3. Evaluate the following integrals:

a. $\int_0^{\pi} \sin x \cos x \sin(\pi \cos x)\, dx = -\frac{1}{\pi^2}\int_{\pi}^{-\pi} t \sin t \, dt = \frac{1}{\pi^2}\int_{-\pi}^{\pi} t \sin t \, dt$

$t = \pi \cos x$

$dt = -\pi \sin x \, dx$

$= \frac{1}{\pi^2}\left(\left[-t\cos t\right]_{-\pi}^{\pi} + \int_{-\pi}^{\pi} \cos t \, dt\right) = \frac{1}{\pi^2}\left(-\pi\cos\pi - \pi\cos(-\pi) + \left[\sin t\right]_{-\pi}^{\pi}\right)$

$u = t \Rightarrow du = dt$

$dv = \sin t \, dt \Rightarrow v = -\cos t$

$= \frac{1}{\pi^2}\left(\pi + \pi + \sin(\pi) - \sin(-\pi)\right) = \frac{2}{\pi}$

b. $\int \frac{\tan\theta}{(1-\tan^2\theta)^2}\, d\theta = \int \frac{\sin\theta\cos^3\theta}{(\cos^2\theta - \sin^2\theta)^2}\, d\theta = \int \frac{\frac{1}{2}\sin 2\theta \cdot \cos^2\theta}{\cos^2 2\theta}\, d\theta$

$= \frac{1}{4}\int \frac{\sin 2\theta \cdot (1+\cos 2\theta)}{\cos^2 2\theta}\, d\theta = -\frac{1}{8}\int\left(\frac{1}{u^2} + \frac{1}{u}\right) du$

$u = \cos 2\theta$

$du = -2\sin 2\theta \, d\theta$

$= \frac{1}{8}\left(\frac{1}{u} - \ln|u|\right) + C = \frac{1}{8\cos 2\theta} - \frac{1}{8}\ln|\cos 2\theta| + C$