



Faculty of Health, Science and Technology  
Mathematics

## Syllabus

### Foundation course in Mathematics

<b>Course Code:</b>	MAGA51
<b>Course Title:</b>	Foundation course in Mathematics <i>Matematisk grundkurs</i>
<b>Credits:</b>	7.5
<b>Degree Level:</b>	Undergraduate level
<b>Progressive Specialisation:</b>	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

Field-specific eligibility A9 or 9

#### Learning Outcomes

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

- read and understand mathematical texts and correctly present elementary logical reasoning,
- work with algebraic expressions and absolute values, solve polynomial and root equations, solve inequalities, and deal with elementary finite sums,
- work with complex numbers in Cartesian and polar form,
- examine functions in terms of concepts such as domain, range and injectivity,
- define and sketch graphs of elementary functions and master their rules for calculations,
- formulate, explain and apply definitions of concepts such as limits, continuity, derivative,
- use limits and derivatives in calculations and problem-solving,
- use the derivative for function studies such as curve sketching, determining local and global extreme values, determining Taylor polynomials and applying l'Hopital's rules in limit calculations,
- perform checks of results and assess their feasibility and accuracy,
- show understanding of the subject by combining new concepts, theorems and problem solving skills, discovering analogies and making generalizations.

#### Content

Instruction is in the form of lectures and exercise sessions.

Main course components:

- Basic logic and set theory: symbols and concepts, basic principles of logical reasoning and proofs
- Basic analytical geometry such as conic sections
- Algebraic simplification, completing the square, factor theorem, equations such as trigonometric equations, inequalities and absolute values
- Geometric and arithmetic sums, the sigma symbol, the binomial theorem
- Complex numbers: Cartesian and polar form, de Moivre's formula, binomial equations, complex exponential functions, inverse functions
- Basic functions: polynomial, power, logarithmic, exponential, trigonometric and inverse trigonometric functions, their definitions, properties, graphs and rules for calculation
- Limits of sequences and functions, continuity, properties of continuous functions
- Definition of the derivative and calculation laws, chain rule, derivatives of elementary functions, implicit differentiation, the mean value theorem
- Basic applications of derivatives: tangents and normals, increasing and decreasing functions.
- Function studies: graph construction, extreme points, asymptotes, concavity
- Applications of derivatives: extreme value problems, linearization, Taylor polynomial with error term using big-O notation and the Lagrange's form, l'Hopital's rules.

### **Reading List**

See separate document.

### **Examination**

Assessment is based on a written exam and presentations of group assignments in the form laboratory work with mathematical software. The number of examination opportunities is limited to three per academic year.

### **Grades**

One of the grades U (Fail), 3 (Pass), 4 (Pass not without distinction), or 5 (Pass with distinction) alternatively 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.

Required course for the Master of Science in Engineering programme, and the Bachelor's programmes in Mathematics and Physics