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MAT104 19/ENG04/052 NO015
Elect/Elect Engineering

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

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

$\frac{du}{dt} = 3 \quad v = \frac{1}{2}(e^{2t})$

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

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

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

$= \frac{3te^{2t}}{2} - \frac{3}{2}\cdot\frac{e^{2t}}{2}$

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

$= \frac{3e^{2t}}{2}\left(t - \frac{1}{4}\right) + C$

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

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

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

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

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

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

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

$\int x\cos x\,dx = x\sin x + x\cos x + C$

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

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

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

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

$u = \sin 7x$ $\quad dv = \cos 2x$

$du = 7\cos 7x\,dx$ $\quad v = \frac{1}{2}\sin 2x$

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

$= \sin 7x \cdot \frac{1}{2}\sin 2x$

$A = 7x \quad B = 2x$

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

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

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

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

4 $\int \frac{(2x-3x^2)}{1-x}\, dx$

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

$$\begin{array}{r} 3x+1 \\ x+1 \overline{)\,-3x^2+2x} \\ -3x^2+3x \\ \hline 0\ -x \\ -\ -x \\ \hline 0\ -1 \end{array}$$

$= 3x+1-\frac{1}{1-x}$

$\int \left(3x+1-\frac{1}{1-x}\right) dx$

$= \frac{3x^2}{2} + x - \int \frac{1}{1-x} \rightarrow u$

$\frac{du}{dx} = -1$

$du = -dx \quad dx = -du$

$\int \frac{-du}{u} = -\ln u = -\ln(1-x)$

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