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Questions

find the Integral of the following

① $x^2 \sin x\,dx$ ② $3te^{2t}\,dt$ ③ $2x^2 \ln x\,dx$ ④ $(2x-3x^2)/(1-x)\,dx$.

Answer

1) $x^2 \sin x\,dx$

Solution

$\int x^2 \sin x\,dx \quad u = x^2 \quad du = 2x\,dx \quad v = -\cos x \quad dv = \sin x$

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

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

$-x^2 \cos x + 2\int x \cos x\,dx$ let $u = x \quad du = 1 \quad dv = \cos x \quad v = \sin x$

$-x^2 \cos x + 2[x \sin x - \int \sin x \cdot dx$

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

2) $3te^{at}\,dt$

Solution

$\int 3te^{2t} \Rightarrow 3\int te^{2t} \quad u = t \quad du = dt \quad v = \frac{1}{2}e^{2t} \quad dv = e^{2t}$

$3\left[\frac{te^{2t}}{2} - \frac{1}{2}\int e^{2t} \cdot dt\right] \Rightarrow 3\left[\frac{te^{2t}}{2} - \frac{1}{4}e^{2t}\right] + C$

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

Solution

$u = \ln x \quad du = \frac{1}{x} \cdot dx \quad v = \frac{2x^3}{3} \quad dv = 2x^2$

$\ln x \cdot \frac{2x^3}{3} - \frac{2}{3}\int x^3 \cdot \frac{1}{x}$

$\ln x \cdot \frac{2x^3}{3} - \frac{2}{3}\int x^2 \left(\ln x \cdot \frac{2x^3}{3}\right) - \frac{2}{9}x^3 + C$

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

Solution

$$\int \frac{x(2-3x)}{1-x} \cdot dx \qquad \text{let } v = 1-x \quad \frac{dv}{dx} = -1 \quad x = 1-v$$

$$-dv = dx$$

$$\int \frac{(1-v)(2-3+3v)}{v} \cdot -dv$$

$$\int \frac{(1-v)(-1+3v)}{v} \cdot -dv$$

$$\int \frac{-1+3v+v-3v^2}{v} \cdot dv$$

$$\int \frac{-1+4v-3v^2}{v} \cdot dv$$