{8}\right)}{\cos\left(\frac{9\pi}{8}\right)} = \frac{-\sqrt{\frac{1 - \sqrt{2}/2}{2}}}{-\sqrt{\frac{1 + \sqrt{2}/2}{2}}}$$

$$= \frac{+\sqrt{1 - \sqrt{2}/2}}{\sqrt{1 + \sqrt{2}/2}}$$

$$= \frac{+\sqrt{2 - \sqrt{2}}}{\sqrt{2 + \sqrt{2}}}$$