Odunlan Olaniyi Olodayo
Mechanical Engineering 100L/1
19/ENG06/040
Serial No: 205

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

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

$du/dt = 3$ $\quad \int dv = \int e^{2t}$

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

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

$$\int uv = 3t\left(\frac{e^{2t}}{2}\right) - \int \frac{e^{2t}}{2}(3dt)$$

$$= 3t\left(\frac{e^{2t}}{2}\right) - \frac{1}{2}\int 3e^{2t}\,dt$$

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

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

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

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

$du/dx = 2x$ $\quad \int dv = \int \sin x$

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

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

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

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

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

$du/dx = -2$ $\quad \int dv = \int \cos x$

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

$$uv - \int v\,du = -2x(\sin x) - \int \sin x(-2dx)$$

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

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

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

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

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

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

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

$\frac{1}{2}(\sin(7x+2x) + \sin(7x-2x))$

$\frac{1}{2}(\sin 9x + \sin 5x)$

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

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

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

4. $\frac{2x - 3x^2}{1-x}$

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

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

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

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