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COLLEGE : MHS
DEPT : Medicine and Surgery

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

Soln

let $u = \ln x$

$\frac{du}{dx} = \frac{1}{x}$

$du = \frac{dx}{x}$

$dv = 2x^2 dx$

$\int dv = \int 2x^2 dx$

$v = \frac{2x^3}{3}$

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

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

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

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

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

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

Soln

let $u = 3t$

$\frac{du}{dt} = 3$ $\qquad dt = \frac{du}{3}$

$\cancel{dt = \frac{3}{du}}$

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

$\int 3te^{2t}\,dt = \int u\,e^{2t}\,\frac{du}{3}$

$\int 3te^{2t}\,dt = \frac{1}{3}\int u e^{2t}\,du$

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

$\int 3te^{2t}\,dt = \frac{1}{3}\left[\frac{u^2 e^{2t}}{4}+c\right]$

$\int 3te^{2t}\,dt = \left[\frac{(3t)^2\,e^{2t}}{12}\right] + c$

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

let $u = x^2$

$\frac{du}{dx} = 2x$

$dx = \frac{du}{2x}$

$\int x^2 \sin x\,dx = \int u \sin x\,\frac{du}{(2x)}$

$\int x^2 \sin x\,dx = \int u \cdot \sin x\,du\,(2x)$

$\int x^2 \sin x\,dx = \cancel{\frac{u^2}{2}(-\cos x)\,(2x)^{-1}}$

$\int \cancel{x^2 \sin x\,dx} =$

$\int x^2 \sin x\,dx = \frac{u^2}{x}\cdot(-\cos x)\cdot\frac{2x^{1}}{1}$

$\int x^2 \sin x\,dx = x^4\,(-\cos x)\times 1$

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

$+2\cos x + c$

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

<u>Solution</u>

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

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

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

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

$$\cos(-x) = \cos x$$

$$= \frac{1}{2}\left[\cos 11x + \cos x\right]$$

$$\cancel{= \frac{1}{2}}$$

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

$$= \frac{1}{2}\left(\frac{\sin 11x}{11} + \frac{\sin x}{1}\right) + c$$

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

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

<u>Solution</u>

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

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

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

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

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

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