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Department: Computer Engineering
Matric No: 19/Eng02/036
Course: Mat 104

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

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

Use partial integration formula

$\int u\,dv = uv - \int v \, du$ where $u = \ln(x)$

$dv = x^{1/2}$

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

$\int u\,dv = \ln(x) \times \frac{2x\sqrt{x}}{3} - \frac{3}{} \int \frac{2x\sqrt{x}}{3} \times \frac{1}{x} dx$

$= \ln x \times \frac{2x\sqrt{x}}{3} - \int \frac{2\sqrt{x}}{3}$

$\ln x \times \frac{2x\sqrt{x}}{3} - \frac{2}{3} \int x^{1/2} \, dx$

$= \ln x \times \frac{2x\sqrt{x}}{3} - \frac{2}{3} \times \frac{2x\sqrt{x}}{3}$

$\frac{2x\sqrt{x} \times \ln x}{3} - \frac{4x\sqrt{x}}{9}$

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

02) $\int 2 \cos 6t \cos t \, dx$

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

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

$dv = x^{1/2}$

$du = \frac{1}{x}$ $\quad v = \frac{2x\sqrt{x}}{3}$

$$\int u\,dv = \ln(x) \times \frac{2x\sqrt{x}}{3} - \int \frac{2x\sqrt{x}}{3} \times \frac{1}{x}\,dx$$

$$= \ln x \times \frac{2x\sqrt{x}}{3} - \int \frac{2\sqrt{x}}{3}$$

$$\ln x \times \frac{2x\sqrt{x}}{3} - \frac{2}{3}\int x^{1/2}\,dx$$

$$= \ln x \times \frac{2x\sqrt{x}}{3} - \frac{2}{3} \times \frac{2x\sqrt{x}}{3}$$

$$\frac{2x\sqrt{x} \times \ln x}{3} - \frac{4x\sqrt{x}}{9}$$

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

02) $\int 2 \cos 6t \cos t\,dx$

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

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

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

$= 2\int \frac{1}{2}\cos 7t + \cos 5t$

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

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

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

$u = \cos x$

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

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

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

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

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

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

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

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

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

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

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

$= \frac{(\cos 5x)^7}{7} - \frac{[\cos x]^5}{5} + C //$

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