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MBBS

① $\int \sin^6 x\,dx$

$= \int (\sin^2 x\,dx)(\sin^4 x\,dx)$

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

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

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

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

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

$= \int 1 = x \quad , \quad -\int 3\cos 2x = -\frac{3\sin 2x}{2}$

$\int 3\cos^2 2x = \int \frac{3}{2} + \frac{3\cos 4x}{2}$

$= \frac{3x}{2} + \frac{3\sin 4x}{8}$

$-\int \cos^3 2x = -\int \cos 2x(\cos^2 2x)\,dx$

$=$ let $u = \sin 2x$

$\frac{du}{dx} = 2\cos 2x$

$dx = \frac{du}{2\cos 2x}$

$= -\int \cos 2x(1-\sin^2 2x)\frac{du}{2\cos 2x}$

$= \frac{-1}{2}\int (1-u^2)\,du$

$$= \frac{1}{2}\int du - u^2\,du$$

$$= \frac{1}{2}\left[u - \frac{u^3}{3}\right] + C$$

$$= \frac{u^3}{6} - \frac{u}{2}$$

$$= \frac{\sin^3 2x}{6} - \frac{\sin 2x}{2}$$

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

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

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

$$= \frac{5x}{16} - \frac{\sin 2x}{4} + \frac{3\sin 4x}{64} + \frac{\sin^3 2x}{48} + C$$

(4) $\cos^4 x \sin^3 x$

$u = \cos x$

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

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

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

$-\int \frac{u^4}{\cos^4 x} \sin^2 x$

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

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

$-\int u^4 ($

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

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

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

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

$u = \cos x$

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

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

$-\int u \cdot \sin^3 x \cdot \frac{du}{-\sin x}$

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

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

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

$-\int u - u^3$

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

$= -\frac{\cos^2 x}{2} + \frac{\cos^4 x}{4} + C$