NAME: ATUME MIMIDOO VICTORIA
MATRICULATION NUMBER: 19/MHS01/107
DEPARTMENT: MEDICINE AND SURGERY
COLLEGE: MEDICINE AND HEALTH SCIENCES
COURSE: MAT 104

ASSIGNMENT.

1: $\int 2x^2 \ln x \, dx$

Soln

Let $u = \ln x$, $dv = 2x^2$

$du/dx = 1/x$ $\int dv = \int 2x^2$

$du = \frac{1}{x} dx$ $v = 2x^3/3$

$\int u\,dv = uv - \int v\,du$. Substituting;

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

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

$$\int 2x^2 \ln x \, dx = \frac{2x^3}{3} \ln x - \frac{2x^3}{3 \cdot 3} + c$$

$$\int 2x^2 \ln x \, dx = \frac{2x^3}{3} \ln x - \frac{2x^3}{9} + c$$

$$\int 2x^2 \ln x \, dx = \frac{2}{3} x^3 \left(\ln x - \frac{1}{3} \right) + c$$

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2 $\int 3te^{2t} dt$

Soln

Let $u = 3t$ $dv = e^{2t}$

$du/dt = 3$ $\int dv = \int e^{2t}$

$du = 3dt$ $v = \frac{1}{2} e^{2t}$

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

Substituting;

$$\int 3te^{2t}dt = 3t \cdot \frac{1}{2}e^{2t} - \int \frac{1}{2}e^{2t} \cdot 3dt$$

$$\int 3te^{2t}dt = \frac{3}{2}te^{2t} - \int \frac{3}{2}e^{2t}dt$$

$$\int 3te^{2t}dt = \frac{3}{2}te^{2t} - \frac{3}{2}\int e^{2t}dt$$

$$\int 3te^{2t}dt = \frac{3}{2}te^{2t} - \frac{3}{2} \cdot \frac{1}{2}e^{2t} + c$$

$$\int 3te^{2t}dt = \frac{3}{2}te^{2t} - \frac{3}{4}e^{2t} + c$$

$$\int 3te^{2t}dt = \frac{3}{2}te^{2t} - \frac{3}{4}e^{2t} + c$$

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3. $\int x^2 \sin x\,dx$

Soln

Let $u = x^2$ $\quad dv = \sin x$

$du/dx = 2x$ $\quad \int dv = \int \sin x$

$du = 2x\,dx$ $\quad v = -\cos x$

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

$\int x^2 \sin x\,dx = x^2 \cdot -\cos x - \int -\cos x \cdot 2x\,dx$

$\int x^2 \sin x\,dx = -x^2 \cos x - \int -2x \cos x\,dx$

$\int x^2 \sin x\,dx = -x^2 \cos x + 2\int x \cos x\,dx$

$\int x^2 \sin x\,dx = -x^2 \cos x + 2 \cdot \frac{x^2}{2} \sin x + c$

$\int x^2 \sin x\,dx = -x^2 \cos x + x^2 \sin x + c$

$\therefore \int x^2 \sin x\,dx = x^2(-\cos x + \sin x) + c$

4 $\int \cos 5x \cos 6x \, dx$

Soln

Using $\cos A \cos B = \frac{1}{2}[\cos(A+B) + \cos(A-B)]$

$A = 5x \quad B = 6x$

$\cos A \cos B = \frac{1}{2}[\cos(5x+6x) + \cos(5x-6x)]$

$\cos A \cos B = \frac{1}{2}[\cos 11x - \cos x]$

$\int \cos 5x \cos 6x \, dx = \frac{1}{2}\int (\cos 11x - \cos x) \, dx$

$\int \cos 5x \cos 6x \, dx = \frac{1}{2}\left[\frac{\sin 11x}{11} - \frac{\sin x}{1}\right]$

$\int \cos 5x \cos 6x \, dx = \frac{\sin 11x}{22} - \frac{\sin x}{2} + C_{//}$

5 $\int \sin 7x \cos 2x \, dx$

Soln

Using $\sin A \cos B = \frac{1}{2}[\sin(A+B) + \sin(A-B)]$

$A = 7x \quad B = 2x$

$\sin A \cos B = \frac{1}{2}[\sin(7x+2x) + \sin(7x-2x)]$

$\sin A \cos B = \frac{1}{2}(\sin 9x + \sin 5x)$

$\int \sin 7x \cos 2x \, dx = \frac{1}{2}\int (\sin 9x + \sin 5x) \, dx$

$\int \sin 7x \cos 2x \, dx = \frac{1}{2}\left[-\frac{\cos 9x}{9} - \frac{\cos 5x}{5}\right]$