Question 1

b)

$$\int_0^{\frac{1}{4}} \frac{tan(\pi t)}{t} dt$$

$$= \int_0^{\frac{1}{4}} \frac{\pi tan(\pi t)}{\pi t} dt$$

Let $u = \pi t$, therefore $du = \pi dt$, therefore $dt = \frac{du}{\pi}$

Therefore the bounds for t = 0, and t = $\frac{1}{4}$ change to

u = $\pi(0) = 0$, and u = $\pi\frac{1}{4} = \frac{\pi}{4}$

Therefore $\frac{\pi tan(\pi t)}{\pi t} dt = \frac{\pi tan(u)}{u} \frac{du}{\pi} = \frac{tan(u)}{u} du$

$$\int_0^{\frac{1}{4}} \frac{\pi tan(\pi t)}{\pi t} dt$$

$$= \int_0^{\frac{\pi}{4}} \frac{tan(u)}{u} du$$

$$= \int_0^{\frac{\pi}{4}} \frac{u + \frac{u^3}{3} \pm \frac{64u^5}{15}}{u} du$$

$$= \int_0^{\frac{\pi}{4}} (1 + \frac{u^2}{3} \pm \frac{64u^4}{15}) du$$

$$= (u + \frac{u^3}{9} \pm \frac{64u^5}{75})|_0^{\frac{\pi}{4}}$$

$$= \frac{\pi}{4} + \frac{1}{9}(\frac{\pi}{4})^3 \pm \frac{64}{75}(\frac{\pi}{4})^3$$

$\doteq 0.839 \pm 0.255$

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