

Homework 1A

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MATH 241-910 :Calculus IV

May 23, 2017

Problem 0. Review materials listed in Quiz 0. Read section 1.1-1.3 in Haberman.

Problem 1. The *divergence theorem* asserts that: Let E be a simple solid region and S is the boundary surface of E with positive orientation. Let F be a vector field whose components have continuous first order partial derivatives. Then,

$$\iint_S \mathbf{F} \cdot d\vec{S} = \iiint_E \nabla \cdot \mathbf{F} dV \quad (1)$$

Use the divergence theorem to evaluate $\iint_S \mathbf{F} \cdot d\vec{S}$ where $\mathbf{F} = xy\vec{i} - \frac{1}{2}y^2\vec{j} + z\vec{k}$, and the surface consists of the three surfaces, $z = 4 - 3x^2 - 3y^2$, $1 \leq z \leq 4$ on the top, $x^2 + y^2 = 1$, $0 \leq z \leq 1$ on the sides and $z = 0$ on the bottom.

Problem 2. Haberman 1.2.3

Problem 3. Read the subsection *Diffusion of a chemical pollutant* in pp. 9. Compare it with the heat equation. After that, do problem 1.2.5.

Due: May 24 (Wednesday), 2017