19/MH801/023

ADEDAYO-OJO PRISCILLA OLAMIDE

MEDICINE AND SURGERY

19/MH801/023

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MATH104: ASSIGNMENT

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

using the formula,

$$\int \sin^n x\,dx = \frac{\sin^{n-1} x\cos x}{n} + \frac{n-1}{n}\int \sin^{n-2} x\,dx$$

where $n=6$

$$\int \sin^6 x\,dx = \frac{\sin^{6-1} x\cos x}{6} + \frac{6-1}{6}\int \sin^{6-2} x\,dx$$

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

$$\int \sin^4 x\,dx = \frac{\sin^{4-1}\cos x}{4} + \frac{3}{4}\int \sin^{4-2} x\,dx$$

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

$$\int \sin^6 x\,dx = \frac{\sin^5 x\cos x}{6} + \frac{5}{6} \times \left[\frac{\sin^3\cos x}{4} + \frac{3}{4}\int \sin^2 x\,dx\right]$$

$$= \frac{\sin^5 x\cos x}{6} + \frac{5(\sin^3\cos x)}{24} + \frac{5}{8}\int \sin^2 x\,dx$$

$$\int \sin^2 x\,dx = \frac{\sin^{2-1} x\cos x}{2} + \frac{2-1}{2}\int \sin^{2-2} x\,dx$$

$$= \frac{\cancel{\sin x}\,\sin x\cos x}{2} + \frac{1}{2}\int \sin^0 x\,dx$$

$$= \frac{\sin x \cos x}{2} + \frac{1}{2}\int 1$$

$$\approx \frac{\sin x \cos x}{2} + \frac{1}{2} \times x$$

$$\approx \frac{\sin x \cos x + x}{2}$$

$$\int \sin^6 x\,dx = \frac{\sin^5 x \cos x}{6} + \frac{5(\sin^3 \cos x)}{24} + \frac{5}{8}\left[\frac{\sin x \cos x + x}{2}\right]$$

$$= \frac{\sin^5 x \cos x}{6} + \frac{5(\sin^3 \cos x)}{24} + \frac{5(\sin x \cos x + x)}{16} + C$$

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

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

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

$$\int \sin x \cdot (\cos^4 x - \cos^6 x)\,dx$$

$$\int (\cos^4 x - \cos^6 x) \sin x\,dx$$

let $u = \cos x$

let $du = \sin x\,dx$

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

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

$\int u^4 = \frac{u^{4+1}}{5}$

$= \frac{u^5}{5}$

$\int u^6 = \frac{u^{6+1}}{7}$

$= \frac{u^7}{7}$

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

$\frac{7u^5 - 5u^7}{35}$

$= \frac{7\cos^5 x - 5\cos^7 x}{35} + C$

3. $\cos x \sin^3 x \, dx$

Let $u = \sin x$

$du = \cos x \, dx$

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

$$= \frac{u^{3+1}}{4}$$

$$= \cancel{u^4} \quad \frac{u^4}{4}$$

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