NAME : ISAAC GRACE AKONOICHO
DEPARTMENT: PETROLEUM ENGINEERING
MATRIC NO: 19/ENG07/012

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

Solution

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

$u = x^2$; $du/dx = 2x$

$dv = \sin x$; $v = -\cos x$

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

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

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

$\int 2x \cos x \, dx$

$u = 2x$; $du/dx = 2$

$dv = \cos x$; $v = \sin x$

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

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

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

$= 2x \sin x + 2\cos x$

~~$\Rightarrow \int (x^2 \sin x) dx = -x^2 \cos x + 2x \sin x$~~

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

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

Solution

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

$u = 3t \quad ; \quad du/dt = 3$

$dv = e^{2t} \quad ; \quad v = \frac{1}{2}e^{2t}$

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

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

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

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

$$\therefore \int 3te^{2t}\,dt = \frac{3}{2}\left[te^{2t} - \frac{1}{2}e^{2t}\right] + c$$

$$= \frac{3}{2}e^{2t}\left[t - \frac{1}{2}\right] + c$$

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

Solution

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

$u = 2x^2 \quad ; \quad du/dx = 4x$

$dv = \ln x \quad ; \quad v = \frac{1}{x}$

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

$= 2x - \int 4 \, dx$

$= 2x - 4x$

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

Solution

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

$u = \ln x \quad ; \quad du/dx = 1/x$

$dv = 2x^2 \quad ; \quad v = \frac{2x^3}{3}$

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

$= \ln x\left(\frac{2x^3}{3}\right) - \int \frac{2x^3}{3} \cdot \frac{1}{x} \, dx$

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

$\int u\,dv = \frac{2x^3}{3} \ln x - \left[\frac{2x^3}{9}\right]$

$\therefore \int 2x^2 \ln x \, dx = \frac{2x^3}{3} \ln x - \frac{2x^3}{9} + c$

$= \frac{2x^3}{3}\left[\ln x - \frac{1}{3}\right] + c$

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

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

Solution

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

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

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

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