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Computer Science

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Find the integral of the following

1) $\int \sin 7x \cos 2x \, dx$

$A = 7x \quad B = 2x$

$$\sin A \cos B = \frac{1}{2} [\sin(A+B) + \sin(A-B)]$$

$$\begin{aligned} \int \sin 7x \cos 2x \, dx &= \frac{1}{2} \int (\sin 9x + \sin 5x) \, dx \\ &= \frac{1}{2} \left[-\frac{\cos 9x}{9} - \frac{\sin 5x}{5} \right] \\ &= -\frac{\cos 9x}{18} - \frac{\sin 5x}{10} + C \end{aligned}$$

2) $\int \cos 3x \cos x \, dx$

$A = 3x \quad B = x$

$$\cos A \cos B = \frac{1}{2} [\cos(A+B) + \cos(A-B)]$$

$$\begin{aligned} \int \cos 3x \cos x \, dx &= \frac{1}{2} \int (\cos 4x + \cos 2x) \, dx \\ &= \frac{1}{2} \left[\frac{\sin 4x}{4} + \frac{\sin 2x}{2} \right] \\ &= \frac{\sin 4x}{8} + \frac{\sin 2x}{4} + C \end{aligned}$$

3) $\int \frac{\cos x}{\sin^2 x} \, dx$

Let $u = \sin x$

$\frac{du}{dx} = \cos x \Rightarrow dx = \frac{du}{\cos x}$

we have $\int \frac{\cos x}{u^2} \cdot \frac{du}{\cos x}$

$$= \int \frac{du}{u^2} = \int u^{-2} du$$

$$= -u^{-1} + C$$

Recall $u = \sin x$

$$= -\frac{1}{\sin x} + C$$

$$4 \int_1^2 \left[\int_0^3 (9x^2y) dx \right] dy$$

$$\int_0^3 (9x^2y) dx$$

$$= \left[\frac{9x^3y}{3} \right]_0^3$$

$$= [3x^3y]_0^3$$

$$= [3(3)^3y] - [3(0)^3y]$$

$$= 3(27)y - 0$$

$$= 81y$$

$$\int_1^2 81y dy$$

$$\left[\frac{81y^2}{2} \right]_1^2$$

$$\frac{81(2)^2}{2} - \frac{81(1)^2}{2}$$

$$= \frac{81(4)}{2} - \frac{81(1)}{2}$$

$$= \frac{324}{2} - \frac{81}{2}$$

$$= \frac{243}{2}$$

$$= 121.5$$