2) (10 points.) $\int x^3(\ln x)dx = ?$ $\quad u = \ln x,\ dv = x^3dx$

$= (\ln x)\left(\frac{x^4}{4}\right) - \int \left(\frac{x^4}{4}\right)\left(\frac{1}{x}dx\right)$ $\quad v = \frac{x^4}{4},\ du = \frac{1}{x}dx$

$= \frac{x^4}{4}\ln x - \frac{x^4}{16} + C$

3) (8 points.) $\int \frac{f''(t)}{\pi + f'(t)}dt = ?$ $\quad u = \pi + f'(t),\ du = f''(t)dt$

$\ln|u| + C = \ln|\pi + f'(t)| + C$

4) (8 points.) $\int 2x[e^{(x^2)}][\sec(e^{(x^2)})]^2[\tan(e^{(x^2)})]^4 dx = ?$ $\quad u = \tan(e^{(x^2)}),\ du = 2x[e^{(x^2)}][\sec(e^{(x^2)})]^2dx$

$\int u^4 du = \frac{u^5}{5} + C$

$= \frac{1}{5}\left[\tan\left(e^{(x^2)}\right)\right]^5 + C$

5) (10 points.) $\int \frac{(5+4x)dx}{9+4x^2} = ? \int \frac{5dx}{9+4x^2} + \int \frac{\frac{1}{2}\cdot 2\cdot 4x\,dx}{9+4x^2}$ $\quad u = 9+4x^2,\ du = 2\cdot 4x\,dx$

(see 1)

$= \frac{5}{6}\tan^{-1}\left(\frac{2}{3}x\right) + \frac{1}{2}\ln|u| + C = \frac{5}{6}\tan^{-1}\left(\frac{2}{3}x\right) + \frac{1}{2}\ln\left(9+4x^2\right) + C$

ABS. VALUES NOT NEEDED

IV. (24 points. 6 points each.) Evaluate the following limits. SHOW ANY WORK YOU DO!!

1) $\lim_{x\to 0} \frac{e^{(x^2)} - 1}{\sin x}$ $\quad (1-1)/0$

$\overset{?}{=}_{L'H} \lim_{x\to 0} \frac{2x\,e^{(x^2)}}{\cos x}$ $\quad 0/1$

$= 0$

2) $\lim_{x\to\infty} \frac{(\ln x)^2}{x}$ $\quad \infty/\infty$

$\overset{?}{=}_{L'H} \lim_{x\to\infty} \frac{2(\ln x)\frac{1}{x}}{1} = \lim_{x\to\infty} \frac{2(\ln x)}{x}$ $\quad \infty/\infty$

$\overset{?}{=}_{L'H} \lim_{x\to\infty} \frac{2\frac{1}{x}}{1}$ $\quad 0$

$= 0$