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DEPARTMENT: MECHATRONICS.

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Assignment

Find the integral of the following.

1. $e^x \sin x\,dx$

solution

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

let $u = e^x$ $\quad dv = \sin x\,dx$

$\frac{du}{dx} = e^x$ $\quad \int dv = \int \sin x\,dx$

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

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

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

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

$$= -e^x \cos x + (-1)e^x \int \cos x\,dx$$

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

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

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

$$= e^x (\sin x - \cos x) + C.$$

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

solution.

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

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

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

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 $u = 2x$ $\frac{du}{dx} = 2$ $\quad du = 2dx$

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

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

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

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

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

3. $2x^2 \ln x dx$

Solution

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

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

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

$v = \frac{x^3}{3} \qquad du = \frac{dx}{x}$

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

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

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

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

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

$= 2\left(\frac{x^3}{3} \ln x - \frac{x^3}{9}\right) + c.$

$\frac{2x^3}{3}\left[\ln x - \frac{1}{9}\right] + c.$

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

Solution

$\int x\cos x\,dx$

Let $u = x$ $\quad dv = \cos x\,dx$ $\quad \int dv = \int \cos x\,dx$

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

$du = 1\,dx$

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

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

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

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

$= x\sin x + \cos x$

$= x\sin x + \cos x + c$