WRITE YOUR NAME:

MAC 2312 Homework 4
Due in class, Friday February 23rd
You can use more paper if necessary, but please STAPLE

Question 1. Evaluate the integral.

$$\int_0^2 xe^{2x}\,dx$$

$$\int_{x=a}^{x=b} u\,dv = [uv]_{x=a}^{x=b} - \int_{x=a}^{x=b} v\,du$$

Let $u = x$, $dv = e^{2x}dx$ $\Rightarrow$ $du = 1\,dx$, $v = \frac{1}{2}e^{2x}$

$$\text{Integral} = \left[x \cdot \frac{1}{2}e^{2x}\right]_0^2 - \int_0^2 \frac{1}{2}e^{2x} \cdot 1\,dx$$

$$= 2 \cdot \frac{1}{2}e^4 - 0 - \frac{1}{2}\int_0^2 e^{2x}\,dx$$

$$= e^4 - \frac{1}{2}\left[\frac{1}{2}e^{2x}\right]_0^2$$

$$= e^4 - \frac{1}{4}(e^4 - 1) = e^4 - \frac{e^4}{4} + \frac{1}{4}$$

$$= \frac{3e^4}{4} + \frac{1}{4} \quad \text{or} \quad \frac{3e^4+1}{4}$$

Question 2. Evaluate the integral.

$$\int (\cos x)^{1/3} \sin x \, dx$$

Let $u = \cos x$

Then $du = -\sin x \, dx$

$-1 du = \sin x \, dx$

$$\text{Integral} = \int u^{1/3}(-1)\, du = -\int u^{1/3}\, du$$

$$= -\frac{u^{4/3}}{4/3} + C = -\frac{3}{4}u^{4/3} + C$$

$$= -\frac{3}{4}(\cos x)^{4/3} + C$$

$$\int u\,dv = uv - \int v\,du$$

Question 3. Evaluate the integral.

$$\int x \ln x \, dx$$

Let $u = \ln x$, $dv = x\,dx$ $\Rightarrow$ $du = \frac{1}{x}\,dx$, $v = \frac{x^2}{2}$

$$\text{Integral} = \ln x \cdot \frac{x^2}{2} - \int \frac{x^2}{2} \cdot \frac{1}{x}\,dx$$

$$= \frac{x^2 \ln x}{2} - \frac{1}{2}\int x\,dx$$

$$= \frac{x^2 \ln x}{2} - \frac{1}{2}\cdot\frac{x^2}{2} + C$$

or $\frac{x^2 \ln x}{2} - \frac{x^2}{4} + C$ or $\frac{2x^2 \ln x - x^2}{4} + C$

or $\frac{x^2(2\ln x - 1)}{4} + C$

$$\int u\,dv = uv - \int v\,du$$

Question 4. Evaluate the integral.

$$\int \sqrt{x} \ln x \, dx$$

Let $u = \ln x$, $dv = x^{1/2}\,dx$ $\Rightarrow$ $du = \frac{1}{x}\,dx$, $v = \frac{x^{3/2}}{3/2} = \frac{2}{3}x^{3/2}$

$$\text{Integral} = \ln x \cdot \frac{2}{3}x^{3/2} - \int \frac{2}{3}x^{3/2} \cdot \frac{1}{x}\,dx$$

$$= \frac{2x^{3/2}\ln x}{3} - \frac{2}{3}\int x^{1/2}\,dx$$

$$= \frac{2x^{3/2}\ln x}{3} - \frac{2}{3}\cdot\frac{x^{3/2}}{3/2} + C$$

$$= \frac{2x^{3/2}\ln x}{3} - \frac{4}{9}x^{3/2} + C$$

or $\frac{6x^{3/2}\ln x - 4x^{3/2}}{9} + C$ or $\frac{2x^{3/2}(3\ln x - 2)}{9} + C$

$$\int u\,dv = uv - \int v\,du$$

Question 5. Evaluate the integral.

$$\int \ln x \, dx$$

Let $u = \ln x$, $dv = 1\,dx$ $\Rightarrow$ $du = \frac{1}{x}\,dx$, $v = x$

$$\text{Integral} = \ln x \cdot x - \int x \cdot \frac{1}{x}\,dx$$

$$= x \ln x - \int 1\,dx$$

$$= x \ln x - x + C$$

or $x(\ln x - 1) + C$