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MAT 104 Assignment

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

Let $r = \ln x$, $du = x^{1/2} dx$, $dv = \frac{dx}{x}$, $u = \frac{2x^{3/2}}{3}$

$$\int r\,du = uv - \int u\,dv$$

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

$$\int \frac{2x^{3/2}}{3} \cdot \frac{dx}{x} \Rightarrow \int \frac{2x^{1/2}}{3} dx$$

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

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

2.) $\int 2\cos 6t \cos t \, dt$, $A = 6t$, $B = t$

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

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

$$= \int \cos 7t + \cos 5t$$

$$\therefore \int 2\cos 6t \cos t = \frac{\sin 7t}{7} + \frac{\sin 5t}{5} + C$$

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

Since m is odd, $u = \cos x$

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

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

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

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

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

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

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

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

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

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

$\therefore \int \sin^3 x \cos^4 x \, dx = \frac{(\cos x)^7}{7} - \frac{(\cos x)^5}{5} + C$