PAL pensions

MATHS ASSIGNMENT (MAT 104)

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DEPARTMENT: MEDICINE AND SURGERY

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

Solution

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

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

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

$= \ln u \left(\frac{2x^3}{3}\right) - \int \frac{2x^3}{3} \cdot \frac{1}{x} dx$

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

$\frac{2x^3}{3}(\ln x) - \frac{2x^3}{9} + C$

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

2. $\int 3t e^{2t} dt$

Solution

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

$du = \frac{3t^2}{2} dx \qquad v = \frac{-1}{2} e^{2t}$

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

$= 3t\left(\frac{1}{2} e^{2t}\right) - \int \frac{1}{2} e^{2t} \cdot \frac{3t^2}{2} dx$

$= \frac{3}{2} t e^{2t} - \int \frac{3}{4} t^2 e^{2t} dx$

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

$\therefore \int 3te^{2t}dt = \frac{3}{2}te^{2t} - \frac{3}{4}e^{2t} + C$ //

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

Solution

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

$du = \frac{x3}{3}dx \qquad v = -\cos x$

$\therefore uv - \int v\,du$

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

$= -\cos x(x^2) - \left[-\sin x \cdot \frac{x^4}{12} + C\right.$

$= -\cos x(x^2) + \sin x\left(\frac{x^4}{12}\right) + C$ //

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

Solution

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

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

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

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

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

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

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

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

Solution

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

$\int \sin 7x \cos 2x\,dx = \frac{1}{2}[\sin(A+B) + \sin(A-B)]$

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

$= \frac{1}{2}[\sin(9x) + \sin(5x)\,dx$

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

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

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