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COURSE: MAT104
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1) $3te^{2t}$

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

$\frac{du}{dt} = \frac{3}{1}$ $\int dv = \int e^{2t}$

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

Using $uv - \int vdu = \int udv$

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

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

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

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

2) $\int x^2 \sin x$

let $u = x^2$ and $dv = \sin x$

$du/dx = 2x$ and $v = -\cos x$

using $uv - \int v du$

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

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

[let $u = -2x$ and $du = \cos x$
$du/dx = -2x$ and $v = \sin x$]

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

$-2x\sin x - (-2)\int \sin x \quad x$

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

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

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

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

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

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

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

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

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

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

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

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

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