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COMPUTER ENGINEERING
19/ENG 02/029 math 104

1 $x^{1/2} \ln x$
2 $2 \cos 6t \cos t$
3 $\sin^3 x \cos^4 x$

Solution

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

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

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

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

$$\int v\frac{du}{dx} + \int u\frac{dv}{dx}$$

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

$$\ln x \left(\frac{x^{3/2}}{3/2}\right) + x^{1/2} \left[\int \frac{1}{x}\right] + c$$

$$\frac{2\ln x}{3}, x^{3/2} + \frac{x^{1/2}}{x} + c$$

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

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

$A = 6t$ $B = 1t$

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

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

$= \frac{2}{2}[\cos 7t + \cos 5t]$

$\int 2\cos 6t \cos t \, dt = \frac{1}{2} \int (2\cos 7t + \cos 5t)$

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

$= \frac{2\sin 7t}{7} - \frac{\sin 5t}{5} + C$

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

$u = \cos x$

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

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

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

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

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

Recall that

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

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

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

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

but $u - \cos x$

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

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

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

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

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