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① $\int \sin 6x$

Solution

$$\int \sin 6x = \frac{-\cos 6x}{6} + C$$

② $\int \cos^4 x \sin^3 x$

Solution

$U = \cos x$

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

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

Since $\sin^2 x + \cos^2 x = 1$

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

$$\int \cos^4 x \sin^3 x \, dx = \int U^4 \cdot \sin x \cdot \sin^2 x \cdot \frac{-du}{\sin x}$$

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

$$= -\int \sin^2 x \cdot U^4 du$$

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

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

$$= \int (U^4 - U^6) du$$

$$= \left[\frac{U^7}{7} - \frac{U^5}{5}\right] + C$$

$$\int (\cos^4 x \sin^3 x) dx = \frac{(\cos x)^7}{7} - \frac{(\cos x)^5}{5} + C$$

(3) $\int \cos x \sin 3x$

Solution

$U = \cos x$

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

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

Since ; $\sin^2 x + \cos^2 x = 1$

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

$\int \cos x \sin 3x = \int U \cdot \sin x \cdot \sin 2x \cdot \frac{-du}{\sin x}$

$= \int U \cdot \sin 2x \cdot -du$

$= -\int \sin 2x \cdot U du$

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

$= \int (U^2 - 1) U du$

$= \int (U^3 - U) du$

$= \left[\frac{U^4}{4} - \frac{U^2}{2} \right]$

$= \frac{(\cos x)^4}{4} - \frac{(\cos x)^2}{2}$