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MATH 104
DEPT: Computer Engineering

1) $x^{1/2} \ln x$

2) $2\cos 6t \cos t$

(3) $\sin^3 x \cos^4 x$

Soln

(1) $x^{1/2} \ln x$

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

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

$\frac{du}{dx} = 1/2 x^{-1/2}$

$\int v \frac{du}{dx} + \int v_1 \frac{du}{dx}$

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

$\ln x \left[\frac{x^{3/2}}{3/2} \right] + x^{1/2} \left[\frac{1}{x} \right] + C$

$\frac{2 \ln x}{3} \cdot x^{3/2} + \frac{x^{1/2}}{x} + C$

$\frac{2 x^{3/2} \ln x}{3} + \frac{\sqrt{x}}{x} + C$

(2) $\int 2 \int \cos 6t \cos t \, dt = 12 \int \cos 6t + \cos t \, dt$

$A = 6t \quad B = 1t$

$\cos A \cos B = 1/2 [\cos(A+B) + \cos(A-B)]$

$= 2/2 [\cos 6t + 1) + \cos(6-1)$

$= 2/3 [\cos 7t + (\cos 5t]$

$\int 2 \cos 6t \cos dt = 1/2 = 1/2 \int (2\cos 7t + \cos 5t$

$= \frac{2}{2} \left[\frac{\sin 7t}{7} - \frac{\sin 5t}{5} \right]$

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

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

$u = \cos x$

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

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

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

$= \int u^4 \sin^2 x \cdot du$

$= \int u^4 \sin^2 x \cdot du$

Recall that

$\sin^2 x + \cos^2 x = 1$

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

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

but $u = \cos x$

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

$- (u^4 - u^6) \, du$

$- \left[\frac{u^{4+1}}{4+1} - \frac{(1^{6+1})}{6+1} \right] + C$

$- \left[\frac{u^5}{5} - \frac{u^7}{7} \right] + C$

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

9