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DEPARTMENT: MECHATRONICS.

MATRIC NO. 19/ENG08/1001.

Assignment

1. find the integral of

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

Solution

let $u = x^2$, then $\frac{du}{dx} = 2x$ $du = 2x\,dx$

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

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

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

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

let $u = 2x$ $\frac{du}{dx} = 2$ $du = 2\,dx$

$dv = \int \cos x\,dx$ $v = \int \cos x\,dx = \sin x$

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

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

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

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

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

let $u = t$ $\quad dv = e^{2t}dx$ $\quad \int dv = \int e^{2t}dx$

$\frac{du}{dx} = 1$ $\quad v = \frac{e^{2t}}{2}$

$du = 1dx$

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

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

$$\frac{2te^{2t}}{2} - \frac{1}{4}e^{2t} + C$$

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

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

3. $2\int x^2 \,\text{In}\, x \, dx$

$2\int x^2 \,\text{In}\, x \, dx$

$dv = x^2 \qquad u = \text{In}\, x \qquad v = \frac{x^3}{3} \qquad du = \frac{dx}{x}$

Hence,

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

$$2\int x^2 \,\text{In}\, x\, dx = \frac{x^3}{3}\text{In}\, x - \int \frac{x^3}{3} \cdot \frac{dx}{x}$$

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

$$= \frac{x^3}{3}\text{In}\, x - \frac{x^3}{9} + c$$

$$= 2\int x^2 \,\text{In}\, x\, dx$$

$$= 2\left(\frac{x^3}{3}\text{In}\, x - \frac{x^3}{9} + c\right)$$

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

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

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

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

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

let u be $1-x$

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

$$\frac{3x^2}{2} + x - \int \frac{1}{u} \, du$$

$$\frac{3x^2}{2} + x + \int \frac{1}{u} \, du$$

$$\frac{3x^2}{2} + x + \ln u$$

$$\frac{3x^2}{2} + x + \ln|1-x| + c$$