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DEPT: Medicine and Surgery MATRIC NUMBER: 19/MHS01/177
MAT104 ASSIGNMENT

Integrate the following;

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

sol

$\int 2x^2 \ln x \to 2\int x^2 \ln x$

let $\ln x$ be u and x^2 be dv

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

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

$\int u dv = \left(\ln x \cdot \frac{x^3}{3}\right) - \int \frac{x^3}{3} \cdot \frac{1}{x}$

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

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

$\int 2x^2 \ln x = \frac{2x^3}{3}\ln x - \frac{2x^3}{9} + c \Rightarrow \frac{2}{3}x^3\left(\ln x - \frac{1}{3}\right) + c$

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

sol

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

let u be t and dv be e^{2t}

$\frac{du}{dt} = 1$ $\quad \cancel{\frac{dv}{dt}} v = \cancel{2e^{2t}}$ $\quad v = \frac{1}{2}e^{2t}$

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

$\int u dv = \left(t \cdot \frac{1}{2}e^{2t}\right) - \int \frac{1}{2}e^{2t} \cdot 1$

$\int u dv = \frac{1}{2}te^{2t} - \int \frac{1}{2}e^{2t}$

$\int u dv = \frac{1}{2}te^{2t} - \frac{1}{2}\int e^{2t}$

$\int u\,dv =$

$3\int t \cdot e^{2t}\,dt = 3\left[\frac{1}{2}te^{2t} - \frac{1}{2}e^{2t}\right] + c$

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

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

let x^2 be u and dv be $\sin x$

$\frac{du}{dv} = 2x$ $\quad v = -\cos x$

$du = 2x\,dx$

$5x - 6x$

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

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

$\int u\,dv = -x^2\cos x - \int -2x\cos x$

$\int u\,dv = -x^2\cos x + 2\int x\cos x$

for $2\int x\cos x$

$u = x$, $dv = \cos x$

$\frac{du}{dx} = 1$ $\quad v = \sin x$

$du = dx$

$\int u\,dv = x \cdot \sin x - \int \sin x \cdot dx$

$\int u\,dv = x\sin x + \cos x + c$

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

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

4. $\int \cos 5x \cos 6x$

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

Let $5x$ be A and $6x$ be B

$\cos 5x \cos 6x = \frac{1}{2}[\cos 11x - \cos x]$

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

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

$$\int \cos 5x \cos 6x = \frac{\sin 11x}{22} - \frac{\sin x}{2} + c$$

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

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

Let $7x$ be A and $2x$ be B

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

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

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

$$\int \sin 7x \cos 2x = \frac{-\sin 9x}{18} - \frac{\sin 5x}{10} + c$$