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Course: MAT 104
Department: MBBS Medicine and Surgery
Matric number: 19/MHS01/085
Attendance number: 028

1. $\int \sin^6 x \, dx$

$= -\frac{\sin^5 x \cos x}{6} + \frac{5}{6}\int \sin^4 x \, dx$

$= -\frac{1}{6}\sin^5 x \cos x + \frac{5}{6}\left(\frac{-\sin^3 x \cos x}{4} + \frac{3}{4}\int \sin^2 x \, dx\right)$

$= -\frac{1}{6}\sin^5 x \cos x - \frac{5}{24}\sin^3 x \cos x + \frac{5}{8}\left(\frac{-\sin x \cos x}{2} + \frac{1}{2}\int dx\right)$

$\therefore \int \sin^6 x \, dx = -\frac{1}{6}\sin^5 x \cos x - \frac{5}{24}\sin^3 x \cos x - \frac{5}{16}\sin x \cos x + \frac{5}{16}x + C$

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

$= \int \cos^2 x \cdot \cos^2 x \cdot \sin^3 x \, dx$

Recall that $\sin^2 x + \cos^2 x = 1$

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

$\therefore \int \cos^2 x \cdot \cos^2 x \cdot \sin^3 x \, dx = \int (1 - \sin^2 x)(1 - \sin^2 x)\sin^3 x \, dx$

$= \int (1 - 2\sin^2 x + \sin^4 x)\sin^3 x \, dx$

$= \int \sin^3 x - 2\sin^5 x + \sin^7 x \, dx$

$= \int \sin^3 x \, dx - \int 2\sin^5 x \, dx + \int \sin^7 x \, dx$

$= \left[\frac{x}{3} + \frac{\cos 3x}{1}\right] - \left[\frac{2x}{5} + \frac{\sin 5x}{1}\right] + \left[\frac{x}{7} + \frac{\sin 7x}{1}\right] + C$

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

let $u = \sin x$, $\frac{du}{dx} = \cos x$, $du = \cos x \, dx$, $dx = \frac{du}{\cos x}$

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

$= \int u^3 \cdot du$

$= \left[\frac{u^4}{4}\right] + C$

$= \left[\frac{\sin x}{4}\right]^4 + C$

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