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COURSE : MATH 104

ASSIGNMENT.

1. $2x^2 \ln x$

Soln.

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

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

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

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

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

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

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

$$= \frac{2x^3}{3} (\ln x - 1/3) + C_{11}$$

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

Soln.

$u = 3t \qquad dv = e^{2t}$

$du = 3dx \qquad v = 1/2\, e^{2t}$

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

$= \int 3te^{2t} = 3t \cdot 1/2\, e^{2t} - \int 1/2\, e^{2t} \cdot 3dx$

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

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

$$\therefore \int 3t e^{2t} dt = \left[ \frac{3te^{2t}}{2} - \frac{3}{4} e^{2t} \right] + C$$

5 $x^2 \sin x$

Soln.

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

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

$du = 2x dx$

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

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

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

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

Soln.

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

But

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

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

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

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

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

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

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

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

Soln:

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

Recall that

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

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

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

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