

Substitution (Definite Integrals)

b.) $\int_1^2 x(x^2+1)^3 dx$ $u = x^2+1$
 $\frac{du}{2} = x dx$
 $\frac{1}{2} \int_2^5 u^3 du$ $(2)^2+1=5$
 $(1)^2+1=2$
 $(\frac{1}{2})(\frac{1}{4}) u^4 \Big|_2^5$
 $\frac{1}{8} u^4 \Big|_2^5$
 $\left[\frac{1}{8} (5)^4 \right] - \left[\frac{1}{8} (2)^4 \right] = 76.125$

c.) $\int_{-1}^1 \frac{\tan x}{1+x^4} dx$ Odd function
 $= \boxed{0}$

d.) $\int_{\pi/4}^{\pi/2} \frac{\sin \sqrt{\theta}}{\sqrt{\theta}} d\theta$ $u = \sqrt{\theta}$
 $du = \frac{1}{2} \frac{d\theta}{\sqrt{\theta}} \rightarrow 2du = \frac{d\theta}{\sqrt{\theta}}$
 $u = \sqrt{\pi/4} = \frac{\pi}{2}$ $2 \int_{\pi/3}^{\pi/2} \sin u du \rightarrow -\cos u$
 $u = \sqrt{\pi/9} = \frac{\pi}{3}$ $2(-\cos \frac{\pi}{2} + \cos \frac{\pi}{3}) = \boxed{1}$

b. $\int_1^2 x(x^2+1)^3 dx$ let $u = x^2+1$
 $= \frac{1}{2} \int u^3 du$ $\frac{1}{2} du = x dx$
 $= \frac{1}{2} \cdot \frac{1}{4} u^4 = \frac{1}{8} (x^2+1)^4 \Big|_1^2$
 $\frac{1}{8} (2^2+1)^4 - \frac{1}{8} (1^2+1)^4 = 76.125$

c. $\int_{-1}^1 \frac{\tan x}{1+x^4} dx = 0 \rightarrow$ odd function

d. $\int_{\pi/9}^{\pi/4} \frac{\sin \sqrt{\theta}}{\sqrt{\theta}} d\theta = \int_{\pi/9}^{\pi/4} \sin \sqrt{\theta} \cdot \theta^{-1/2} d\theta$
let $u = \sqrt{\theta}$ $2du = \theta^{-1/2} d\theta$ $\frac{\pi}{4}$
 $= 2 \int \sin u du = -2 \cos u = -2 \cos \sqrt{\theta} \Big|_{\pi/9}^{\pi/4}$
 $= -2 \cos \sqrt{\pi/4} + \cos \sqrt{\pi/9} = 1$