

Vector & Tensor Analysis
Exam # 2

1) Evaluate $\int_0^1 \int_{y^2}^{\sqrt{y}} \frac{y}{x} e^x dx dy$.

2) Find the area of the surface whose parametric equations are:

$$\begin{aligned}x &= uv \\ y &= u + v \quad \text{with } u^2 + v^2 \leq 1 \\ z &= u - v\end{aligned}$$

3) Let C denote the intersection of the cylinder $x^2 + y^2 = 1$ with the plane $y + z = 2$.
Orient C counterclockwise and evaluate the work of $\vec{F} = z\vec{i} + x\vec{j} + y\vec{k}$ along C .

4) Let S denote the boundary of the unit cube defined by
 $0 \leq x \leq 1, 0 \leq y \leq 1, 0 \leq z \leq 1$.

Evaluate the flux of $\vec{F} = xy\vec{i} + y^2z\vec{j} + z^3\vec{k}$ across the surface S .

5) Check if $\vec{F} = 2x\vec{i} - 2\vec{j} + \vec{k}$ is conservative. Then evaluate the work of \vec{F} along a closed contour C .