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Matric No: 19/ENG02/004

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

2 $2\cos 6t \cos t$

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

<u>Solution</u>

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

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

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

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

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

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

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

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

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

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

$A = 6t \quad B = t$

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

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

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

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

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

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

$u = \cos x$

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

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

$= \int u^4 \cancel{\sin^3 x} \frac{du}{\sin x}$

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

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

Recall that

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

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

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

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

but $u - \cos x$

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

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

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

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

$\left(\frac{(\cos x)^7}{4}\right) - \frac{(\cos x)^5}{5}$