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19/MHS01/069
1. Assignment Maths 104
2. MBBS
MHS

1. $\sin^6 x = (\sin^2 x)^2 (\sin^2 x)$

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

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

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

$$= \frac{1}{8}\left(1-2\cos 2x+\frac{1+\cos 4x}{2}\right)(1-\cos 2x)$$

$$= \frac{1}{16}(2-4\cos 2x+1+\cos 4x)(1-\cos 2x)$$

$$= \frac{1}{16}(3-4\cos 2x+\cos 4x)(1-\cos 2x)$$

$$= \tfrac{1}{16}(3-4\cos 2x+\cos 4x-3\cos 2x+4\cos^2 2x-\cos 4x\cos 2x)$$

$$= \tfrac{1}{16}(3-7\cos 2x+\cos 4x+2(2\cos^2 2x)-\tfrac{1}{2}2\cos 4x\cos 2x)$$

$$= \tfrac{1}{16}(3-7\cos 2x+\cos 4x+2(1+\cos 4x)-\tfrac{1}{2}(\cos 6x+\cos 2x))$$

$$= \tfrac{1}{16}(3-7\cos 2x+\cos 4x+2+2\cos 4x-\tfrac{1}{2}(\cos 6x+\cos 2x))$$

$$= \frac{1}{32}(6-14\cos 2x+2\cos 4x+4+4\cos 4x-\cos 6x-\cos 2x)$$

$$= \tfrac{1}{32}[6+4-14\cos 2x-\cos 2x+2\cos 4x+4\cos 4x-\cos 6x]$$

let $\sin^6 x = R$

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

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

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

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

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

$u = \cos x$

$du/dx = -\sin x$

$dx = -du/\sin x$

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

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

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

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

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

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

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

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

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

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

$u = \cos x$

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

$du = -\sin x \, dx$

$-du = \sin x \, dx$

$dx = -du/\sin x$

$\cos x \sin^3 x = u \cdot \sin x \cdot \sin^2 x$

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

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

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

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

$$\int \cos^4 x \sin^3 x = -\int u \cdot (1 - u^2) \cdot du$$

$$= -\int u - u^3 du$$

$$= -\left(\frac{u^2}{2} - \frac{u^4}{4}\right) + c$$

$$= \frac{u^4}{4} - \frac{u^2}{2} + c$$

$u = \cos x$

$$\int \cos^4 x \sin^3 x = \frac{(\cos x)^4}{4} - \frac{\cos x)^2}{2} + c$$