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Math 104

1 $\int x^{1/2} \ln x \, dx$

$u = \ln x \quad dv = x^{1/2}$

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

$du = \frac{dx}{x} \quad v = \frac{2x^{3/2}}{3}$

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

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

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

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

$= \frac{2x^{3/2} \ln x}{3} - \frac{2}{3}\left[\frac{2}{3} \times \frac{3}{2}\right] + C$

$= \frac{2x^{3/2} \ln x}{3} - \frac{4x^{3/2}}{9} + C$

2 $\int 2\cos 6t \cos t \, dt$

$2\int \cos 6t \cos t$

$2\int \frac{1}{2}[(\cos 7t) + (\cos 5t)]$

$\int \cos 7t + \cos 5t$

$= \frac{\sin 7t}{7} + \frac{\sin 5t}{5} + C$

3 $\int \sin^3 x \cos^4 x \, dx$

$u = \cos x$

$\frac{du}{dx} = -\sin x$

$dx = \frac{-du}{\sin x}$

$\int \sin x \cdot \sin^2 x \cdot u^4 \cdot \frac{-du}{\sin x}$

$-\int \sin^2 x \, u^4 \, du$

$-\int (1 - \cos^2 x) u^4 \, du$

$-\int (1 - u^2) u^4 \, du$

$\int (u^2 - 1) u^4 \, du$

$\int u^6 - u^4 \, du$

$= \frac{u^7}{7} - \frac{u^5}{5} + C$

$= \frac{\cos^7 x}{7} - \frac{\cos^5 x}{5} + C$