19/ENG05/054 MECHATRONICS ENGINEERING

OMOLUABI SEAN SEREMI

MAT 104

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

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

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

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

$= -x^2\cos x - \int 2x \cdot -\cos x$

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

$u = 2x, \quad du = 2, \quad dv = -\cos x, \quad v = -\sin x$

$= -2x\sin x - \int -\sin x \cdot 2$

$= -2x\sin x - 2\cos x$

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

2) $\int 3te^{2t}\,dt = \int u\,dv$

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

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

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

3) $\int 2x^2 \ln x \, dx = \int u\,dv$

$u = \ln x, \quad dv = 2x^2, \quad du = \frac{1}{x}, \quad v = \frac{2}{3}x^3$

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

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

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

4) $\int (2x - 3x^2)/(1-x)\,dx$

$$
\begin{array}{r|l}
 & 2x - x^2 \\
\hline
1 - x & 2x - 3x^2 \\
 & -(2x - 2x^2) \\
\hline
 & -x^2 \\
 & -(-x^2 + x^3) \\
\hline
 & -x^3
\end{array}
$$

$= -\int (2x - x^2)\,dx + \int \frac{-x^3}{(1-x)}\,dx = \int (2x - x^2)\,dx + \int x^3/(x-1)$

$= 2x^2/2 - x^3/3 + x^3 \ln(x-1) + C$

$= x^2 - x^3/3 + x^3 \ln(x-1) + C$