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19/MHS01/311 MATH 104

1) $\int \sin^6 x \, dx$

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

Solving: $\int \sin^4(x)\, dx$

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

Solving: $\int \sin^2(x)\, dx$

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

Solving: $\int 1\, dx$

$= x$

$\therefore = \frac{x}{2} - \frac{\cos(x)\sin(x)}{2}$

$\therefore$

$-\frac{\cos(x)\sin^5(x)}{4} - \frac{3\cos(x)\sin(x)}{8} + \frac{3x}{8}$

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

$$\int \sin^6(x)\,dx = -\frac{\cos x \sin^5 x}{6} - \frac{5\cos x \sin x}{16} + \frac{5x}{16} + C$$

$$\int \sin^6(x)\,dx = \frac{-10x}{32} + \frac{15\sin 2x}{64} - \frac{3\sin 4x}{64} - \frac{\sin 6x}{192} + C$$

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

$u = \cos x \qquad \frac{du}{dx} = -\sin x$

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

$\int u^4 \sin^2(x)\,\frac{du}{-\sin x}$

$-\int u^4 \cdot \sin^2(x)\,du$

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

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

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

$$-\left(\frac{u^5}{5} - \frac{u^7}{7}\right) + C$$

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

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

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

$u = \sin x$

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

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

$\int \frac{\cos x \, u^3 \, du}{\cos x}$

$\int u^3$

$\frac{u^4}{4} + C$

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