NAME: OBUKOFE OKEOGHENE FAVOUR.
MATRIC NUMBER: 19/MHS01/275.
DEPT: MEDICINE AND SURGERY.

MAT 104 ASSIGNMENT.

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

Also the same as $\int (\sin^2 x)^3 \, dx = \int \left[\frac{1}{2}(1 - \cos 2x)\right] dx =$

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

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

To find the $\int 3\cos^2 2x$:

$\int 3\cos^2 x = 3\int \cos^2 2x = 3\int \frac{1}{2}(1 + \cos 4x) \, dx.$

$\frac{3}{2}\int (1 + \cos 4x) dx = \frac{3}{2}\left(x + \frac{\sin 4x}{4}\right) + c = \frac{3x}{2} + \frac{3}{8}\sin 4x + c.$

Therefore we have

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

To find the $\int \cos^3 2x \, dx$:

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

let $u = \sin 2x$.

$du = -2\cos 2x \, dx$

$\frac{-du}{2} = \cos 2x \, dx.$

$$\int \cos 2x\,(1-\sin^2 2x) = \int -\frac{du}{2}\cdot(1-u^2) = \frac{1}{2}\int du\,(u^2-1)$$

$$\frac{1}{2}\left(\frac{u^3}{3}-u\right) = \frac{u^3}{6}-\frac{u}{2} = \frac{(\sin 2x)^3}{6}-\frac{\sin 2x}{2}\,..$$

There fore.:

$$\int \sin^6 x\,dx = \frac{1}{8}\left[x-\frac{3}{2}\sin 2x+\frac{3x}{2}+\frac{3}{8}\sin 4x-\left(\frac{\sin^3 2x}{6}-\frac{\sin 2x}{2}\right)\right] + c.$$

$$\int \sin^6 x\,dx = \frac{5x}{16}-\frac{3}{2}\sin 2x+\frac{3}{8}\sin 4x-\frac{1}{48}\sin^3 2x+\frac{1}{16}\sin 2x + c.$$

$$\int \sin^6 x\,dx = \frac{5x}{16}-\frac{23}{16}\sin 2x+\frac{3}{8}\sin 4x-\frac{1}{48}\sin^3 2x + c$$

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

Since m is odd, $u = \cos x$.

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

Also recall: $\sin^2 x = 1 - \cos^2 x$.

$\therefore \int \cos^4 x \sin^3 x \, dx = \int u^4 \cancel{\sin x} (1 - \cos^2 x) \cdot \frac{-du}{\cancel{\sin x}} =$

$\int (u^2 - 1) \cdot u^4 \, du = \int (u^6 - u^4) \, du = \frac{u^7}{7} - \frac{u^5}{5} + c$.

$\therefore \int \cos^4 x \sin^3 x \, dx = \cancel{\frac{(\cos x)^7}{7}}$

$\frac{(\cos x)^7}{7} - \frac{(\cos x)^5}{5} + c$.

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

let. $u = \sin x$, $\frac{du}{dx} = \cos x.$

$\cancel{dx} = du = \cos x \, dx.$

$\therefore \int \cos x \sin^3 x \, du = \int u^3 du = \frac{u^4}{4} + c = \frac{(\sin x)^4}{4} + c$

$\therefore \int \cos x \sin^3 x \, dx = \frac{(\sin x)^4}{4} + c.$