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Computer Engineering 19/ENG02/051
MAT 104

1) $3te^{2t}$

Let $u = 3t$; $dv = e^{2t}$

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

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

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

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

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

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

$\left[\frac{3te^{2t}}{2} - \frac{3e^{2t}}{4} + C\right]$

2) $x^2 \sin x$

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

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

Using $uv - \int v\,du$

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

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

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

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

$\therefore -2x \cdot \sin x - \int(\sin x)(-2)\,dx$

$-2x\sin x + (-2)\int \sin x\,dx$

$-2x\sin x + (-2)(-\cos x + C)$

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

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

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

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

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

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

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

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

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

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

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

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