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Mat no :- 19/MHS01/138

① $\int \sin^6 x \, dx$

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

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

$= \int (1 - \cos^2 x)(1 - 2\cos^2 x + \cos^4 x) \, dx$

$= \int (1 - 3\cos^2 x + \cos^4 x - \cos^6 x) \, dx$

$= \int 1 - 3\int \cos^2 x + \int \cos^4 x - \int \cos^6 x$

$= x - 3\left(\frac{\cos^3 x}{3}\right) + \frac{\cos^5 x}{5} - \frac{\cos^7 x}{7}$

$= x - \cos^3 x + \frac{\cos^5 x}{5} - \frac{\cos^7 x}{7} + C$

② $\int \cos^4 x \sin^3 x \, dx$

Let $u = \cos x$

$du/dx = -\sin x$

$dx = -du/\sin x$

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

$= \int u^4 \sin^3 x \cdot -du/\sin x$

$= \int u^4 \sin^2 x \cdot du$

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

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

$= -\int u^4 - u^6 \, du$

$$= -\cos^6 x/5 + \cos^7 x/7$$

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

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

$u = \cos x$

$du/dx = -\sin x$

$dx = -du/\sin x$

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

$= \int \cos x \sin^3 x = -du/\sin x$

$= -\int u \sin^{-2} x \, du$

$= -\int u \sin 2x \, du$

$= -\int u(1 - \cos^2 x) \, du$

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

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

$= -(u^2/2 - u^4/4)$

$= -\frac{u^2}{2} + \frac{u^4}{4}$

~~$= \frac{u^2}{2}$~~

$= \frac{\cos^4 x}{4} - \frac{\cos^2 x}{2} + C$