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19/MHS01/272
MAT 104

Solution

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$= uv - \int v \cdot du$

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

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

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

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

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

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

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

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

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

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

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

soln

$A = 7x \qquad b = 2x$

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

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

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

$= \frac{1}{2}\left[-\frac{\cos 9x}{9} + \left(-\frac{\cos 7x}{7}\right)\right] + c$

$\int \sin 7x \cos 2x\,dx = -\frac{\cos 9x}{18} - \frac{\cos 7x}{14} + c$