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DEPT : MBBS

MATHS ASSIGNMENT

① $\int \sin^6 x \, dx$

$\int [\sin^2 x]^3 dx$ since $\sin^2 x = \frac{1}{2}[1 - \cos 2x]$

$\int [\frac{1}{2}(1 - \cos 2x)]^3 dx$

$\frac{1}{6}\int [1 - \cos 2x]^3 dx$

$\frac{1}{6}\int [1 - \cos 2x](1 - \cos 2x)(1 - \cos 2x) \, dx$

$\frac{1}{6}\int [1 - \cos 2x - \cos 2x + \cos^2 2x][1 - \cos 2x] dx$

$\frac{1}{6}\int [1 - 2\cos 2x + \cos^2 2x][1 - \cos 2x] dx$

$\frac{1}{6}\int (1 - \cos 2x - 2\cos 2x + 2\cos^2 2x + \cos^2 2x$

$- \cos^3 2x)$

But $\cos^2 2x = \frac{1}{2}[1 + \cos 4x] \; \dots *)$

$\frac{1}{6}\int (1 - 3\cos 2x + 3\cos^2 2x)$

$\frac{1}{6}\int (\cancel{1 - 3(\frac{1}{2}[1+\cos 4x}$

$\frac{1}{6}\int 1 - 3\cos 2x + 3(\frac{1}{2}(1 + \cos 4x))$

$\frac{1}{6}\int 1 - 3\cos 2x + \frac{3}{2}[1 + \cos 4x]$

$\frac{1}{6}\int\left[1 - 3\cos 2x + \frac{3}{2} + \frac{3}{2}\cos 4x\right] dx$

$= \frac{1}{6}\int\left[1 + \frac{3}{2} - 3\cos 2x + \frac{3}{2}\cos 4x\right] dx$

$= \frac{1}{6}\int\left[\frac{5}{2} - 3\cos 2x + \frac{3}{2}\cos 4x\right] dx$

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

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

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

$\int (\cos^2 x)^2 \sin x \times \sin^2 x \, dx$

$\int \left[\frac{1}{2}(1+\cos 2x)\right]^2 \sin x \left(\frac{1}{2}\left[1-\cos 2x\right]\right)$

$\frac{1}{4} \times \frac{1}{2}\int (1+\cos 2x)^2 (1-\cos 2x) \sin x \, dx$

$\frac{1}{8}\int (1+\cos 2x)(1+\cos 2x)(1-\cos 2x) \sin x \, dx$

let $u = \cos 2x$ $du = -2\sin 2x$

$\frac{1}{8}\int (1+u)(1+u)(1-u) \sin x \, dx$

$$= \frac{1}{8}\int (1+2u+u^2)(1-u)\sin x\, dx$$

$$= \frac{1}{8}\int (1-u+2u-2u^2+u^2-u^3)\sin x\, dx$$

$$= \frac{1}{8}\int (1+u-u^2-u^3]\sin x\, dx$$

$$dx = \frac{du}{-2\sin 2x}$$

$$= \frac{1}{8}\int (1+u-u^2-u^3)\sin x \frac{du}{-2\sin 2x}$$

$$\frac{1}{-2}\, \frac{1}{8}\int (1+u-u^2-u^3)\frac{du}{\sin 2x}$$

$$\frac{1}{-16}\left[u+\frac{u^2}{2}-\frac{u^3}{3}-\frac{u^4}{4}\right]\frac{du}{\sin 2x}$$

$$\frac{1}{-16}\left[\cos 2x + \frac{\cos^2 2x}{2} - \frac{\cos^3 2x}{3} - \frac{\cos^4 2x}{4}\right] \times \frac{1}{\sin 2x}$$

$$+ C$$

(3) $\int \cos x \sin^3 x$

let $u = \sin x$ $du = \cos x \, dx$

$\int \cos x \, u^3 \, dx$

$\int \cancel{\cos x} \, u^3 \frac{du}{\cancel{\cos x}}$

$\int u^3 \, du$

$= \frac{u^4}{4} + 6$

$= \frac{\sin^4 x}{4} + 6x + C$