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Date :- 23rd May, 2020

Assignment

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

Let $u = \ln x$, $dv = 2x^2$, $du = \frac{1}{x}dx$, $V = \frac{2x^3}{3}$

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

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

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

$\int u\,dv = \frac{2x^3}{3}\ln x - \frac{2x^3}{9} + C$

$\therefore \int 2x^2 \ln x = \frac{2x^3}{3}(\ln x + \frac{1}{3}) + C$

2. $\int 3te^{2t} dx$

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

$du = 3dt$ $\qquad V = \frac{1}{2}e^{2t}$

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

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

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

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

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

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

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

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

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

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

$= -x^2 \cos x + \int 2x \cos x\,dx$

* $\int 2x \cos x\,dx$

Let $u = 2x$ $\quad dv = \cos x$

$du = 2dx$ $\quad v = \sin x$

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

$2x \cdot \sin x - \int \sin x \cdot 2dx$

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

$\therefore \int x^2 \sin x\,dx = -x^2 \cos x + 2x \sin x + 2\cos x + C$

4 $\int \cos 5x \cos 6x \, dx \quad = \frac{1}{2}\left[\cos(A+B) - \cos(A-B)\right]$

Let $A = 5x$, $B = 6x$

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

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

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

5 $\int \sin 7x \cos 2x \, dx = \frac{1}{2}\left[\sin(A+B) + \sin(A-B)\right]$

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

$\frac{1}{2}\left[\sin 9x - \sin 5x\right] = \frac{1}{2}\int \sin 9x - \sin 5x$

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

$= \frac{\cancel{1}}{\cancel{2}} \frac{-\cos 9x}{18} - \frac{\cos 5x}{10} + c$

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