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Assignment

1 $\sin^6 x$

Solution

$$\int \sin^6 x \, dx = \int \sin^4 x \cos^2 x \, dx$$

$$= \frac{1}{6} \times \sin^5 x \cos x + \frac{5}{6} \times \int \sin^4 x \cos x \, dx$$

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

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

$$= \frac{1}{6} \times \sin^5 x \cos x + \frac{5}{6} \times \left(\frac{1}{4} \times \sin^3 x \cos^2 x + \frac{3}{8} \times \int (1 - \cos^2 x) \, dx \right)$$

$$= \frac{1}{6} \times \sin^5 x \cos x + \frac{5}{6} \times \left(\frac{1}{4} \times \sin^3 x \cos^2 x + \frac{3}{8} \times \left(x - \frac{\sin^2 x}{2} \right) \right)$$

$$= \frac{\sin^5 x \cos x}{6} - \frac{5 \sin^3 x \cos x}{24} + \frac{5x}{16} - \frac{5 \sin^2 x}{32} + C$$

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

Solution

$$\int \cos^4 x \sin^3 x \, dx, \text{ let } t = \cos x$$

$$\int -t^4 + t^6 \, dt$$

$$= -\int t^4 \, dt + \int t^6 \, dt$$

$$= -\frac{t^5}{5} + \frac{t^7}{7}$$

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

3 $\cos x \sin^3 x$

Solution

$$\int \cos x \sin^3 x \, dx, \text{ let } t = \sin x$$

$$\int t^3 \, dt$$

$$= \frac{t^4}{4}$$

4 Substitute back $t = \sin(x)$

$$= \frac{(\sin(x))^4}{4} + C$$

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