(1) $\sin^6 x$

Using reduction formula

$$\int \sin^n x\,dx = -\frac{\sin^{n-1}x\cos x}{n} + \frac{n-1}{n}\int \sin^{n-2}x\,dx$$

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

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

$$\Rightarrow \frac{1}{6}\sin^5 x\cos x - \frac{5}{24}\sin^3 x\cos x +$$

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

$$\Rightarrow \frac{1}{6}\sin^5 x\cos x - \frac{5}{24}\sin^3 x\cos x - \frac{5}{16}\sin x\cos x + \frac{5}{16}$$

$$+C$$

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

odd

$\int \underbrace{\cos^4 x \cdot \sin^2 x}_{f(u)} \underbrace{\sin x \, dx}_{du}$

$\Rightarrow -1 \int (1-\cos^2 x) \cos^4 x \cdot -\sin x \, dx$

Let $u = \cos x$

$du = -\sin x \, dx$

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

$= -1 \int u^4 - u^6 \, du = -1 \left[\frac{u^5}{5} - \frac{u^7}{7}\right] + C$

$\Rightarrow -1 \left(\frac{\cos^5 x}{5} - \frac{\cos^7 x}{7}\right) + C$

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

Soln

$u = \sin x$

$du = \cos x$

$\int u^3 du = \frac{u^4}{4} = \frac{\sin^4 x}{4} + C$