Faculty of Health, Science and Technology
Mathematics

Syllabus

Fundamental concepts and proofs in mathematics

Course Code:	MAGA12
Course Title:	Fundamental concepts and proofs in mathematics *Matematisk uppbyggnad och bevisföring*
Credits:	6
Degree Level:	Undergraduate level
Progressive Specialisation:	First cycle, has only upper-secondary level entry requirements (G1N)

Major Field of Study:
MAA (Mathematics)

Course Approval
The syllabus was approved by the Faculty of Health, Science and Technology 2017-02-17, and is valid from the Autumn semester 2017 at Karlstad University.

Prerequisites
Upper secondary school level Mathematics E or Mathematics 4, or equivalent

Learning Outcomes
The aim of the course is that students acquire basic knowledge and understanding of algebra and analysis with an emphasis on the logical structures of mathematics, proofs and how mathematical theory is constructed.

Upon completion of the course the student should be able to:
- read and interpret mathematical text,
- formulate and use all definitions and theorems treated in the course and prove a given selection of its most important theorems,
- perform mathematical and logical reasoning and express them correctly orally and in writing,
- demonstrate proof by using different methods such as direct proof, proof by contradiction, and proof by induction,
- handle sets and logical expressions,
- determine if relations are functions, surjections, injections or equivalence relations and determine equivalence classes,
- solve problems regarding divisibility of integers and polynomials and congruence of integers,
- solve polynomial equations and linear Diophantine equations,
- calculate with matrices, such as addition, multiplication and determine inverses, calculate determinants, solve linear equation systems with constant coefficients, and solve some types of matrix equations,
- show understanding of the subject by being able to combine new concepts, theorems and experiences of examples, and by being able to discover analogies and make generalizations.

Content
Logic and set theory: propositions, logic operators, sets and set operations.
Number theory: divisibility, prime numbers, the Euclidean algorithm, the fundamental theorem of arithmetic, position system, linear Diophantine equations.
Functions and relations: surjections, injections, bijections, equivalence relations, congruence calculation.
Proof methods: direct proofs, proofs by contradiction, and mathematical induction.
Polynomials: divisibility, the factor theorem, the division algorithm, the Euclidean algorithm, polynomial equations.
Elementary linear algebra: linear equation systems, Gauss elimination, matrices, calculation rules for matrices, inverse matrices, determinants and calculation rules for determinants.
Limits and continuity: formal definitions of limit and continuity, continuous functions and their properties, least upper bound property, extreme value theorem and intermediate-value theorem.

Instruction is in the form of lectures and workshops. Students are required to perform a minor assignment in the form of a proof or calculation individually and present it orally.

Reading List
See separate document.

Examination
Assessment is based on a written exam and on an individual assignment presented orally.
The number of re-take opportunities is limited to three per academic year.

Grades
One of the grades U (Fail), G (Pass), or VG (Distinction) is awarded in the examination of the course.

Quality Assurance
Follow-up relating to learning conditions and goal-fulfilment takes place both during and upon completion of the course in order to ensure continuous improvement. Course evaluation is partly based on student views and experiences obtained in accordance with current regulations and partly on other data and documentation. Students will be informed of the result of the evaluation and of any measures to be taken.

Course Certificate
A course certificate will be provided upon request.

Additional information
The local regulations for studies at the Bachelor and Master levels at Karlstad University stipulate the obligations and rights of students and staff.