25/04/2020

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D $\int x^2 \sin dx$

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

$du = 2x\, dx$ $\quad v = -\cos x$

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

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

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

Now let $u = x$ and $dv = \cos x\, dx$. The $du = dx$ and $v = \sin x$. Now, use integration by part again

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

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

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

2) $\int 3t e^{2t}\, dt$

let $u = 3t$ $\quad dv = e^{2t}$

$du = 3dt$ $\quad v = \frac{e^{2t}}{2}$

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

$= 3t \cdot \frac{e^{2t}}{2} - \int \frac{e^{2t}}{2} 3\, dt$

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

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

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

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

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

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

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

$= \frac{2}{3} x^3 \left(\ln x - \frac{1}{3} \right)$

4) $\int \frac{2x - 3x^2}{1 - x} \, dx$

$$
\begin{array}{r|l}
 & 3x - 1 \\
\hline
1 - x & 2x - 3x^2 \\
 & -3x + 3x^2 \\
\hline
 & x \\
 & x - 1 \\
\hline
 & 1
\end{array}
$$

$\int (3x - 1)\,dx + \int \frac{1}{1 - x}$

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$\frac{3}{2}x^2 - x + \ln(1-x) + C$