

MAT 104

AMULU ALKO CHUKWUEBUKA OLIVER  
MECHATRONICS ENGINEERING  
19/ENG051014

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

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

$$u = x^2 \quad du = 2x \, dx$$

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

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

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

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

$$u = 2x \quad du = 2 \, dx$$

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

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

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

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

$$2x \sin x + 2 \cos x + C$$

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

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

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

$$u = 3t \quad du = 3 \, dt$$

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

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

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

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

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

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

$$u = 2x^2 \quad du = 4x \, dx$$

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

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

$$\underline{\underline{2x - \int 4 \, dx}}$$

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

$$u = \ln x \quad du = \frac{1}{x} \, dx$$

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

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

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

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

$$= \frac{2x^3}{3} \ln x - \frac{2x^3}{9} + C$$

$$= \underline{\underline{\frac{2x^3}{3} \ln x - \frac{2x^3}{9} + C}}$$

4

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

$$\begin{array}{r} 3x+1 \\ (1-x) \overline{) 3x^2+2x} \\ \underline{-3x^2+3x} \phantom{0} \\ \phantom{0} -x+0 \phantom{0} \\ \underline{-2+1} \phantom{0} \\ \phantom{00} -1 \phantom{0} \end{array}$$

$$\begin{array}{r} -x+0 \\ -2+1 \\ \hline -1 \end{array}$$

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

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

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

$$u = \cancel{x} + 1 - x$$

$$du = -1 dx \quad dx = -1 du$$

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

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

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

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

---

---