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 Course Code: Mat 104

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 MBB 100 C-1L
 Maths 104

$$\begin{aligned}
 \int \sin^6 x &= (\sin^2 x)^2 (\sin^2 x) \\
 &= \left(\frac{1 - \cos 2x}{2} \right)^2 \left(\frac{1 - \cos 2x}{2} \right) \\
 &= \frac{1}{8} (1 - 2\cos 2x + \cos^2 2x) (1 - \cos 2x) \\
 &= \frac{1}{8} \left(1 - 2\cos 2x + \frac{1 + \cos 4x}{2} \right) (1 - \cos 2x) \\
 &= \frac{1}{16} (2 - 4\cos 2x + 1 + \cos 4x) (1 - \cos 2x) \\
 &= \frac{1}{16} (3 - 4\cos 2x + \cos 4x) (1 - \cos 2x) \\
 &= \frac{1}{16} (3 - 4\cos 2x + \cos 4x + 2(2\cos^2 2x) - \frac{1}{2}(\cos 4x + \cos 2x)) \\
 &= \frac{1}{16} (3 - 4\cos 2x + \cos 4x + 2(1 + \cos 4x) - \frac{1}{2}(\cos 4x + \cos 2x)) \\
 &= \frac{1}{32} [6 - 4\cos 2x + 2\cos 4x + 4 + 4\cos 4x - \frac{1}{2}(\cos 4x + \cos 2x)] \\
 &= \frac{1}{32} [10 - 15\cos 2x + 6\cos 4x - \frac{1}{2}\cos 4x]
 \end{aligned}$$

let $\int \sin^6 x = R$

$$R = \frac{1}{32} \int (10 - 15\cos 2x + 6\cos 4x - \frac{1}{2}\cos 4x) dx$$

$$R = \frac{1}{32} \left(10x - \frac{15\sin 2x}{2} + \frac{6\cos 4x}{4} - \frac{15\cos 4x}{8} \right) + C$$

$$\int \sin^6 x = \frac{10x}{32} - \frac{15\sin 2x}{64} + \frac{6\cos 4x}{128} - \frac{15\cos 4x}{192} + C$$

$$2 \quad \cos^4 x \sin^3 x$$

$$u = \cos x$$

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

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

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

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

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

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

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

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

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

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

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

$$b \quad \cos x \sin^3 x$$

$$3 \quad \cos x \sin^3 x$$

It can be re-wrote as

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

$$\text{let } u = \sin x$$

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

$$du = \cos x dx$$

