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Maths 104

Assignment

I. $2x^2 \ln x \, dx$
Recall
$\int u \, dv = uv - \int v \, du$

$\Rightarrow \left[\ln \cdot \frac{2x^3}{3}\right] - \int \left[\frac{2x^3}{3} \cdot \frac{1}{x} \, dx\right]$

$= \left[\ln x \cdot \frac{2x^3}{3}\right] - \int \frac{2x^2}{3} dx$

$= \left[\ln x \cdot \frac{2x^3}{3}\right] - \frac{2x^3}{9} + c$

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

IV. $\int 3t e^{2t} dt$
$u = 3t$; $dv = e^{2t}$
$du = 3dx$; $v e^{2t} = 1/2 e^{2t}$
$\int u \, dv = uv - \int v \, du$
$= 3t \cdot \frac{e^{2t}}{2} - \int \frac{e^{2t}}{2} \cdot 3$

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

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

$$= \frac{3le^{2l}}{2} - \int \frac{3e^{2l}}{2}$$

$$= \frac{3le^{2l}}{2} - \left[\frac{3}{2}\int e^{2l}\right]$$

$$= \frac{3le^{2l}}{2} - \frac{3e^{2l}}{4} + C$$

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

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

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

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

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

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

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

$A = 5x$ and $B = 6x$

Recall that:

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

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

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

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

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

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

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

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

$A = 7x$ and $B = 2x$

Recall that:

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

$$= \frac{1}{2}\left[\sin(7x+2x) + \sin(7x-2x)\right]$$

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

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

$$= \frac{1}{2}\int\left[\sin 9x + \sin 5x\right) dx$$

$$= \frac{1}{2} \cdot \left(-\frac{\cos 9x}{9} - \frac{\cos 5x}{5}\right]$$

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

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