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Math 104 Assignment

Integrate:

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

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

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

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

$\int u \cdot dv = uv - \int v \cdot du$

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

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

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

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

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

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

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

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

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

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

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

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

Let $u = \cos x$, $du/dx = -\sin x \Rightarrow dx = -du/\sin x$

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

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

$$= \int \sin^3 x \cdot u^4 \cdot \frac{-du}{\sin x} = -\int \sin^2 x \cdot u^4 \cdot du$$

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

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

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

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

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

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