Name: Ogudu Chidera Jane
Matric no: 19/17HS01/294
Dept: MBBS

1) $2x^2 \ln x$

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

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

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

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

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

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

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

OR

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

2) $3te^{2t}$

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

$$du = 3dx \qquad v = \frac{1}{2}e^{2t}$$

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

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

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

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

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

3) $x^2 \sin x$

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

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

$du = 2x\,dx$

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

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

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

$= -x^2 \cos x + \begin{cases} u = 2x & dv = \cos x \\ du = 2dx & v = \sin x \end{cases}$

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

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

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

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

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

$A = 5x \qquad B = 6x$

Recall that;

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

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

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

$\int \cos 5x \cos 6x\,dx = \frac{\sin 11x}{22} + \frac{\sin x}{2} + C$

5) $\sin 7x \cos 2x$

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

Recall that;

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

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

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

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