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MATRIC NO: 19/MHS01/407

MAT 104 ASSIGNMENT

1. $\int \sin^6 x\,dx = \int \sin^2 x \cdot \sin^4 x$

$= \int \left(\frac{1-\cos 2x}{2}\right) \cdot \left(\frac{1-\cos 2x}{2}\right)^2$

$= \int \frac{1-\cos 2x}{2} \cdot \frac{1-\cos 2x}{2} \cdot \frac{1-\cos 2x}{2}$

$= \frac{1}{8}\int (1-\cos 2x)(1-2\cos 2x + \cos^2 2x)$

$= \frac{1}{8}\int 1 - 3\cos 2x + 3\cos^2 2x - \cos^3 2x$

$= \frac{1}{8}\int 1 - 3\cos 2x + 3\left\{\frac{1+\cos 4x}{2}\right\} - \cos 2x\{1-\sin^2 2x\}$

$= \frac{1}{8}\int 1 - 3\cos 2x + \frac{3}{2} + \frac{3\cos 4x}{2} - \cos 2x + \cos 2x \sin^2 2x$

$= \frac{1}{8}\int \frac{5}{2} - 4\cos 2x + \frac{3\cos 4x}{2} + \cos 2x \sin^2 2x$

$= \frac{1}{8}\left[\frac{5}{2}x - \frac{4\sin 2x}{2} + \frac{3\cos 4x}{8} + \frac{\sin^3 2x}{6}\right] + C$

$= \frac{1}{8}\left\{\frac{5}{2}x - 2\sin 2x + \frac{3\cos 4x}{8} + \frac{\sin^3 2x}{6}\right\} + C$

2. $\int \cos^4 x \sin^3 x$

$u = \cos x$

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

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

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

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

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

$$= -\int u^4 - u^6$$

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

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

$\therefore$

$$\int \cos^4 x \sin^3 x = \frac{\cos^7 x}{7} - \frac{\cos^5 x}{5} + C$$

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

$u = \sin x$

$\frac{du}{dx} = \cos x$

$dx = \frac{du}{\cos x}$

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

$$= \int u^3 du$$

$$\int \cos x \sin^3 x \, dx = \left[\frac{u^4}{4} \right] + C$$

$$= \frac{\sin^4 x}{4} + C.$$