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ASSIGNMENT.

Integrate the following functions:

1) $\sin^6 2x$.

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

3) $\cos 2x \sin^3 2x$.

Solutions.

1) $\int \sin^6 2x$

$\int (\sin^2 2x)^3 dx$

$\int \left(\frac{1-\cos 2x}{2}\right)^3$

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

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

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

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

$\frac{1}{8}\left(x - \frac{3\sin 2x}{2} + \frac{3\sin 4x + 12x}{8} - \frac{\sin 2x - 3\sin^3 2x}{8_2}\right)$

$\frac{x}{8} - \frac{3\sin 2x}{16} + \frac{3\sin 4x + 12x}{64} - \frac{3\sin 2x - 3\sin^3 2x}{16} + c$

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

$u = \cos x$

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

$\int u^4 \cdot \cancel{\sin x} \cdot \sin^2 x \cdot \frac{-du}{\cancel{\sin x}}$

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

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

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

$\int (-u^4 + u^6) du$

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

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

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

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

$u = \sin x$

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

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

$\int u^3 - du$

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

$\cos x \sin^3 x = \frac{\sin^4 x}{4} + C$