

Syllabus of Lectures and Tutorials MAT1, Winter Semester, weekly schedule

Differential Calculus of Functions of a Real Variable:

1. Sequences of real numbers, fundamental concepts and definitions, limits of sequences and methods for their calculating, the number e .
2. Functions of a real variable, fundamental concepts and definitions, limits (proper and improper) and methods for their calculating, continuity.
3. Basic theorems for continuous functions and their applications: Bolzano's and Weierstrass's theorems, derivatives and their geometric and physical meaning, derivative rules, derivative of composite and inverse functions.
4. Derivatives of higher orders, differentials of the 1st and higher orders, Lagrange's theorem and its consequences, l'Hospital's rules.
5. An analysis of functions sequent on the properties of the 1st and 2nd derivatives (intervals of monotony, local extremes, convexity and concavity, points of inflection, asymptotes).
6. Global (absolute) extremes on compact intervals, word problems. Taylor's theorem, Taylor's polynomial and its applications.

Linear Algebra:

7. Vector (linear) spaces, the vector space of ordered n -tuples, \mathbb{R}_2 , \mathbb{R}_3 , linear combinations, linear independence and dependence, bases, the dimension, subspaces.
8. Linear hull, matrices, the rank of a matrix, Gauss's algorithm.
9. Systems of linear algebraic equations, basic methods for solving, Gaussian elimination, Frobenius theorem.
10. Matrix multiplication, inverse matrices and their applications, matrix equations.
11. Determinants of the 2nd and 3rd orders, Sarrus's rule, inverse matrices by means of determinants, Cramer's rule.

Analytic Geometry in Space:

12. Fundamental properties of geometric vectors. General form and parametric representation of a plane. Parametric equations of straight lines. A straight line as the intersection of two planes.
13. Relationship problems on straight lines and planes, deviations and distances of planes and straight lines. Application of analytic methods for solving geometric problems in the space.

Please note: In general the exercises at each tutorial shall be based on the subject matter of the previous lecture. The exception is analytical geometry when the last two weeks of the semester will be devoted to analytical geometry on lectures only and it is not included in tutorials.

The final exam and tutorial tests are primarily based on the textbook Bubeník F.: Mathematics for Engineers, Prague.