Joint Faculties of Humanities and Theology

ÄMAB01, Mathematics 2 for Subject Teachers: Analysis in Several Variables, Linear Algebra and Didactics, 15 credits

Matematik 2 för ämneslärare: flervariabelanalys, lineär algebra och ämnesdidaktik , 15 högskolepoäng

First Cycle / Grundnivå

Details of approval

The syllabus was approved by The Education Board of Faculty of Science on 2025-06-10. The syllabus comes into effect 2025-06-10 and is valid from the spring semester 2026.

General information

The course is a component of the teacher education programme at Lund University.

Language of instruction: Swedish and English
Teaching activities in the course modules Analysis in Several Variables and Linear Algebra are held in English, while mathematical didactics is taught in Swedish.

Main field of study	*Specialisation*
Mathematics	G1F, First cycle, has less than 60 credits in first-cycle course/s as entry requirements

Learning outcomes

The overall goal of the course is for students to acquire basic knowledge in differential and integral calculus for functions of several variables as well as in linear algebra. The course also aims to allow students to work with mathematics didactic questions in relation to research results and theories on teaching and learning. Through the course's subject didactic content, students will be prepared for the practical part of the education.

Knowledge and understanding

On completion of the course, the students shall be able to

- use and account for mathematical concepts and methods in linear algebra and differential and integral calculus for functions of several variables
- account for some didactic theories in mathematics
- account for examples of qualitative research methods including how qualitative data can be processed and analysed
- describe how pupils with mathematical difficulties or needs for special support. can be taught
- describe a lesson plan based in mathematics didactic research.

Competence and skills

Upon completion of the course, the student should be able to:

- interpret relevant information and independently identify, formulate, and solve problems related to linear algebra and multivariable calculus
- handle problems within linear algebra and differential and integral calculus for functions of several variables
- identify the logical structure in mathematical reasoning and conduct mathematical proofs
- apply various strategies for problem formulation, problem-solving, and computations in mathematics relevant to their own and pupils problem-solving
- use concepts and methods in analysis and linear algebra that are relevant for applications and for the upcoming teaching profession
- present and discuss mathematical reasoning both orally and in writing
- analyze different teaching methods from a mathematics didactic perspective
- consider, communicate, and integrate a gender equality perspective in educational activities.

Judgement and approach

On completion of the course, the students shall be able to

- use a formal approach to mathematics and argue for the purpose of mathematical proofs
- critically assess different forms of teaching of relevance to teaching mathematics in upper-secondary schools.

Course content

The course consists of the modules:

- Analysis in Several Variables (6 credits)
- Linear Algebra (6 credits)
- Subject Didactics (3 credits)

Analysis in Several Variables (6 credits)

- Functions of several variables: continuity, basic topology in R^n.
- Differential calculus for functions of several variables: partial derivatives, differentiability, the chain rule, gradient and directional derivative, Taylor's formula, extreme values.
- Integral calculus for functions of several variables: multiple integrals, substitution of variables, differentiation under integral signs, improper integrals.

Linear Algebra (6 credits)

- Matrices: matrix operations, matrix inverse, matrix rank.
- Determinants: definition and properties.
- Linear spaces: subspace, span, linear dependence/independence, basis, dimension.
- Euclidean spaces: scalar product, orthonormal bases, orthogonalisation, orthogonal matrices, orthogonal projection, orthogonal complement, least squares method, isometries.
- Linear mappings: matrices of linear mappings, kernel and image, change of basis, rank-nullity theorem.
- Spectral theory: eigenvalues, eigenvectors, the spectral theorem.
- Systems of linear ordinary differential equations.
- Quadratic forms: bilinear forms, diagonalisation, quadratic curves, quadratic surfaces.

Subject Didactics (3 credits)

Topics relevant to mathematics upper-secondary school teaching are considered from subject and subject didactic perspectives. Communication of mathematics both orally and in writing is addressed, as well as problem construction and problem-solving linked to relevant mathematics didactic research and curriculum documents. Examples of qualitative mathematics didactic research are used to illustrate research methods and to connect profession and theory. Lesson planning that takes into account all students, from high-performing to low-performing in mathematics, as well as a field day in upper-secondary school, are included in the course.

Course design

The teaching consists of lectures and instruction in smaller student groups in the form of lessons and exercises, as well as a didactic seminar series. A significant component of the lessons is practice in problem-solving and oral mathematical communication. The didactic seminar series is part of the course Subject Didactics and aims to prepare students for the practical part of the subject teacher education. This course includes at least one mandatory field day where the student observes mathematics lessons at a high school.

Assessment

The assessment is based on the following components of the different modules:

Analysis in Several Variables 1: written examination, 6 credits
Linear Algebra: written examination 6 credits
Subject Didactics: individual written report and oral presentation of lesson plan, 3 credits.

Students who do not pass an assessment will be offered another opportunity for assessment soon thereafter.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Grades

Grading scale includes the grades: Fail, Pass, Pass with distinction
The grading scale for all examination parts is Pass and Fail. The written examinations are graded using exam points. To achieve a Pass on each written examination, a minimum of 50% of the total possible points is required.

To receive a Pass for the entire course, all examination parts must be passed. To receive a Pass with Distinction, all examination parts must be passed and the combined score on the written examinations must be at least 75% of the total possible points.

Entry requirements

Admission to the course requires 24 credits, including knowledge equivalent to the courses

- ÄMAA01 Mathematics 1 for Subject Teachers: Analysis in One Variable, 13 credits
- ÄMAA02 Mathematics 1 for Subject Teachers: Algebra and Vector Geometry, 7.5 credits
- ÄMAA04 Mathematical Didactics 1, 3.5 credits.

Further information

The course may not be included in degree together with ÄMAD02 Mathematics with Didactics 2, 15 credits, MATB21 Mathematics: Analysis in Several Variables 1, 7.5 credits, or MATB32 Mathematics: Linear Algebra, 7.5 credits.

The course is given by the Centre for Mathematical Sciences, Lund University.