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Assignment

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

Solution

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

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

Recall: $\int u dv = uv - \int v du$.

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

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

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

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

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

Solution

$U = 3t$; $dv = e^{2t}$

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

Recall: $\int u dv = uv - \int v du$.

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

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

$$\int 3te^{2t} dt = \frac{3}{2} te^{2t} - \frac{3}{2}\left(\frac{1}{2} e^{2t}\right) + C$$

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

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

Solution

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

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

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

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

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

$du = 2dx \quad dv - \sin x$

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

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

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

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

Solution

$A = 5x, \quad B = 6x$

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

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

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

$\int \cos 5x \cos 6x \, dx = \frac{1}{2}\left(\frac{\sin 11x}{11} - \frac{\sin x}{1}\right) + C$

$= \frac{\sin 11x}{22} + \frac{\sin x}{2} + C$

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

$A = 7x = B = 2x$

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

$$\sin 7x \cos 2x = \frac{1}{2}\left[\sin 9x + \sin 5x\right]$$

$$\int \sin 7x \cos 2x \, dx = \frac{1}{2}\int \left[\sin 9x + \sin 5x\right]$$

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

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