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MAT 104

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① $\int \sin 7x \cos 2x$

$A = 7x, B = 2x$

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

$= \frac{1}{2}[\sin(7x+2x) + \sin(7x-2x)]$

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

$\int \sin 7x \cos 2x = -\frac{\cos 9x}{18} - \frac{\cos 5x}{10} + C$

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

$A = 3x, B = x$

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

$= \frac{1}{2}[\cos(3x+x) + \cos(3x-x)]$

$= \frac{1}{2}[\cos 4x + \cos 2x]$

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

$\int \cos 3x \cos x \, dx = \frac{\sin 4x}{8} + \frac{\sin 2x}{4} + C$

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

Let $u = \sin x$

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

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

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

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

$= \frac{u^{-1}}{-1} = \frac{-1}{u}$

$u = \sin x$

$\int \frac{\cos 2x}{\sin^2 x} dx = \frac{-1}{\sin x} + C$

4. $\int_2^3 \left[\int_0^3 (9x^2 y)\, dx\right] dy$

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

$\left[\frac{9x^3 y}{3}\right]_0^3 = 3(3)^3 y = 81y$

$\therefore \int_1^2 81y\, dy = \left[\frac{81y^2}{2}\right]_1^2$

$= \left[\frac{81(2)^2}{2}\right] - \left[\frac{81(1)^2}{2}\right]$

$= 162 - 40.5$

$= 121.5$