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Mat 104

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

Solution

$\int u\,dv = uv - \int v\,du \quad \ldots (1)$

for $\int u\,dv = \int x^2 \sin(x)\,dx$

$u = x^2 \Rightarrow \frac{du}{dx} = 2x$

$du = 2x\,dx$

$dv = \sin(x)dx$

$\int dv = \int \sin(x)\,dx$

$v = -\cos(x)$

Substitute to bo eqn (1)

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

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

$u = x \Rightarrow du/dx = 1 \Rightarrow du = dx$

$dv = \cos(x)dx \Rightarrow \int dv = \int \cos(x)dx$

$v = \sin(x)$

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

since $\int \sin(x)dx = -\cos(x)$; thus the becomes

$\int x\cos(x)dx = x\sin(x) + \cos(x) \ldots 3$

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

substitute in (3) into (2)

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

2. $\int 3te^{2t}\,dt$

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

let $u = 3t$

$du/dt = 3$, so $du = 3dt$

let $dv = e^{2t}dt$

$v = \frac{1}{2}e^{2t}$

$\int 3t(e^{2t})dt = 3t(1/2)e^{2t} - \int \frac{1}{2}e^{2t}\,3dt$

$= 3/2\,te^{2t} - 3/4\,e^{2t}$