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COURSE: MAT 104

1) $3te^{2t}$

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

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

$du = 3dt \quad \int u\,dv = uv - \int v\,du$

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

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

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

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

2) $x^2 \sin x$

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

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

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

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

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

[let $u = -2x \quad dv = \cos x$

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

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

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

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

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

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

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

$u = \sin 7x \qquad dx = \cos 2x$

$du/dx =$

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

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

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

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

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

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

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

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

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

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