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Computer Engineering
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MAT 104

1. $3te^{2t}$

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

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

$v = \frac{e^{2t}}{2}$

$du = 3dt$

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

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

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

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

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

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

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

$\frac{du}{dx} = 2x$ 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 $du = \cos 3x$

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

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

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

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

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

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

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

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

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

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

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

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

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

$$
\begin{array}{r}
2x - x^2 \\
1-x \,\overline{\big)\, 2x - 3x^2} \\
-\; 2x - 2x^2 \\
\hline
-x^2 \\
-\; -x^2 + x^3 \\
\hline
-x^3
\end{array}
$$

Which can now be

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

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