5. $\int \sin 7x \cos 2x$

Solution

~~[illegible]~~

~~[illegible]~~

Recall;

$$\sin Ax \cos Bx = \frac{1}{2}\left[\sin(A+B)x + \sin(A-B)x\right]$$

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

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

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

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

$$= \frac{-\cos(9x)}{18} - \frac{\cos(5x)}{10} + c$$

3. $\int x^2 \sin x$

Solution

$u = x^2$, $dv = \sin x$

$du = 2x\,dx$ $\quad v = -\cos x$

$\int x^2 \sin x = -x^2\cos x - \int -2x\cos x\,dx$

$= -x^2\cos x + \int 2x\cos x\,dx$

$= -x^2\cos x + 2x\sin x - \int 2\sin x\,dx$

$= -x^2\cos x + 2x\sin x - (-2\cos x) + c$

$\int x^2 \sin x = -x^2\cos x + 2x\sin x + 2\cos x + c$

4. $\int \cos 5x \cos 6x$

Solution

Recall,

$\cos Ax \cos Bx = \frac{1}{2}\left[\cos(A-B)x + \cos(A+B)x\right]$

$\int \cos 5x \cos 6x = \int \frac{1}{2}\left[\cos(5-6)x + \cos(5+6)x\right]$

$= \int \frac{1}{2}\left[\cos(-x) + \cos(11x)\right]$

$= \frac{1}{2}\int \cos(-x) + \cos(11x)$

$= \frac{1}{2}\int \cos(-x)\,dx + \frac{1}{2}\int \cos(11x)\,dx$

$\boxed{\text{Recall, } \cos(-x) = \cos x}$

$= \frac{1}{2}\int \cos(x)\,dx + \frac{1}{2}\int \cos(11x)\,dx$

$= \frac{1}{2} \times \frac{\sin(x)}{1} + \frac{1}{2} \times \frac{\sin(11x)}{11} + c$

$= \frac{\sin(x)}{2} + \frac{\sin(11x)}{22} + c$

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MAT 104 ASSIGNMENT

1. $\int 2x^2 \ln x$

solution

$u = \ln x \quad , \quad dv = 2x^2$

$du = \frac{1}{x}dx \quad\quad v = \frac{2x^3}{3}$

$$\int 2x^2 \ln x = \ln x \cdot \frac{2x^3}{3} - \int \frac{2x^3}{3} \cdot \frac{1}{x}\, dx$$

$$= \frac{2x^3}{3}\ln x - \int \frac{2x^2}{3} dx$$

$$= \frac{2x^3}{3}\ln x - \frac{2}{3}\int x^2 dx$$

$$= \frac{2x^3}{3}\ln x - \frac{2x^3}{9} + c$$

$$\int 2x^2 \ln x = \frac{2x^3}{3}\left(\ln x - \frac{1}{3}\right) + c$$

2. $\int 3te^{2t}$

solution

$u = 3t \quad , \quad dv = e^{2t}$

$du = 3dt \quad\quad v = \frac{1}{2}e^{2t}$

$$\int 3te^{2t} = 3t \cdot \frac{1}{2}e^{2t} - \int \frac{1}{2}e^{2t} \cdot 3dt$$

$$= \frac{3}{2}te^{2t} - \frac{3}{2}\int e^{2t} dt$$

$$= \frac{3}{2}te^{2t} - \frac{3}{2} \times \frac{1}{2}e^{2t} + c$$

$$= \frac{3}{2}te^{2t} - \frac{3}{4}e^{2t} + c$$

$$\int 3te^{2t} = \frac{3e^{2t}}{2}\left(t - \frac{1}{2}\right) + c$$