Linnæus University

Course syllabus

Board of Education Science
School of Computer Science, Physics and 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 by the Board of the School of Computer Science, Physics and Mathematics 2011-06-10

The course syllabus is valid from autumn semester 2011

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

Expected learning outcomes

Common learning outcomes:

After completing the course students will be able to:

- 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

- 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 in basic mathematics
- interpret, communicate and argue with representational forms of mathematics

Module 2. Calculus I

- perform calculations of limits, derivative and integral
- interpret and use the basic functions and equations
- sketch graphs and solve the extreme value problems
- solve basic types of differential equations
- use the derivative and integral for problem solving
- describe the definitions of and deduce relationships between key concepts in the course and be able to use these relationships when solving problems in Calculus
- deduce simple relationship for limits, derivatives and integrals
- interpret, communicate and argue with representational forms of mathematics from didactic starting points

Module 3. Vector Geometry

- 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

Module 4. Mathematics from a didactic perspective

- show in-depth subject knowledge in mathematics relating to lower secondary school (classes 7-9) 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

Overall content:

The program begins with a deepening, on their own mathematics knowledge. During the introductory courses, mathematics at university level is studied, at the same time the students are collecting math examples with relevance to lower secondary school

(classes 7-9) in a mathematics education portfolio which is monitored in module 4 Mathematics, from a didactic perspective. During the course field studies are conducted in lower secondary school. These field studies intended to give students an insight into the position of Mathematics in the school and the practice of the teaching profession.

Module 1. Basic mathematics. 7.5 credits

- 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. Calculus I. 7.5 credits

- Limits and Continuity: limit definition, general properties, Squeeze Theorem, standard limits, the number “e”
- Derivative and function study: definition of the derivative, general properties, the derivates of elementary functions, mean-value theorem, extreme value problems, curve sketching, asymptotes
- Integrals: Antiderivatives, the definition of the definite integral, the fundamental theorem of calculus, the mean-value theorem for integrals, integration by parts, the method of substitution, intergrals of rational functions
- Differential equations: linear and separable DE of first order, linear DE of second order with constant coefficients

Module 3. Vector Geometry. 7.5 credits

- 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, anything about higher order determinants

Module 4. Mathematics from a didactic perspective. 7.5 credits

The course begins with a critical discussion around the examples in the Education portfolio that students bring with them from the introductory math courses.
Examples have been selected based on relevance to the national curriculum and syllabi and are discussed in relation to the theoretical framework of abilities / competencies as the basis for syllabus.
The student's math skills in arithmetic, geometry, algebra, functions, probability and statistics relating to mathematics in lower secondary school (classes 7-9) are deepened and problematized from different didactic perspective.
Mathematics subject nature and historical development are highlighted in a comprehensive, school-oriented perspective.
Mathematical abilities and competencies are treated from a theoretical perspective and then connected to mathematics content and the whole illustrated by orientation around ways and working forms to support concept development and to highlight different strategies for solving problems with a particular focus on the role of language and variety of forms of representation.
Students will solve and construct their own data which are then analyzed with regard to the purpose, content, mathematical abilities and developable solution strategies.

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.

On request, students may have their credits translated to ECTS-marks. Such a request must be sent to the examiner before the grading process starts.

Course Evaluation
After completing the course, is a course evaluation compiled and written feedback to the students. The statement recognized for the current institutional bodies and for the relevant Programme Board, and filed by the course coordinator department.

Required Reading and Additional Study Material
Required Reading
Module 1
Hellström Lennart, Johansson Per Gunnar, Morander Staffan, Tengstrand Anders
Elementär algebra, Studentlitteratur, latest edition.

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 och band 2, Gleerups förlag, latest edition.

Module 2
Robert A. Adams. Calculus – A Complete course, AddisonWesley
Educational Publishers, latest edition.

Didactic literature
Hansen Hans Christian, Skott Jeppe, Jess Kristine, Schou John, Matematik för lärare Ypsilon band 1 och band 2, Gleerups förlag, latest edition.

Module 3
Tengstrand Anders, Linjär algebra med vektorgeometri, Studentlitteratur, latest edition.

Didactic literature
Hansen Hans Christian, Skott Jeppe, Jess Kristine, Schou John, Matematik för lärare Ypsilon band 1 och band 2, Gleerups förlag, latest edition.

Module 4
Andersson, Andreas, Begreppskartor - ett verktyg för bättre förståelse, Nämnaren 2/2002, www.ncm.gu.se – sök under Artikelregister. Pages 3. 4/2008. www.ncm.gu.se Pages 5.

Bergsten, Christer, Häggström, Johan & Lindberg, Lisbeth (1997). Algebra för alla. Nämnaren Tema, NCM. ISBN 91-88450-08-2

Emanuelsson, Göran, Wallby, Karin, Johansson, Bengt & Ryding, Ronnie (2000). Matematik – ett kommunikationsämne. Nämnaren Tema, NCM. Göteborgs universitet, 1996. Pages 150.ISBN 91-88450-06-6

Grevholm, Barbro, Kognitiva verktyg för lärande i matematiktankekartor och begreppskartor, (Tangenten 1/2005).
www.caspar.no/tangenten/innhald051.html-pages 8. Latest edition.

Grevholm Barbro (red.) (2001). Matematikdidaktik – ett nordiskt perspektiv. Lund: Studentlitteratur. (Ca 150 pages). Latest edition.

Hansen, Hans Christian, Skott, Jeppe & Jess, Kristine. (2009). Matematik för lärare Ypsilon band 1 och band 2, Gleerups förlag.
ISBN13:9789140668134
och
ISBN13: 9789140667861

Johnsen Høines, Marit (2000). Matematik som språk, verksamhetsteoretiska perspektiv. Malmö: Liber. ISBN 91-47-04670-8. (ca 100 pages)ISBN: 9789147046706

Kilborn, Wiggo & Löving, Madeleine. Baskunskaper i matematik. Lund, Studentlitteratur.ISBN13: 9789144022178

Myndigheten för skolutveckling, Mer än matematik, Liber distribution, 2008,ISBN 978-91-85589-46-3

National Research Council (2001). Adding it up: Helping Children learn mathematics. In Jeremy Kilpatrick, Jane Swafford, & Bradford Findell (Eds.). Mathematics Learning Study Committee, Center for Education, Division of Behavioral and Social Sciences and Education. Washington, DC: National Academy Press. (aprox 100 pages), ISBN13: 9780309069953

Niss, Mogens (2003). Mathematical competencies and the learning of mathematics: the Danish KOM project. Proceedings of the 3rd Mediterranean Conference on Mathematical Education - Athens, Hellas 3-4-5 January 2003, 116-124.

Niss, Mogens & Højgaard Jensen, Tomas (Red.) (2002). Kompetencer og matematikloering. Ideer og inspiration til udvikling af matematikundervisning i Danmark. Uddannelsesstyrelsens temahoefteserie nr. 18-2002. Undervisningsministeriet 2002. (aprox 70 pages)

Rystedt Elisabeth & Trygg Lena, Laborativ matematikundervisning – vad vet vi? NCM:s forskningsöversikter, 2009, (aprox 80 pages).

Schoenfeld Allan. (1992). Learning to think mathematiucally: problem solving, metacognition, and sense making in mathematics. I: Grouws Douglas(ed.) Handbook of research on mathematics teaching and learning (p. 334-370). New York: Macmillan. ISBN 13 9780029223819

Sollervall Håkan, Tal och de fyra räknesätten, Studentlitteratur, 2007. Pages 172 (172), ISBN 9789144045276

Skolverket. Lusten att lära med fokus på matematik. Kvalitetsgranskningar 20012002. rapport nr 221, 2003.www.skolverket.se Pages 45
Stockholm: Skolverket. www.skolverket.se (Can be downloaded).

Skolverket. Kursplan och betygskriterier för ämnet matematik. Stockholm: Skolverket. www.skolverket.se/sb/d/165/a/8906

Materials to be provided by the department, approx. 200 pages.