

MAT 91122 Opgave E24

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9/12 1998

Vi skal udregne planintegralet

$$\iint_S \frac{y^2}{x^3} dA$$

hvor $S = \{(x, y) \in \mathbb{R}^2 \mid 1 \leq x \leq \ln 3 \wedge 0 \leq y \leq xe^{-x}\}$. Vi finder

$$\begin{aligned} \iint_S \frac{y^2}{x^3} dA &= \int_1^{\ln 3} dx \int_0^{xe^{-x}} \frac{y^2}{x^3} dy \\ &= \int_1^{\ln 3} \left[\frac{y^3}{3x^3} \right]_0^{xe^{-x}} dx = \frac{1}{3} \int_1^{\ln 3} e^{-3x} dx \\ &= -\frac{1}{9} [e^{-3x}]_1^{\ln 3} = \frac{1}{9} \left(-\frac{1}{27} + e^{-3} \right) - \frac{1}{243} + \frac{1}{9} e^{-3} \end{aligned}$$