NAME: IKOBHO DEBORAH -ELUM MATRIC NO: 19/MHS01/204
COURSE: MATHS 104
DEPARTMENT: MEDICINE AND SURGERY
DATE: FRIDAY 23rd MAY 2020

1) $2x^2 \ln x$

Solution

$U = \ln x \quad dv = 2x^2$

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

$\int U dv = uv - \int v du$

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

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

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

$\therefore \int 2x^2 \ln x dx = \frac{2x^3}{3}\ln x - \frac{2x^3}{9} + C$

OR

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

2) $3te^{2t}$

Solution

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

$du = 3dx \quad V = \frac{1}{2}e^{2t}$

$\int u dv = uv - \int v du$

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

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

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

$\therefore \int 3te^{2t} dt = \left[\frac{3te^{2t}}{2} - \frac{3}{4}e^{2t}\right] + c$

3) $x^2 \sin x$

Solution

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

$\frac{du}{dx} = 2x \qquad v = -\cos x$

$du = 2x dx$

$\int u dv = uv - \int v du$

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

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

$= -x^2 \cos x + \left[\begin{matrix} u = 2x & dv = \cos x \\ du = 2dx & v = \sin x \end{matrix}\right]$

$= -x^2 \cos x + uv - \int v du$

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

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

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

4) $\cos 5x \cos 6x$

Solution

$A = 5x, B = 6x$

Recall that

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

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

$\int \cos 5x \cos 6x \, dx = \frac{1}{2}\left[\frac{\sin 11x}{11} + \sin x\right] + c$

$\therefore \int \cos 5x \cos 6x \, dx = \frac{\sin 11x}{2x} + \frac{\sin x}{2} + C$

⑤ $\sin 7x \cos 2x$

Solution

$A = 7x$, $B = 2x$

Recall that;

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

$\int \sin 7x \cos 2x \, dx = \frac{1}{2} \int \sin 9x + \sin 5x$

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

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