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Assignment

Integrate the following

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

Solution

$u = \ln x, \quad \frac{du}{dx} = \frac{1}{x} \therefore du = \frac{dx}{x}$

$dv = 2x^2, \quad v = \frac{2x^3}{3}$

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

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

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

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

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

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

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

2) $3te^{2t}$

Solution

$u = 3t, \quad \frac{du}{dt} = 3, \quad du = 3dt$

$dv = e^{2t}, \quad v = \frac{1}{2}e^{2t}$

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

$\int u\,dv = 3t\frac{e^{2t}}{2} - \int \frac{e^{2t}}{2} \cdot 3dt$

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

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

3. $x^2 \sin x$

Solution

$u = x^2$, $\frac{du}{dx} = 2x$, $du = 2x\,dx$

$dv = \sin x$, $v = -\cos x$

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

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

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

$\int x \cos x\,dx$

$u = x$, $\frac{du}{dx} = 1$, $du = dx$

$dv = \cos x$, $v = \sin x$

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

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

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

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

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

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

Solution

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

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

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

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

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

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

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

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

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