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19/MHS01/198

MBBS

Mat 104

Assignment

. Integrate the following

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

Let $u = \ln x$, $dv = 2x^2$

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

$\therefore du = dx/x$

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

$I = \frac{2x^3}{3}(\ln x) - 2/3 \int x^2) dx$

$= \frac{2}{3}x^3 (\ln x) - 2/3) \frac{x^3}{3}$

$\Rightarrow \int 2x^2 \ln x \, dx = 2/3x^3 (\ln x) - \frac{2x^3}{9}) + c$ //

$$= \frac{2}{3}x^3(\ln x - 2/3)\frac{x^3}{3}$$

$$\Rightarrow \int 2x^2 \ln x \, dx = 2/3x^3(\ln x - \frac{2x^3}{9}) + c$$

2) $\int 3te^{2t} \, dx$

$u = t$, $dv = e^{2t}$

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

$dx = du$

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

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

$$= 3(\frac{te^{2t}}{2} - 1/2 \cdot \frac{e^{2t}}{2})$$

$$\int 3te^{2t} da = 3\left(\frac{te^{2t}}{2} - \frac{e^{2t}}{4}\right) + c$$

$\int x^2 \sin x$

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

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

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

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

$u = x \quad , dV = \cos x$

$du = dx \quad V = -\sin x$

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

$I \quad = -2(x \sin x + \cos x)$

$\cancel{2x \sin x - x}$

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

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

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

let $5x = A$ & $6x = B$

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

$$\ldots = x\sin x - \int \sin x\,dx$$

$$\therefore I = -2(x\sin x + \cos x)$$

$\cancel{-2x\sin x - x}$

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

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

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

let $5x = A$ & $6x = B$

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

$$\int \cos 5x \cos 6x = 1/2 \cos 11x + \cos(-x)$$

$$= 1/2(\cos 11x - \cos x)\,dx$$

$$1/2\left[1/11 \sin x - 1/x \sin x\right] dx$$

$$\therefore \int \cos 5x \cos 6x = 1/22 \sin 11x + 1 \sin x + c$$

$$I = 1/22 \sin 11x - \sin x + c$$

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

let $7x = A$ & $2x = B$

$\sin A \cos B \cos B = 1/2[\sin(A+B) + \sin(A-B)]$

$I = 1/2(\sin 9x + \sin 5x)$

$= 1/2 \int (\sin 9x + 5x) dx$

$= 1/2[-1/9 \cos 9x - 1/5 \cos 5x] + C$

$\therefore \int \sin 7x \cos 2x \, dx = -1/18 \cos 9x - 1/5 \cos 5x + C$ //