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MAT 104 ASSIGNMENT

1. $2x^2 \ln x$

Solution

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

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

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

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

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

$$= \frac{2x^3}{3} \cdot \ln x - \frac{2x^3}{3 \times 3} + c$$

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

2. $3t e^{2t}$

Solution

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

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

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

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

$= \frac{3t}{2}e^{2t} - \int \frac{3}{2}e^{2t}\,dx$

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

$= \cancel{\frac{3te^{2t}}{2}} \cdot \frac{3t}{2}e^{2t} - \frac{1}{2} \cdot \frac{3}{2}e^{2t} + C$

$\therefore \int 3te^{2t}\,dt = \left[\frac{3t}{2}e^{2t} - \frac{3}{4}e^{2t}\right] + C$

3 $x^2 \sin x$

<u>Solution</u>

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

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

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

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

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

$$= -x^2 \cos x + \begin{bmatrix} u = 2x & dv = \cos x \\ du = 2dx & v = \sin x \end{bmatrix}$$

$$= -x^2 \cos x + uv - \int v\,du$$

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

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

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

~~4. Cos x Cos~~

4 $\cos 5x \cdot \cos 6x$

Solution

$A = 5x, \; B = 6x$

Recall that:

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

$$\cos 5x \cos 6x = \tfrac{1}{2}\{\cos 11x + \cos x\}$$

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

$$\therefore \int \cos 5x \cos 6x\,dx = \frac{\sin 11x}{22} + \frac{\sin x}{2} + C$$

5. $\sin 7x \cos 2x$

<u>Solution</u>

$A = 7x, B = 2x$

Recall that;

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

$$\sin 7x \cos 2x = \tfrac{1}{2}[\sin 9x + \sin 5x]$$

$$\int \sin 7x \cos 2x = \tfrac{1}{2}\int \sin 9x + \sin 5x$$

$$\cancel{\int \sin 7x \cos 2x\,dx = \tfrac{1}{2}\int \sin 9x}$$

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

$$\therefore \int \sin 7x \cos 2x\,dx = -\frac{\cos 9x}{18} - \frac{\cos 5x}{10} + C$$