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Department: Mechatronics Engineering

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1. $\sin 7x \cos 2x$

$\sin a \cdot \cos b = \frac{1}{2}\left(\sin(a+b) + \sin(a-b)\right)$

$= \frac{1}{2}\left(\sin(9x) + \sin(5x)\right)$

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

$= \frac{1}{2}\left(-\frac{\cos 9x}{9}\right) + \frac{1}{2}\left(-\frac{\cos 5x}{5}\right) + C$

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

$= \frac{1}{2}\int \cos(3x+x) + \cos(3x-x)\,dx$

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

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

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

3 $\int \frac{\cos x}{\sin^2 x}\,dx$ let $u = \sin x$

$du = \cos x\,dx$

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

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

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

$= \frac{u^{-1}}{-1}\,du = -\sin^{-1} x + C$

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

$$\int_1^2 9x^2 y \, dx = y \cdot \frac{9x^3}{3} \Big|_1^2$$

$$= 3y(2^3 - 1^3)$$

$$= 3y(7)$$

$$= 21y$$

$$\int_0^3 21y \, dy = \frac{21y^2}{2} \Big|_0^3$$

$$= \frac{21}{2}(3^2 - 0^2)$$

$$= \frac{21}{2}(9)$$

$$= \frac{189}{2}$$