

Mathematics A2 (BMETE90AX02).

Dr. Peter MOSON (www.math.bme.hu, +3614632690, +36309329626) on Tuesdays, Wednesdays. Office hour: H. building 41. Wednesday, 7-8 a.m.

Program

Mathematics A2a -Vector Functions (of parts taught by Peter Moson).

Functions in several variables: continuity, differential and integral calculus, partial derivatives, Young's theorem. Local and global maxima/minima. Vector-vector functions, their derivatives, Jacobi matrix. Integrals: area and volume integral.

Infinite series: convergence, divergence, absolute convergence. Sequences and series of functions, convergence criteria, power series, Taylor series.

Fourier series: expansion, odd and even functions.

Literature:

Thomas' Calculus by Thomas, G.B. et al. Addison-Wesley, 2005. (ISBN0321185587).

Hungarian translation is available: http://www.interkonyv.hu/konyvek/Thomas_kalkulus_3

Test 1. Function of several variables. March 22, 2016. 13%,

Test 2. Vector-vector functions. Functional sequences, series. May 3, 2016. 13%.

Make up tests: 14-th week (May 17-20).

Written exam. Dates: May 23, June 7, June 14, June 21, 2016.

Detailed Program of the first 6 weeks.

2016-02-16.

Introduction.

Functions of 2 real variables. Domain of definition, range, graph. Total, partial derivatives.

Examples $f(x,y) = 1-x-y$, $(1-x^2-y^2)^{1/2}$, x^2+y^2 , x^2-y^2 , $1/(x^2+y^2)^{1/2}$.

Homework $f(x,y) = xy$, $\arcsin(y-x)$.

2016-02-17.

Functions of 2 real variables. Taylor polynomial. Tangent plane. Local extremum (necessary, sufficient condition).

2016-02-23.

Functions of 2 real variables. Derivation rules (chain rule). Directional derivative (max, min – gradient).

Level curves (gradient is perpendicular).

Global extremum (on compact sets). Example: $f(x,y) = x^2+y^2-2y$ on $x^2+y^2 \leq 4$. Investigation on the boundary by its parametrization.

2016-02-24.

Functions of 2 real variables.

Global extremum (on compact sets). Example: $f(x,y) = x^2-xy+y^2-2y$ on the compact domain bounded by the lines $x=0$, $y=4$, $y=x$. Investigation on the boundary by its parametrization.

Conditional extremum. Example: $f(x,y) = x^2+y^2-2y$ on $x^2+y^2=4$.

Double integrals on normal domains.

2016-03.01.

Functions of 2 real variables.

Normal domains with respect to x , y . Order of integration. Example - $f(x,y)=y \exp(-x^2)$, $D: 0 < y < 1, y^2 < x < 1$.

Calculation of the area of domains by double integrals. Example (D is the compact set bounded by curves $y=x$, $y=x^2$).

Separable double integrals.

Substitution (polar coordinates). Volume of the sphere (by elementary method, by the integration of $f(x,y)= (1-x^2-y^2)^{1/2}$, $D: x^2+y^2 < 1$).

Homework (optional). Thomas, 15.1. 5, 31. 15. 3. 3.

2016-03.02.

Functions of 2 real variables.

Improper integrals. Example - $f(x,y)= \exp(-x^2-y^2)$, $D: 0 < x,y < \infty$.

Application of double integrals (volume, center of gravity, moment of inertia of plates, etc.).

Examples: $D: 0 < x < 3, 0 < y < 3-x$; $0 < x < 3, 0 < y < \sqrt{9-x^2}$, center of gravity.

2016-03.08.

Functions of 3 real variables. Level surfaces.

Triple integration in Cartesian, spherical, cylindrical coordinates. Volume of a pyramid, sphere, cylinder, cone.

The topics included into Test 1 finish here.

2016-03.09.

Practical lecture. Solution of Sample Test 1 (60 minutes, 3 exercises, 13%).

2016-03.16.

Practical lecture. Solution of Sample Test 1 published on the internet (3 exercises, 13%).

2016-03.22.

Test 1 (60 minutes). Solution of the problems (30 minutes).