NAME: MGBOH BIYELUM EMILIA
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① $\int \sin^6 x$

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

$= \int (\sin^2 x) \cdot (\sin^2 x)^2 \, dx$

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

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

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

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

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

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

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

since m = odd

$u = \cos x$

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

and $\sin^2 x + \cos^2 x = 1$

$\sin^2 x = 1-\cos^2 x$

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

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

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

$= -\int (u^4 - u^6)\, du$

$= \int (u^6 - u^4)\, du$

$= \left[\frac{u^6}{7} - \frac{u^5}{5} \right] + c$

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

3 $\int \cos x \sin^3 x$

Solution

$u = \cos x$

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

$du = -\sin x\, dx$

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

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

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

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

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

$= -\int (u - u^3)\, du$

$= \int (u^3 - u)\, du$

$= \left[\frac{u^4}{4} - \frac{u^2}{2} \right] + c = \frac{(\cos x^4)}{4} - \frac{(\cos x)^2}{2}$