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MATHS 104

Assignment

1) $2x^2 \operatorname{In} x$

$u = \operatorname{In} x$ $\quad$ $dv = 2x^2$

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

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

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

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

$$\int 2x^2 \operatorname{In} x\,dx = \frac{2x^3}{3} \operatorname{In} x - \frac{2}{3} \left[\frac{x^3}{3}\right] + c$$

$$\therefore \int 2x^2 \operatorname{In} x\,dx = \frac{2x^3}{3} \left[\operatorname{In} x - \frac{1}{3}\right] + c$$

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

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

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

$$\int udv = uv - \int vdu$$

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

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

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

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

3 $x^2 \sin x$

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

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

$du = 2xdx$

$$\int udv = uv - \int vdu$$

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

$$\int x^2 \sin x\,dx = -x^2\cos x + 2\int \cos x \cdot x\,dx \quad \text{—} \; (\mathrm{I})$$

$$\int \cos x \cdot x\,dx$$

$u = x$ $\qquad\qquad\qquad$ $dv = \cos x$

$\frac{du}{dx} = 1$ $\qquad\qquad\qquad$ $v = \sin x$

$du = dx$

$$\int \cos x \cdot x\,dx = x\sin x - \int \sin x \cdot dx \quad \text{—} \; (\mathrm{II})$$

Put eqn (II) into (I)

$$\int x^2 \sin x\,dx = -x^2\cos x + 2\left[x\sin x - \int \sin x \cdot dx\right]$$

$$\int x^2 \sin x\,dx = -x^2\cos x + 2\left[x\sin x - [-\cos x]\right] + c$$

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

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

4 $\cos 5x \cos 6x$

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

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

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

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

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

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

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

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

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

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

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

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

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

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