

Name: BALOGUN SHAMSUDEEN
Dept: Computer Science
Matric No: 19/SCI01/028

ASSIGNMENT

① $\int e^x \sin x dx$
Solution

$$u = \sin x \quad dv = e^x$$

$$du = \cos x dx \quad v = e^x$$

$$\int u dv = uv - \int v du$$
$$= (\sin x)(e^x) - \int e^x \cos x dx$$
$$= e^x \sin x - \int e^x \cos x dx$$

$$\int e^x \cos x dx$$

$$u = \cos x \quad dv = e^x$$

$$du = -\sin x dx \quad v = e^x$$

$$\int u dv = uv - \int v du$$
$$= e^x \cos x - \int e^x (-\sin x dx)$$
$$= e^x \cos x + \int e^x \sin x dx$$

$$\int e^x \sin x dx = e^x \sin x - [e^x \cos x + \int e^x \sin x dx]$$

$$\int e^x \sin x dx = e^x \sin x - e^x \cos x - \int e^x \sin x dx$$

$$\text{let } \int e^x \sin x dx = I$$

$$I = e^x \sin x - e^x \cos x - I$$

$$I + I = e^x \sin x - e^x \cos x$$

$$\frac{2I}{2} = \frac{e^x \sin x - e^x \cos x}{2}$$

$$I = \frac{e^x \sin x}{2} - \frac{e^x \cos x}{2}$$

$$\int e^x \sin x dx = \frac{e^x \sin x - e^x \cos x}{2} + C$$

$$\int e^x \sin x dx = \frac{1}{2} [e^x \sin x - e^x \cos x] + C$$

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

Solution

$$2 \int x^2 \ln x$$

$$u = \ln x$$

$$dv = x^2$$

$$du = \frac{1}{x} dx$$

$$v = \frac{x^3}{3}$$

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

$$= 2 \left[\ln(x) \times \frac{x^3}{3} - \int \frac{x^3}{3} \times \frac{1}{x} dx \right]$$

$$= 2 \left[\frac{x^3 \ln(x)}{3} - \int \frac{x^2}{3} dx \right]$$

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

$$= 2 \left[\frac{x^3 \ln(x)}{3} - \frac{1}{3} \times \frac{x^3}{3} \right]$$

$$= 2 \left[\frac{x^3 \ln(x)}{3} - \frac{x^3}{9} \right]$$

$$\therefore \int 2x^2 \ln x dx = \left[\frac{2x^3}{3} \left(\frac{\ln(x)}{1} - \frac{1}{3} \right) \right] + C$$

3. $\int x^2 \sin x dx$
Solution

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

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

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

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

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

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

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

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

$$du = 2 dx \quad v = \sin x$$

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

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

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

$$= 2x \sin x - 2(-\cos x)$$

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

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

4. $\int x \cos x dx$
Solution

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

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

$$du = 1 dx \quad v = \sin x$$

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

$$= x \sin x - \int \sin x \times 1 dx$$

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

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

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