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ENG

1 $3te^{2t}$

in respect to t

$\int 3te^{-t^2} dt$

$3\int te^{-t^2} dt$

let $u = -t^2$ then $du = -2t\,dt$

so $-\frac{1}{2} du = t\,dt$

let $u = -t^2$ find $\frac{du}{dt}$

$\frac{d}{dt}[-t^2]$

$-\frac{d}{dt}[t^2]$

using power rule

$\frac{d'}{dt}[t^n]$

$= nt^{n-1}$

where $n = 2-(2t)$

multiply 2 by -1

$= -2t$

$3\int e^u \frac{1}{-2} du$

$3\int e^u \left(-\frac{1}{2}\right) du$

combine e^u and $\frac{1}{2}$

$3\int -\frac{e^u}{2} du$

$= 3\left(-\int \frac{e^u}{2} du\right)$

multiply -1 by 3

$-3\int \frac{e^u}{2} du$

Since $\frac{1}{2}$ is constant

$\therefore -3\left(\frac{1}{2}\int e^u\,du\right)$

simplify

$-\frac{3}{2}\int e^u\,du$

the integral of e^u with respect to u is e^u

$-\frac{3}{2}(e^u + c)$

$-\frac{3}{2}e^u + c$

replace all occurence of u with $-t^2$

$= -\frac{3}{2}e^{-t^2} + c$

2 $x^2 \sin x$

using integration by part

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

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

let

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

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

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

subistituting into equation

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

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

$\int x \cos(x)\,dx$

using integration by part

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

$= dx$

$dv = \cos(x)\,dx \Rightarrow \int dv = \int \cos(x)\,dx \Rightarrow v = \sin(x)$

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

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

$\int x \cos(x)\,dx = x \cdot \sin(x) + \cos(x)$

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

$\int x \cos(x)\,dx$

substitute in $\int x \cos(x)\,dx = x \sin(x) + \cos(x)$

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

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

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

3 $\sin 7x \cos 2x$

using

$\sin(t) \times \cos(s) = \frac{1}{2} \times (\sin(t+s) + \sin(t-s))$

$\therefore \sin 7x \cos 2x$

$= \frac{1}{2} \times (\sin(9x) + \sin(5x))$

Divide through

$= \frac{\sin(9x)}{2} + \frac{\sin(5x)}{2}$