MAT 104 191ENG06/005

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

$= ut \quad v = 3t,\ dv = 7e^{2t}$ $\quad dv/dt = 2 \quad dt = dy/2$

$dv/dt = 3, \quad v = \int e^{2t}\,dt = u + U = 2t.$

$= \int e^{u}\frac{du}{2} = \frac{1}{2}\int e^{u}\,du = \frac{1}{2}e^{u} = \frac{e^{2t}}{2}$

$\frac{dv}{dt} = 3. \quad V = \frac{e^{2t}}{2} \quad = \int u\,dv = uv - \int v\,du$

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

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

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

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

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

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

$\frac{du}{dx} = 2x \quad v = \int \sin x\,dx = -\cos x$

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

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

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

$= x\sin x + \cos x + C$

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

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

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

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

$ut = 7x, \quad B = 2x$

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

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

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

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

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

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

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

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

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

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

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

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

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