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MAT 104 Assignment

Integrate the following with respect to their variable

1 $3te^{2t}$

Using integration by part

$d(uv) = udv - \int vdu$

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

$du/dt = 3$ $\quad$ $\cancel{dv/dt = \frac{1}{2}e^{2t}}$ $\quad$ $v = \frac{1}{2}e^{2t}$

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

$\therefore \int 3te^{2t}dx = 3t/2 \cdot e^{2t} - \int 3/2 \, e^{2t} dt$

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

$= \frac{3t}{2}e^{2t} - 3/2 \cdot 1/2 \, e^{2t} + c$

$= \frac{3t}{2}e^{2t} - \frac{3}{4}e^{2t} + c$

2 $x^2 \sin x$

Using integration by part

$d(uv) = udv - \int vdu$

let $u = x^2$ $\quad$ $dv = \sin x \, dx$

$du = 2x \, dx$ $\quad$ $v = -\cos x$

$\therefore \int x^2 \sin x \, dx = x^2 \cdot -\cos x - \int 2x \cdot -\cos x$

$= -x^2 \cos x + 2\int x \cos x$

let $u = x$, $dv = \cos dx$

$du = dx$ $\quad$ $v = \sin x$

$\therefore \int x \cos x = x \sin x - \int \sin x \, dx$

$= x \sin x + \cos x$

$\therefore \int x^2 \sin x \, dx = -x^2 \cos x + 2(x \sin x + \cos x)$

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

3 $\sin 7x \cos 2x$

From Trig. identities

$\sin ax \cos bx = \frac{1}{2}(\sin(a-b)x + \sin(a+b)x)$

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

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

$= \frac{1}{2}\int \frac{-1}{5} \cos 5x - \frac{1}{9} \sin 9x + C$

4 $(2x - 3x^2)/1-x$

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

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

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

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