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Matric no: 19/MHS01/313
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Assignment

1 ~~Sin 6~~ $\sin^6 x$

using Reduction formula

$u = \sin x \Rightarrow du = \cos x \, dx$

$$S_n = \frac{\sin^{n-1}x \cos x}{n} + \frac{n-1}{n} S_{n-2}$$

$$S_6 = \frac{-\sin^{6-1}x \cos x}{6} + \frac{6-1}{6} S_{6-2}$$

$$S_6 = \frac{\sin^5 x \cos x}{6} + \frac{5}{6} \sin_4$$

obtain expression for S_4

$$S_4 = \frac{-\sin^3 x \cos x}{4} + \frac{3}{4} S_2$$

$$S_2 = \frac{-\sin x \cos x}{2} + \tfrac{1}{2} S_0$$

$$S_0 = \int \sin^0 x \, dx = \int 1 dx = x$$

S_0 into S_2, then S_2 into S_4

$$S_4 = \frac{-\sin^3 x \cos x}{4} + \tfrac{3}{4}\left(\frac{-\sin x \cos x}{2} + \tfrac{1}{2}x\right)$$

$$S_4 = \frac{-\sin^3 x \cos x}{4} - \frac{3\sin x \cos x}{4} + \tfrac{3}{8} x$$

S_4 into S_6

$$S_6 = \frac{-\sin^5 x \cos x}{6} + \tfrac{5}{6}\left(\frac{-\sin^3 x \cos x}{4} - \frac{3\sin x \cos x}{4} + \tfrac{3}{8}x\right)$$

$$S_6 = \frac{-\sin^5 x \cos x}{6} - \frac{5\sin^3 x \cos x}{24} - \frac{5\sin x \cos x}{16} + \tfrac{5}{16} x$$

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

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

$u = \sin x \Rightarrow du \rightarrow \cos x \, dx$

$\int \cos^4 x \sin^3 x - \int u^{13}$

let $u = \cos x \Rightarrow du \Rightarrow -\sin x \, dx \Rightarrow -du = \sin x \, dx$

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

$= 1 - u^2$

as $\cos^4 x = u^4$

Substituting, we have

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

$= \frac{1}{7} \cos^7 x - \frac{1}{5} \cos^5 x + C$

3 $\cos x \sin^3 x$

$u = \sin x \Rightarrow du \Rightarrow \cos x \, dx$

$\int \cos x \sin^3 x \, dx = \int du \, u^3 \, du = \frac{1}{4} u^4 + C$

$= \frac{1}{4} \sin^4 x + C$