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MAT104

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

Solution

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

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

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

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

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

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

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

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

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

$du = \frac{3t^2}{2} dx \qquad v = \frac{1}{2} e^{2t}$

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

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

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

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

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

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

<u>Solution</u>

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

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

$uv - \int v du$

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

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

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

~~= Cos~~

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

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

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

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

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

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

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

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

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

Solution

$A = 7x \quad B = 2x$

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

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

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

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

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