Department of Mathematics

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

Seminar 1

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 hand-in of one of the problems. Solve problems 1-4 below and write down your solutions on separate sheets. Write your name and personal number on the top of each page. When the seminar starts you will be informed about which problem to hand in. Before starting with the seminar problems you should solve the recommended exercises from the text book Calculus by Adams and Essex (8th edition). These exercises are:

Section	Recommended problems
10.1:	11, 25, 27, 29, 31, 33, 35, 37, 39
10.6:	3, 5, 9, 13
11.1:	17, 21, 33
11.2:	3
11.3:	5, 7, 11, 13, 15
12.1:	5, 9, 13,15, 17, 23, 27, 33
12.2:	5, 7, 9, 11, 15

PROBLEMS

Problem 1. Consider the sets in the xy-plane given by

$$\begin{aligned} D_1 &= \{(x,y)\colon 0 < y - x^2,\ y = x\} \\ D_2 &= \{(x,y)\colon 0 \le y^2 - x,\ x^2 + y^2 < 1\} \\ D_3 &= \{(x,y)\colon |x| \le 1,\ |y| \le 2\} \end{aligned}$$

(a) Sketch the sets D_1, D_2 och D_3.
(b) Mark the *inner points* of the sets.
(c) Mark the *boundary points* of the sets.
(d) Determine which of the sets that are *open*, *closed* or neither *open* nor *closed*.

Problem 2. Consider the cylinder S given by the equation $x^2 + y^2 = 1$ and the curve C that is given by the intersection between the cylinder and the plane given by the equation $ax + by + cz = 0$.

Express the parametric equation of the curve C as $\mathbf{r}(t)$ when

(a) $a = b = 0, \quad c = 1,$
(b) $b = c = 1, \quad a = 0,$
(c) $a = b = 1, \quad c = 0,$
(d) $a = b = c = 1.$

Problem 3. A particle travels in an orbit that is described by

$$\mathbf{r}(t) = (1 - t, \cos 2t, -\sin 2t),$$

(a) Compute the velocity $\mathbf{r}'(t)$.
(b) Compute the acceleration $\mathbf{r}''(t)$.
(c) Show that the velocity and the acceleration are perpendicular.

Problem 4. Let $f(x, y) = 10x^2 + 6xy + 13y^2$ for all (x, y) in $\mathbb{R}^2$.

(a) Make the change of variables given by $u = 3x + 2y$ och $v = x - 3y$, and write the new function in the variables u and v.
(b) Sketch some of the level curves of the function f.
(c) Sketch the graph of the function f.
(d) Determine a parametrization of the curve that is given by the intersection of the graph of the function f and the plane given by the equation $z = x - y$.