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Math 104.

Gen mathematics III

~~Assign~~ Assignment.

① $\sin^6 x$.

Soln

$$\int \sin^6 x dx = \int \sin^2 x \cdot \sin^4 x dx$$

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

$$= \int \frac{1 - \cos 2x}{2} \cdot \frac{1 - \cos 2x}{2} \cdot \frac{1 - \cos 2x}{2} dx$$

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

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

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

$$= \frac{1}{8} \int \left(1 - 3\cos 2x + 3 \left[\frac{1 + \cos 4x}{2} \right] - \cos^2 2x [1 - \sin^2 2x] \right) dx$$

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

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

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

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

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

$$u = \cos x$$

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

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

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

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

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

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

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

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

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

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

$$\textcircled{3} \int \cos x \sin^3 x \, dx$$

$$u = \sin x$$

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

$$dx$$

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

$$\int \cos x \sin^3 x \, dx = \int \cos x \cdot \sin^3 x \frac{dx}{\cos x}$$

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

$$\int \cos x \sin^3 x \, dx = \left[\frac{u^4}{4} \right] + C$$

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