MONDAY-JERUMEH IBUEBUE
19/MHS01/246
MHS MBBS 100101
MAT 104

1) $\int 2x^2 \ln x \, dx$

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

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

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

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

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

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

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

$= \frac{2x^3}{3} \left[\ln x - \frac{1}{3} \right] + C$

2) $\int 3te^{2t}dt$

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

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

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

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

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

$\int u\,dv = \frac{3te^{2t}}{2} - \frac{3}{2} \cdot \frac{1}{2}e^{2t} + C$

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

3) $x^2 \sin x$

$\int x^2 \sin x\,dx$

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

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

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

$\int u\,dv = x^2 \cdot (-\cos x) - \int \cos x\, 2x\,dx$

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

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

$u = 2x$ $\quad dv = \cos x$

$du = 2dx$ $\quad v = \sin x$

$\Rightarrow 2x \sin x - \int \sin x\, 2dx$ — (ii)

Eqn (ii) into (i)

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

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

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

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

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

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

$\int \cos 5x\cos 6x = \frac{1}{2}[\cos(11x) + \cos(-x)]$

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

$\int \cos 5x\cos 6x = \frac{\sin 11x}{22} + \left(\frac{\sin(-x)}{-2}\right) + c$

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

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

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

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

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

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