Math 53: Multivariable Calculus **Sections 102, 103**

Worksheet for 2020-05-01

Conceptual Review

Question 1. Suppose $\mathbf{F}$ is defined on all of $\mathbb{R}^3$ except at the origin, and that $\nabla \times \mathbf{F} = \mathbf{0}$. Can you conclude that $\mathbf{F}$ is conservative?

Question 2. Parametrize the portion of the cylinder $x^2 + y^2 = 1$ between the planes $z = 0$ and $z = 2 + x$.

Problems

Problem 1. Let $\mathbf{F} = \langle a, b, c \rangle$ where a, b, c are constants.

Let D be the region $x^2 + y^2 + z^2 \leq 1$ and let E be the solid cube $-2 \leq x, y, z \leq 2$.

(a) Compute $\iint_{\partial D} \mathbf{F} \cdot \mathbf{n} \, dS$ and $\iint_{\partial E} \mathbf{F} \cdot \mathbf{n} \, dS$.

(b) Compute $\iint_{\partial D} |\mathbf{F} \cdot \mathbf{n}| \, dS$ and $\iint_{\partial E} |\mathbf{F} \cdot \mathbf{n}| \, dS$.