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Course: MAT104

1 $\int x^2 \sin x \, dx$

$u = x^2 \qquad v = \sin x$

$du = 2x \qquad dv = \cos x$

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

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

$= x^2 \sin x - \left| \begin{array}{ll} u = 2x & v = \sin x \\ du = 2 & \end{array} \right.$

$\Rightarrow 2x \sin x - \int 2 \sin x$

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

2 $3te^{2t} \, dx$

$u = 3t \qquad v = e^{2t}$

$du = 3 \qquad dv = e^{2t}$

$udv = uv - \int v\,du$

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

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

3 $2x^2 \ln x \, dx$

$u = 2x^2 \qquad v = \ln x$

$du = 4x \qquad dv = \frac{1}{x}$

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

$$= 2x^2 \ln x - \int \ln x \cdot 4x$$

$$= 2x^2 \ln x - \int 4x \ln x\,dx \;;\; u = 4x \quad V = \ln x \quad du = 4$$

$$\Rightarrow -4x \ln x - \int 4 \ln x$$

$$= 2x^2 \ln x - 4x \ln x - x \ln x + x + C$$

$$= 2x^2 \ln x - 5x \ln x + x + C$$

4 $\dfrac{2x - 3x^2}{1-x}$

$$\begin{array}{r|l} & 3x+1 \\ \hline -x+1 & -3x^2+2x \\ & -3x^2+3x \\ \hline & 0-x \\ & -x+1 \\ \hline & -1 \end{array}$$

$$\therefore \int 3x+1\,dx + \int \frac{-1}{1-x}$$

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