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COURSE: MATH 104
MAT NO: 191ENG0606/0026 MECHANICAL ENG.

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

Let $u = 3t$, $dv = e^{2t}$
$du = 3$, $v = \frac{e^{2t}}{2}$

$\int u\,dv = uv - \int v\,du$
$\int u\,dv = 3t \cdot \frac{e^{2t}}{2} - \int \frac{e^{2t}}{2} \cdot 3$
$\int u\,dv = \frac{3te^{2t}}{3} - \int \frac{3e^{2t}}{2}$
$\int u\,dv = \frac{3te^{2t}}{3} - \frac{3}{2}\int e^{2t}$
$\int u\,dv = \frac{3te^{2t}}{3} - \frac{3}{2}\left[\frac{e^{2t}}{2}\right] + C$

$\int u\,dv = \frac{3te^{2t}}{3} - \frac{3e^{2t}}{4} + C$ //

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

let $u = x^2$ / $dv = \sin x$
$du = 2x$, $v = -\cos x$
$\int u\,dv = uv - \int v\,du$

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

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

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

$\int u\,dv = -x^2 \cos x - 2 [-\cos x - x \sin x] + C$

$\int u\,dv = -x^2 \cos x + 2 \cos x + 2x \sin x + C$ //

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

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

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

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

$\sin A \cos B = \frac{1}{2} [\sin 9x + \sin 5x$

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

$\int \sin 7x \cos 2x = -\frac{\cos 9x}{18} - \frac{\cos 5x}{10} + C$ //

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

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

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

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