ONYEDIMMA ADAEZE WINIFRED
19/MMS01/355
MATH 104

1. Integrate $\sin^6 x$

Let $I = \sin^6 x$

$I = (\sin^3 x)^2$ - - - (1)

$\sin^3 x = \frac{1}{4}(3\sin x - \sin 3x)$

From (1);

$I = [\frac{1}{4}(3\sin x - \sin 3x)]^2$

$I = \frac{1}{16}(9\sin^2 x + \sin^2 3x - 6\sin 3x \sin x)$ (2)

$= \frac{1}{16}[9(1-\cos 2x)/2 + (1-\cos 6x)/2 - 3(\cos 2x - \cos 4x)]$

$= \frac{1}{16}[9x/2 - \sin 2x/4 + x/2 - \sin 6x/12 - 3\sin 2x/2 + 3\sin 4x/4] + C$

$= \frac{1}{16}[5x - 7\sin 2x/4 + 3\sin 4x/4 - \sin 6x/12 + 3\sin 4x/4] + C$

$= \frac{1}{16}[5x - 7\sin 2x/4 + 3\sin 4x/4 + \sin 6x/12] + C$

(2) Integrate $\cos^4 x \sin^3 x$

$\int \cos^4 x \sin^3 x \, dx \rightarrow \int \sin^3 x \cos^4 x \, dx$

Using $\int f(u) du$

$$\int \cos^4 x \sin^3 x \, dx = \int \underbrace{\sin^2 x \cdot \cos^4 x}_{f(u)} \underbrace{\sin x \, dx}_{du}$$

$$= \int \cos^4 x \sin^3 x \, dx = -1 \int (1-\cos^2 x) \cos^4 x \cdot -\sin x \, dx$$

Let $u = \cos x$

$du = -\sin x \, dx$

$$\int \cos^4 x \sin^3 x \, dx = -1 \int (1-u^2) u^4 \, du$$

$$\int \cos^4 x \sin^3 x \, dx = -1 \int u^4 - u^6 \, du$$

$$\int \cos^4 x \sin^3 x \, dx = -1 \left[\frac{u^5}{5} - \frac{u^7}{7} \right] + c$$

$$\int \cos^4 x \sin^3 x \, dx = -1 \left[\frac{\cos^5 x}{5} - \frac{\cos^7 x}{7} \right] + c$$