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Electrical Electronic Engg.

MAT104 SERIAL NUM: 121

19/ENG04/040

Integrate

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

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

$$u = \ln x \quad du = x^{-1/2} dx$$

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

$$\int u \cdot dx = \ln x - \int u \cdot du$$

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

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

$$\int \frac{2x^{1/2}}{3} dx = \frac{2x^{1/2+1}}{3(1/2+1)} = \frac{2x^{3/2}}{3(3/2)} = \frac{2x^{3/2}}{9/2} = \frac{4x^{3/2}}{9}$$

$$\int x^{1/2} \ln x \, dx = \frac{2x^{3/2} \ln x}{3} - \frac{4x^{3/2}}{9} + C$$

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

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

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

$$= \cos(A+B) + \cos(A-B)$$

$$= \int 2 \cos 6t \cos t \, dt = \int \cos 7t + \cos 5t$$

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

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

Let $u = \cos x$

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

$$\text{Recall: } \cos^2 x + \sin^2 x = 1$$

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

$$= \int \sin^5 x \cdot u^4 \cdot \frac{-du}{\sin x} = - \int \sin^4 x \cdot u^4 \cdot du$$

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

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

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

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

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

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

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