Ajibade Pharez Toluwanimi
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MAT104

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

Solution.

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

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

$= \frac{1}{2}[\sin 9x + \sin 5x]$

$\int \sin 7x \cos 2x = \frac{1}{2}\left[\int \sin 9x + \int \sin 5x\right]$

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

$= -\frac{1}{18}\cos 9x + \left(-\frac{1}{10}\cos 5x\right) + C$

$= -\frac{1}{18}\cos 9x - \frac{1}{10}\cos 5x + C$

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

$A = 3x \quad B = x \text{ or } 1x$

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

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

$\cos 3x \cos x = \frac{1}{2}[\cos 4x + \cos 2x]$

$\int \cos 3x \cos 2x = \frac{1}{2}\left[\int \cos 4x + \int \cos 2x\right]$

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

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

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

Solution

$u = \sin x$

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

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

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

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

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

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

Sub $u = \sin x$

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

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

Solution

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

$\left[\frac{9x^3y}{3}\right]_0^3 = \frac{9(3)^3 y}{3} - \frac{9(0)^3 y}{3}$

$= \frac{9 \times 27 \times y}{3} = 81y$

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

$\frac{81(2)^2}{2} - \frac{81(1)^2}{2} = \frac{324}{2} - \frac{81}{2}$

$= \frac{243}{2}$