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## ASSIGNMENT

$$\textcircled{1} \int e^x \sin x \, dx$$

Solution

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

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

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

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

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

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

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

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

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

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

$$= e^x \cos x + \int e^x \sin x \, dx$$

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

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

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

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

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

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

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

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

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

$$② \int 2x^2 \ln x \, dx$$

solution

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

$$u = \ln x$$

$$dv = x^2$$

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

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

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

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

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

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

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

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

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

$$\textcircled{3} \int x^2 \sin x \, dx$$

Solution

$$u = x^2 \quad dv = \sin x$$

$$du = 2x \, dx \quad v = -\cos x$$

$$\begin{aligned} \int u \, dv &= uv - \int v \, du \\ &= x^2(-\cos x) - \int (-\cos x) \times 2x \, dx \\ &= -x^2 \cos x + \int 2x \cos x \, dx \end{aligned}$$

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

$$u = 2x \quad dv = \cos x$$

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

$$\begin{aligned} \int u \, dv &= uv - \int v \, du \\ &= 2x \sin x - \int \sin x \times 2 \, dx \\ &= 2x \sin x - 2 \int \sin x \, dx \\ &= 2x \sin x - 2(-\cos x) \\ &= 2x \sin x + 2 \cos x \end{aligned}$$

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

$$\textcircled{4} \int x \cos x \, dx$$

Solution

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

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

$$\begin{aligned} \int u \, dv &= uv - \int v \, du \\ &= x \sin x - \int \sin x \times 1 \, dx \\ &= x \sin x - \int \sin x \, dx \\ &= x \sin x - (-\cos x) + C \\ &= x \sin x + \cos x + C \end{aligned}$$