Linnæus University

Jnr: 2018/1259-3.1.2.2

Course syllabus

Faculty of Technology
Department of Mathematics

1MAÄ01 Matematik I - inriktning mot arbete i årskurs 7-9, 30 högskolepoäng

Mathematics I - For Lower Secondary School Teachers, 30 credits

Main field of study
Mathematics

Subject Group
Mathematics

Level of classification
First Level

Progression
G1F

Date of Ratification
Approved 2011-06-10
Revised 2018-04-23 by Faculty of Technology. Removal of ECTS-grading scale and course evaluation is changed.
The course syllabus is valid from autumn semester 2018

Prerequisites
General entry requirements and English B, Mathematics D, Civics A. (Field-specific entry requirements 6c. Specific entry requirements: Mathematics D)

Objectives

Common objectives:

- discern and describe basic characteristics of the teaching profession in relation to the subject matter and subject didactics
- identify and define subject didactic issues related to the activities that the education prepares for.

Otherwise the expected learning outcomes are valid for each module.

Module 1 Basic mathematics
After completing this module students will be able to:

- perform calculations in different numbers areas, in terms of rational and irrational numbers
- solving basic equations and inequalities containing rational expressions
- solve problems in set theory, number theory and combinatorics
- describe the definitions and sketch graphs of elementary functions
- perform basic calculations with complex numbers and solving complex polynomial equations

- describe the definitions of and deduce the relationship between key concepts of the course and be able to use these relationships when solving problems
- interpret, communicate and argue with representational forms of mathematics.

Module 2 Geometry
After completing this module students will be able to:

- describe, in a broad sense, the structure of Euclid´s Elements and of axiomatic systems in general
- solve problems of geometry concerning triangles and circles
- give an account of the interplay between geometry and algebra
- know the basics of projective and hyperbolic geometry and be able to solve some problems in these areas
- derive the symmetry groups for plane figures
- give an account of the three classic geometric "unsolvable" problems
- compare different approaches to geometric problems
- give an account of the fractal concept

Module 3 Vector Geometry
After completing this module students will be able to:

- perform calculations with matrices and vectors and use these to describe and interpret the geometric processes
- perform calculations with dot product, cross product, volume product (determinants) and understand the geometric significance of these concepts
- deduce equations of lines and planes on the parameter form and normal form and give geometric interpretations
- calculate angles and distances between points, lines and planes
- explain the concept of linear transformation and its matrix representation and be able to calculate matrices for reflection-, projection-, and rotation operators and matrices of others linear transformations
- compute and interpret the eigenvalues and eigenvectors
- describe the definitions of and deduce relationships between key concepts in the course and be able to use these relationships when solving problems in Vector Geometry
- interpret, communicate and argue with representational forms of mathematics from didactic starting points.

Module 4 Mathematics Education for lower secondary and upper secondary school I
After completing this module students will be able to:

- show in-depth subject knowledge in mathematics relating to upper and lower secondary school and the prerequisites in mathematics needed to mutual understanding
- use school and Mathematics written policy on the development of mathematics teaching content
- describe the mathematical abilities and skills relating to conceptualization, representation, problem solving, communication and reasoning in relation to the mathematics content
- identify the role of language in mathematics, especially regarding conceptualization.

Content

The course begins with a deepening on their own mathematics knowledge.
During the introductory courses students meet classical mathematics, while they are collecting the math example with relevance to mathematics education in upper secondary school. These examples are collected in an education portfolio, which is

secondary school. These examples are collected in an education portfolio, which is followed up in the introductory mathematics education course in Mathematics II. During the course the students conduct field studies in lower and upper secondary school.
These field studies intends to give students an insight into the position of Mathematics in lower and upper secondary schools and the teaching profession practice.

Module 1. Basic mathematics. 7.5 credits
Course Content

- Introductory to the Education portfolio and a didactics perspective in mathematics
- Numbers, logic, set theory
- Algebraic expressions, equations and inequalities, functions, elementary functions
- Integers, divisors, prime numbers, division algorithm, diophantine equations
- Induction
- Permutations, combinations, binomial theorem
- Complex numbers, complex plane, de Moivre formula, complex quadratic equations, factor theorem, binomial equations

Module 2. Geometry. 7.5 credits
Course Content

- Measuring of lengths, areas and volumes
- Euclid´s Element. Axiomatic systems
- Theorems about triangles and circles
- Constructions with ruler and compasses
- Problem solving
- Geometry and algebra – an interplay. Symmetry groups of plane figures
- Conic Sections
- Basics of projective geometry, hyperbolic geometry and fractal geometry
- Three classical ”unsolvable” geometric construction problems; something about number fields.

Module 3. Vector Geometry. 7.5 credits
Course Content

- Systems of linear equations, Gauss elimination
- Matrices, vectors, basis and change of basis, dot product, cross product, determinants
- Lines and planes, angle and distance calculations
- Linear transformations, matrix of a linear transformation, the composition of linear transformations, diagonalization, soemthing about higher order determinants

Module 4 Mathematics Education for lower secondary and upper secondary school I, 7.5 credits

The course begins with an introduction to the mathematics education research field with emphasis on the teaching profession. The course also looks at different directions in mathematics education research in a historical perspective. Central mathematics education issues, concepts and research findings are described, reviewed and discussed. It is particularly important that all teachers take responsibility for ensuring that students receive a versatile development. The course also problematize how experiences, perspectives and learning may impact on the planning and implementation of teaching. The student's own mathematical knowledge is deepened and problematized from different didactic perspective. This will be done in relation to mathematics content regarding grades 7-9's. Different methods to concretize course content and proficiency in grades 7-9 mathematics courses will be considered. Concept formation, forms of representation, problem solving, communication and reasoning will be related to the

mathematics content and the mathematical abilities/competencies. The role of language in mathematics is described, reviewed and discussed.

Type of Instruction

Teaching consists of lectures, group exercises and mandatory seminars. Part of the program may be networked.

Examination

The course is assessed with the grades Fail (U), Pass (G) or Pass with Distinction (VG).
The course is examined through active participation in seminars, methodology sessions and presentations, as well through oral and written presentations of individual and group assignments, and through written examination / exam. A part of the examination consists of practical elements (field studies) that the student implements and presents.

Course Evaluation

During the course or in close connection to the course, a course evaluation is to be carried out. The result and analysis of the course evaluation are to be communicated to the students who have taken the course and to the students who are to participate in the course the next time it is offered. The course evaluation is carried out anonymously. The compiled report will be filed.

Required Reading and Additional Study Material

Required Reading

Module 1

Vretblad A., Ekstig K. *Algebra och geometri*, Gleerups, latest edition. 190 (311) pages.

Ekstig Kerstin, Hellström Lennart, Sollervall Håkan.
Matematik Startbok, Studentlitteratur, latest edition.

Didactic literature
Hansen Hans Christian, Skott Jeppe, Jess Kristine, Schou John, Matematik för lärare Ypsilon band 1, Gleerups förlag, latest edition.

Module 2

Anders Tengstrand. *Åtta kapitel om geometri*. Studentlitteratur, 2005. 240 (311) pages.

Didactic literature
Hansen Hans Christian, Skott Jeppe, Jess Kristine, Schou John, Matematik för lärare Ypsilon band 1, Gleerups förlag, latest edition.

Module 3

Torsten Lindström. *Med fokus på linjär algebra*, Studentlitteratur,152 pages latest edition.

Didactic literature
Hansen Hans Christian, Skott Jeppe, Jess Kristine, Schou John, Matematik för lärare Ypsilon band 1, Gleerups förlag, latest edition.

Module 4

Andersson, Andreas, Begreppskartor - ett verktyg för bättre förståelse, Nämnaren 2/2002. ncm.gu.se/pdf/namnaren/4447_02_2.pdf

Andreas Ryve: Vad är kunskap i matematik? ncm.gu.se/pdf/namnaren/0709_06_2.pdf

Grevholm, Barbro, Kognitiva verktyg för lärande i matematik- tankekartor och begreppskartor. www.caspar.no/tangenten/2005/barbro_grevholm_1_2005.pdf

Hansen, Hans Christian; Skott, Jeppe & Jess, Kristine. (2009). Matematik för lärare Ypsilon band 1 och band 2, Gleerups förlag. ISBN13: 9789140668134 och

ISBN13:9789140667861

Hansen, Hans Christian; Skott, Jeppe; Jess, Kristine & Sverker Lundin. (2010). Matematik för lärare, Delta Didaktik, ISBN: 9789140671462

Myndigheten för skolutveckling, Mer än matematik. www.skolverket.se/2.3894/publicerat/2.5006?_xurl_=http%3A%2F%2Fwww4.skolverket.se%3A8080%2Fwtpub%2Fws%2Fskolbok%2Fwpubext%2Ftrycksak%2FRecord%3Fk%3D1891

Niss, Mogens & Højgaard Jensen, Tomas (Red.) (2002). Kompetencer og matematiklœring. Ideer og inspiration til udvikling af matematikundervisning i Danmark. pub.uvm.dk/2002/kom/hel.pdf

Ola Helenius: Kompetenser och matematik. ncm.gu.se/pdf/namnaren/1115_06_3.pdf

Schoenfeld Allan. (1992). Learning to think mathematically: problem solving, metacognition, and sense making in mathematics. gse.berkeley.edu/faculty/AHSchoenfeld/Schoenfeld_MathThinking.pdf

Skolverket. Kursplan och betygskriterier för ämnet matematik.

Material provided by the department.