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19/MHS01/024

MBBS 100 LEVEL

MAT 104

1 $2x^2 \ln x$

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

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

$du = 1/x \, dx$

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

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

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

$$= \frac{2x^3}{3} \ln x - \frac{2x^3}{3} \times \frac{1}{3} + c$$

$$= \frac{2x^3}{3} \ln x - \frac{2x^3}{9} + c$$

$$\int 2x^2 \ln x = \frac{2x^3}{3} [\ln x - 1/3] + c$$

2 $\int 3te^{2t}\,dt \longrightarrow I$

Solution

$u = 3t^{1-1}$ $\quad$ $dv = e^{2t}$

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

$du = 3dt$

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

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

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

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

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

$= \frac{3t}{2}e^{2t} - \frac{3}{2} \times \frac{1}{2}e^{2t} + c$

$\int 3te^{2t} = \frac{3te^{2t}}{2} - \frac{3}{4}e^{2t} + c$

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

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

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

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

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

$= -\cos x(x^2) + \int 2x\cos x\,dx$ ---- (1)

$\therefore \int 2x\cos x\,dx$ $\left[\begin{array}{ll} u = 2x & dv = \cos x \\ du = 2dx & v = \sin x \end{array}\right]$

Put it in equation 1

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

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

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

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

Solution

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

Recall that:

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

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

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

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

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

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

Solution

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

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

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

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

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