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MATH 102.
General Math.

Assignment.

(1) $\int 2x^2 \ln x \, dx$

Soln

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

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

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

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

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

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

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

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

Soln

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

$du = \frac{3t^2}{2} dx$ $\quad V = \frac{1}{2} e^{2t}$

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

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

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

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

LATE

$$\int 8te^{2t}dt = \frac{3}{2}te^{2t} - \frac{3}{4t^2}te^{2t} + C$$

$$\therefore \int 8te^{2t}dt = \frac{3}{2}te^{2t} - \frac{3}{4}e^{2t} + C$$

(3) $\int x^2 \sin x\, dx$.

Soln

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

$du = \frac{x^3}{3}dx$ $\quad v = -\cos x$

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

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

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

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

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

Soln

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

$A = 5x$; $B = 6x$

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

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

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

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

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

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

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

$=$

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

Soln

$A = 7x, \; b = 2x$

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

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

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

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

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

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