Department of Mathematics

SF1626
Several Variable Calculus
Academic year 2016/2017, Period 2

Seminar 6

See www.kth.se/social/course/SF1626 for information about how the seminars work and what you are expected to do before and during the seminars.

This seminar will start with a quiz on a variant of one of the recommended exercises from the text book Calculus by Adams and Essex (8th edition) which are marked by boldface in the following list:

Section	**Recommended exercises**
16.1	3, 7, 11
16.2	9, 15, 17
16.3	**3**, **5**, 9
16.4	**5**, **11**, **15**
16.5	1, **3**, 5

In the seminar the following problems will be discussed.

PROBLEMS

Problem 1. Let $\mathbf{F}$ be the vector field given by

$$\mathbf{F}(x, y, z) = (x^2 - yz,\ y^2 - xz,\ z^2 - xy).$$

for all (x, y, z) in $\mathbb{R}^3$.

(a) Determine $\operatorname{rot} \mathbf{F} = \nabla \times \mathbf{F}$ and $\operatorname{div} \mathbf{F} = \nabla \cdot \mathbf{F}$.

(b) Determine whether there is a potential, i.e., a function g such that $\mathbf{F} = \operatorname{grad} g$.

(c) Compute the flux of $\mathbf{F}$ out from the sphere given by

$$(x - a)^2 + (y - b)^2 + (z - c)^2 = r^2.$$

Problem 2. Let $\mathbf{F} = \operatorname{rot} \mathbf{G} = \nabla \times \mathbf{G}$ where

$$\mathbf{G}(x, y, z) = (z^2 - y^2,\, x^2 - z^2,\, y^2 - x^2)$$

(a) Compute the flux of $\mathbf{F}$ through the triangle with verices in $(1, 0, 0)$, $(0, 1, 0)$ and $(0, 0, 1)$. (The normal direction is chosen so that it points away from the origin.)

(b) Use Stoke'e Theorem in order to relate the flux from part (a) to a line integral and compute this line integral by means of a parametrization.