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

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

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

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

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

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

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

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

which can now be

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

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

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MAT 104
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1.) $3te^{2t}$

Solution

let $U = 3t$ and $dV = e^{2t}$

$\frac{du}{dt} = \frac{3}{x}$ $\quad$ $\int dV = 3e^{2t}$

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

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

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

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

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

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

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

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

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

Using $uv - \int vdu$

$(x^2)(-\cos x) - \int(-\cos x)(2xdx)$

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

$\left[\begin{array}{l}\text{let } u = -2x \text{ and } dv = \cos x \\ du/dx = -2x \text{ and } v = \sin x\end{array}\right]$

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

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

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

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

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