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DEPARTMENT: MEDICINE AND SURGERY

COLLEGE: MEDICINE AND HEALTH SCIENCES

MATRIC NO: 19/MHS01/147

COURSE CODE: MAT 104

MAT 104 Assignment

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

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

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

$du = x^{-1} dx$

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

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

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

$= \frac{2x^3}{3} \ln x - \frac{1}{3} \left[\frac{2x^3}{3}\right]$

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

$= \frac{2x^3}{3} \left(\ln x - \frac{1}{3}\right) + C$

**2** $\int 3t e^{2t} dt$

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

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

$du = 3dt$

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

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

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

$= \frac{3}{2} t e^{2t} - \frac{1}{2} \left[\frac{3}{2} e^{2t}\right]$

$= \frac{3}{2} t e^{2t} - \frac{3}{4} e^{2t} + C$

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

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

$\frac{du}{dx} = 2x$ , $v = -\cos x$

$du = 2x\,dx$

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

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

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

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

$= -x^2\cos x -$ {

Let $u = -2x$ and $dv = \cos x$

$\frac{du}{dx} = -2$ ; $v = \sin x$

$du = -2dx$

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

$\Rightarrow -2x \cdot \sin x - \int \sin x \cdot -2dx$

$\Rightarrow -2x \cdot \sin x - \int -2\sin x\,dx$

$\Rightarrow -2x\sin x - \left(-2\int \sin x\,dx\right)$

$\Rightarrow -2x\sin x - \left(-2\left[-\cos x\right]\right)$

$\Rightarrow -2x\sin x + 2\left[-\cos x\right]$

$\Rightarrow -2x\sin x - 2\cos x$

}

$= -x^2\cos x + 2x\sin x + 2\cos x + C$

$= -x^2\cos x + 2x\sin x + 2\cos x + C$

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

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

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

let $A = 5x$, $B = 6x$

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

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

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

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

$= \frac{\sin 11x}{22} - \frac{\sin x}{2} + C$

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

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

let $A = 7x$, $B = 2x$

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

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

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

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

$$= \frac{-\cos 9x}{18} - \frac{\cos 5x}{10} + C$$