Faculty of Science

MATA32, Mathematics: Algebra and Vector Geometry, 7.5 credits

Matematik: Algebra och vektorgeometri, 7,5 högskolepoäng

First Cycle / Grundnivå

Details of approval

The syllabus was approved by Study programmes board, Faculty of Science on 2023-12-11 and was last revised on 2024-02-14. The revised syllabus comes into effect 2024-02-14 and is valid from the autumn semester 2024.

General information

The course is a compulsory course for first-cycle studies for a Bachelor of Science degree in mathematics and in physics. The course can also be given as a stand-alone course or as part of a course package.

Language of instruction: Swedish and English
The course is given alternately in Swedish or English, depending on the course instance. The course is given in Swedish within the Swedish taught specialisations of the Science Bachelor's Programme and as a stand-alone course. The course is given in English within the English taught specialisations of the Science Bachelor's Programme.

Main field of study	*Specialisation*
Mathematics	G1N, First cycle, has only upper-secondary level entry requirements

Learning outcomes

The overarching goal of the course is that the students acquire a deeper understanding of the foundations of algebra as well as knowledge of vector geometry and the foundations of linear algebra. Particular emphasis is put on developing the mathematical theory in a systematic manner contributing to the further aims of enhancing the students' ability to assimilate mathematical text, to carry out a mathematical reasoning, to solve problems of both theoretical and applied character, and to communicate mathematics. Furthermore, the course aims to prepare the students for further studies in mathematics and the natural sciences.

Knowledge and understanding

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

- explain basic concepts and definitions that are listed under the contents of the course
- illustrate and interpret important concepts in the course in concrete situations
- derive algebraic relationships and formulae
- algebraically represent geometric objects, concepts and relations in the threedimensional space.

Competence and skills

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

- derive basic relations between key concepts introduced in the course and use thetheories, methods and techniques covered in the course to solve mathematical problems
- integrate concepts from the different parts of the course in connection withproblem solving
- present solutions to mathematical problems within the framework of the course, logically coherent and with adequate terminology
- describe a course section using everyday language that can be understood also by an individual with another educational background
- give simple and constructive feedback on other students' presentations
- complete tasks during a given time frame.

Judgement and approach

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

- give examples to argue for the relevance and applicability of vector geometry and basic linear algebra in other sciences
- critically evaluate other students' solutions and presentations.

Course content

The course treats:

- Elementary logic and set theory
- Basic properties of the natural numbers and the integers: induction, divisibility, Euclid’s algorithm
- Basic properties of polynomials: divisibility, Euclid’s algorithm
- Complex numbers
- Linear systems of equations, Gaussian elimination
- Vectors in two and three dimensions, bases and coordinates, linear dependence, equations of lines and planes
- Scalar product, calculation of distances and angles

- Vector and volume product, calculation of area and volume
- Matrices, determinants, matrix invertibility.

In addition, material on the axiomatic structure of the real numbers as well as the binomial theorem is treated during lectures taught jointly with the course Analysis in One Variable.

Course design

The teaching consists of lectures, seminars, exercise classes and mentoring meetings. An essential element of the seminars and exercise classes is training in problem solving and mathematical communication. Group assignments and an individual task are included in the course requirements. The group assignments concern problem solving and applications of theoretical aspects. The individual task aims at providing the students with training in popular scientific communication.

Assessment

The examination consists of the following parts:

- assignments during the course (1.5 credits)
- written examination at the end of the course (6 credits)

Students who do not pass the ordinary examination are offered a resit examination during the scheduled re-examination period.

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 the assignments is Fail, Pass. The grading scale for the written examination is Fail, Pass, Pass with Distinction.

For a Pass grade on the whole course, the student must have Pass grades in the assignments and in the written examination.

The final grade is determined by the grade in the written examination.

Entry requirements

General requirements and studies equivalent of course Mathematics 4/D from Swedish Upper Secondary School.

Further information

The course may not be included in a degree together with Mathematics 1 alpha (MAT131 or MATA11), Mathematics 1 beta (MAT132 or MATA12), Algebra 1 (MATA15), Linear Algebra 1 (MATA22) or Foundations of Algebra (MATA23).

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