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MAT 104

① $\int e^x \sin x\,dx$

Solution

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

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

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

$du = \cos x\,dx$

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

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

$e^x \sin x =$ $u = \cos x$, $dv = e^x$

$dy/dx = -\sin x$, $v = e^x$

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

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

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

let $I = e^x \sin x\,dx$

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

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

$\int e^x \sin x\,dx = 1/2 [e^x \sin x - e^x \cos x] + C$

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

solution

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

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

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

$x\,du = dx$

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

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

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

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

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

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

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

solution

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

$du/dx = 2x \qquad v = -\cos x$

$du = 2x\,dx$

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

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

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

$u = 2x, \; dv = \cos x$

$du/dx = 2, \; v = \sin x$

$uv = \int v \, du$

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

$= 2x \sin x + 1 \cos 2x$

$\therefore \int x^2 \sin x \, dx = -x^2 \cos x + 2x \sin x + 1 \cos 2x + C$

④ $\int x \cos x \, dx$

solution.

$u = x, \; dv = \cos x$

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

$du = dx$

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

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

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