

19/ENG05/031

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MECHATRONICS ENGINEERING  
MAT 104

$$\textcircled{1} \int \sin 7x \cos 2x \, dx$$

Soln

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

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

$$\int \sin 7x \cos 2x \, dx = \frac{1}{2} [\sin(9x) - \sin(-5x)] \, dx$$

$$= \frac{1}{2} (\sin 9x + \sin 5x) \, dx$$

$$= \frac{1}{2} \left[ \int \sin 9x \, dx + \int \sin 5x \, dx \right]$$

$$= \frac{1}{2} \left[ -\frac{1}{9} \cos 9x - \frac{1}{5} \cos 5x \right]$$

$$= -\frac{\cos 9x}{18} - \frac{\cos 5x}{10} + C$$

$$\textcircled{2} \int \cos 3x \cos x \, dx$$

Soln

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

$$= \frac{1}{2} [\cos(4x) + \cos(2x)] \, dx$$

$$= \frac{1}{2} \int (\cos 4x + \cos 2x) \, dx$$

$$= \frac{1}{2} \left[ \int \cos 4x \, dx + \int \cos 2x \, dx \right]$$

$$= \frac{1}{2} \left[ \frac{1}{4} \sin 4x + \frac{1}{2} \sin 2x \right]$$

$$= \frac{\sin 4x}{8} + \frac{1}{4} \sin 2x + C$$

$$= \frac{2\sin 4x + \sin 2x}{8} + C$$



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

SSL

$$u = \sin x \quad \frac{du}{dx} = \cos x \quad dx = \frac{1}{\cos x} du$$

$$= \int \frac{\cos x}{u^2} dx$$

$$= \int \frac{\cos x}{u^2} \cdot \frac{1}{\cos x} du$$

$$= \int \frac{1}{u^2} du$$

$$= \frac{u^{-2+1}}{-1} + C$$

$$= -\frac{1}{u} + C = -\frac{1}{\sin x} + C = \underline{\underline{-\operatorname{cosec} x + C}}$$

$$\textcircled{4} \int_1^2 \int_0^3 9x^2y \, dx \, dy$$

Ans

$$\int_1^2 \int_0^3 9x^2y \, dx \, dy$$

SSL

$$\int_1^2 \left[ \frac{9x^3y}{3} \right]_0^3 dy$$

$$\int_1^2 [3x^3y]_0^3 dy$$

$$\int_1^2 [3(3)^3y - 3(0)y] dy$$

$$\int_1^2 [81y - 0] dy = [81y^2]_1^2$$

$$= 81(2) - 81(1)$$

$$= \underline{\underline{81}}$$