

MAT 104 Assignment

Answers

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

$$\text{Let } v = \ln x, \quad dv = \frac{1}{x} dx$$

$$u = 2x^{3/2}, \quad du = 3x^{1/2} dx$$

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

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

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

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

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

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

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

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

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

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

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

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

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

$$dx \quad \cdot \quad \sin x$$

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

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

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

$\sin x$

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

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

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

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

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

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

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