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19/MHS01/061   MBBS

1) $\cos x \quad \sin^3 x$

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

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

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

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

$4 \Rightarrow \sin x \Rightarrow du \Rightarrow \cos x \, dx$

$\int \cos^4 x \sin^3 x = \int u^3$

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

$= \sin x \, dx$

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

$= 1 - 4^2$

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

substituting, we have

$= \int (1 - u^2) u^4 du = \int (u^6 - u^4) du = u$

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

3)

a) ~~Sin 6~~ $\sin^6 x$

Using Reduction formula

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

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

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

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1) $\cos x \quad \sin^3 x$

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

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

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

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

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

$\int \cos^4 x \sin^3 x = \int u^3$

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

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

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

~~Sin6~~ $\sin^6 x$

Using Reduction formula

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

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

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

$S_6 = \frac{-\sin^5 x \cos x}{6} + \frac{5}{6} S_4$

Similarly, we obtain expression for S_4

$S_4 = \ldots$

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

$4 \Rightarrow \sin x \Rightarrow du \Rightarrow \cos x$

$\int \cos^4 x \sin^3 x = \int u^4$

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

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

$= 1 - 4^2$

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

substituting, we have

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

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

3)

a) ~~Sin6~~ $\sin^6 x$

Using Reduction formula

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

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

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

$S_6 = \frac{-\sin^5 x \cos x}{6} + \frac{5}{6} S_4$

similarly, we obtain expression for S_4

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

Substitute the above S_4 in S_6,

$$S_4 = \frac{\sin^5 x \cos x}{6} = \frac{5}{6}\left(-\frac{\sin^3 x \cos x}{4} - \frac{3\sin x \cos x}{4} + \frac{3x}{8}\right)$$

$$-\frac{5\sin^3 x \cos x}{24} - \frac{5\sin x \cos x}{16} + \frac{5}{1}$$

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