Assignment

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

Let $v = \ln x$

$\frac{dv}{dx} = \frac{1}{x}$

$x\,dv = dx$

$dv = \frac{dx}{x}$

Let $du = 2x^2\,dx$

$\int (1)\,du = \int 2x^2\,dx$

$u = \frac{2x^3}{3}$

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

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

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

$= \frac{2x^3}{3} \ln x - \frac{1}{3} \int 2x^2\,dx$

$= \frac{2x^3}{3} \ln x - \left(\frac{1}{3} \times \frac{2x^3}{3}\right) + c$

$= \frac{2x^3}{3} \ln x - \frac{2x^3}{9} + c$

$\therefore \int 2x^2 \ln x\,dx = \frac{2x^3}{3} \ln x - \frac{2x^3}{9} + c$

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

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

$$\text{Let } v = 3t$$
$$\frac{dv}{dt} = 3$$
$$dv = 3dt$$
$$\text{Let } du = e^{2t} dt$$
$$\int (1) du = \int e^{2t} dt$$
$$u = e^{2t}$$

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

$$\int 3t \times e^{2t} dt = e^{2t} \times 3t - \int e^{2t} \times 3dt$$
$$= 3te^{2t} - 3\int e^{2t} dt$$

But, $\int e^{2t} dt$ $\quad = 3te^{2t} - 3e^{2t} + c$

$$= 3e^{2t}(t-1) + c$$

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$$\therefore \int 3te^{2t} dt = 3e^{2t}(t-1) + c$$

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

Let $v = x^2$

$\frac{dv}{dx} = 2x$

$dv = 2x\,dx$

Let $du = \sin x\,dx$

$\cancel{\frac{du}{dx}}$ $\cancel{= +C\phi}$ $\int (1)\,du = \int \sin x\,dx$

$u = -\cos x$

Recall; $\int V\,du = uv - \int u\,dv$

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

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

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

But, $\int x\cos x\,dx$

Let $v = x$

$\frac{dv}{dx} = 1$

$dv = dx$

Let $du = \cos x\,dx$

$\int (1)\,du = \int \cos x\,dx$

$u = \sin x$

Recall; $\int V\,du = uv - \int u\,dv$

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

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

$= x\sin x + \cos x + c$

$= -x^2\cos x + 2[x\sin x + \cos x] + c$

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

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

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

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

$= \frac{1}{2}\left[\cos 11x + (\cos x)\right]$

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

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

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

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

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

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

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

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

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

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

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

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