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DEPT: Medicine & Surgery

MAT 104 ASSIGNMENT

① $2x^2 \ln x$

Soln

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

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

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

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

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

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

$= \frac{2x^3}{3} (\ln x) - \frac{2x^3}{9} + C$

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

② $3te^{2t}$

Soln

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

$u = 3t$ $\qquad du = \frac{3t^2}{2} dx$

$v = \frac{1}{2} e^{2t}$ $\qquad dv = e^{2t}$

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

$= 3t\left(\frac{1}{2} e^{2t}\right) - \int \frac{1}{2} e^{2t} \times \frac{3t^2}{2} dx$

$= \frac{3}{2} te^{2t} - \int \frac{3}{4} t^2 e^{2t} \, dx$

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

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

(3) $x^2 \sin x$

Soln

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

$u = x^2$ $\qquad$ $V = -\cos x$

$du = \frac{x^3}{3} dx$ $\qquad$ $dv = \sin x$

$$\therefore UV - \int v\,du$$

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

$$= -\cos x (x^2) - \left(-\sin x \times \frac{x^4}{12}\right) + C$$

$$= -\cos x (x^2) + \sin x \left[\frac{x^4}{12}\right] + C_0$$

(4) $\cos 5x \cos 6x$

Soln

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

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

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

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

$$= \tfrac{1}{2}\left[\cos 11x + \cos(-x)\right] dx$$

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

$$= \tfrac{1}{2}\left[\frac{\sin 11x}{11} - \frac{\sin x}{1}\right] + C$$

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

(5) $\sin 7x \cos 2x$

Soln

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

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

$$\therefore \int \sin 7x \cos 2x \, dx = \tfrac{1}{2}\left[\sin(7x+2x) + \sin(7x-2x)\right.$$

$$= \tfrac{1}{2}\left(\sin 9x + \sin 5x\right) dx$$

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

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

$$\therefore \int \sin 7x \cos 2x \, dx = -\frac{\cos 9x}{18} - \frac{\cos 5x}{10} + C_{11}$$