Math 250a (Kennedy) - Quiz 3 - Fall '07

1. Find

$\int t\, e^{5t}\, dt$ Let $u = t$ $v' = e^{5t}$

Then $u' = 1$ $v = \frac{1}{5} e^{5t}$

$= \frac{1}{5} t e^{5t} - \int \frac{1}{5} e^{5t} dt$

$= \frac{1}{5} t e^{5t} - \frac{1}{25} e^{5t} + C$

$\int x^3 \ln x\, dx$ Let $u = \ln x$ $v' = x^3$

then $u' = \frac{1}{x}$ $v = \frac{1}{4} x^4$

$= \frac{1}{4} \ln x\; x^4 - \int \frac{1}{x} \frac{1}{4} x^4 dx$

$= \frac{1}{4} x^4 \ln x - \frac{1}{16} x^4 + C$

$\int \tan^{-1} x\, dx$ Let $u = \tan^{-1} x$ $v' = 1$

then $u' = \frac{1}{1+x^2}$ $v = x$

$= x \tan^{-1} x - \int \frac{x}{1+x^2} dx$

$= x \tan^{-1} x - \frac{1}{2} \ln (1+x^2) + C$

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2. Given that $\int_0^\pi x \sin x\, dx = \pi$. Find $\int_0^\pi x^2 \cos x\, dx$.

Let $u = x^2$, $v' = \cos x$

Then $u' = 2x$ $v = \sin x$

$\int_0^\pi x^2 \cos x\, dx = x^2 \sin x \Big|_0^\pi - \int 2x \sin x\, dx$

$= \pi^2 \sin 0 - 0 \sin 0 - 2\pi = \boxed{-2\pi}$