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19/SCI01/072

Find the integral of the following

1. $x^2 \sin x dx$

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

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

$du = 2x dx$

$dv = \sin x dx$

$\int dv = \int \sin x dx$

$V = -\cos x$

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

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

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

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

$= -x^2 \cos x +$

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

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

$V = \sin x$

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

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

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

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

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

let $u = 3t$, $\frac{du}{dt} = 3$, $du = 3dt$

$\int dv = \int e^{2t}$

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

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

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

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

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

$dv = \ln x = \frac{1}{x}dx \Rightarrow V = x^3/3$

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

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

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

$= \int x^n\,dx = \frac{x^{n+1}}{n+1}$

$\int x^2\,dx = x^3/3$

$\frac{2x^3}{3}\ln x - \frac{2x^3}{9}$

$\frac{2x^3}{3}\ln x - \frac{2x^3}{9} + c$

$= 2x^3 A \, k$

$x + c$ 4. $\int \frac{2x - 3x^2}{1-x}\,dx$

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

$= 2 - 2x - 2\ln(|1-x|) + -9 + 6x + 3 + 3\ln(|1-x|)$

Simplifying $\frac{-5 + 2x + 3x^2}{2} + \ln(|1-x|)^2$

$\int \frac{2x - 3x^2}{1-x} = \frac{-5 + 2x + 3x^2}{2} + \ln(|1-x|)$