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Assignment: Mat104

Level: 100lvl

Introduction

- ① $\int e^x \sin x dx$ ② $\int 2x^2 \ln x dx$ ③ $\int x^2 \sin x dx$
④ $\int x \cos x dx$

④ $\int e^x \sin x dx$

$u = e^x \quad du = \sin x \quad du = e^x dx$
 $\frac{dy}{dx} = e^x \quad v = -\cos x$

$\int uv = UV - \int U dv$

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

⑦ $\int e^x \sin x dx$

$u = \sin x, \quad du = e^x$

$\frac{dy}{dx} = \cos x \quad v = e^x$

$du = \cos x dx$

$\int u dv = UV - \int U du$

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

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

$\int u dv = UV - \int U du$
 $= e^x \cos x + \int e^x \sin x dx$

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

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

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

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

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

$$(2) \int 2x^2 \ln x dx$$

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

$$\frac{du}{dx} = \frac{1}{x} \quad v = \frac{2x^3}{3}$$

$$v du = dx$$

$$dv = \frac{d(2x^3)}{3}$$

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

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

$$\int 2x^2 \ln x dx = \frac{1}{3} (2x^3 \ln x) - \frac{2x^3}{9}$$

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

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

(2)

$$(3) \int x^2 \sin x dx$$

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

$$\frac{du}{dx} = 2x, \quad v = \cos x$$

$$du = 2x dx$$

$$\int u dv = UV - \int V du$$

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

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

$$\left[\begin{aligned} U &= 2x, \quad du = 2 dx \\ \frac{dy}{dx} &= 2, \quad V = \cos x \\ &= UV - \int V du \\ &= 2x \cos x - \int (\cos x)(2 dx) \\ &= 2x \cos x + 2 \sin x \end{aligned} \right]$$

L.I.A.T.E

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

④ $\int x \cos x dx$

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

$$\frac{dy}{dx} = 1, \quad v = \sin x$$

$$du = dx$$

$$\int u dv = UV - \int V du$$

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

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