Mathematics II – Midterm Exam, Spring 2019

Syllabus

This syllabus corresponds to the Exercise sheets “Linear Algebra”, “Limits”, “Level Curves” and “Differential Calculus” (except for exercises 3.25.d, 3.28,.3.29 and 3.35-3.46).

Complements of Linear Algebra
Eigenvalues and eigenvectors of a square matrix. Eigenspaces and algebraic multiplicity of an eigenvalue.
Characteristic polynomial and geometric multiplicity of an eigenvalue.
Eigenvalues of symmetric matrixes.
Classification of quadratic forms.
Elementary topology of $\mathbb{R}^n$ Euclidian distance; neighborhoods and open balls; interior, exterior, boundary; Open subsets of $\mathbb{R}^n$.
Closure of a set and closed sets. Compact sets.
Functions of several real variables Some generalities: domain and range.
Limit of a real function of several variables.
The squeezing Theorem.
Limit with respect to a subset of the domain; Directional limits and main properties. Relationship to the existence of limit.
Notion of continuity.
Differential calculus Directional derivatives and partial derivatives: definition and geometric interpretation.
Linear approximation of a function: the notion of differentiability.
Link between differentiability and the existence of directional and partial derivatives.
Level Curves Definition and main properties. Relationship between the gradient of a function and its level curves.