



Faculty of Health, Science and Technology  
Mathematics

## Syllabus

### Introduction to Analysis

<b>Course Code:</b>	MAGB18
<b>Course Title:</b>	Introduction to Analysis <i>Grundläggande analys</i>
<b>Credits:</b>	7.5
<b>Degree Level:</b>	Undergraduate level
<b>Progressive Specialisation:</b>	First cycle, has less than 60 credits in first-cycle course/s as entry requirements (G1F)

**Major Field of Study:**  
MAA (Mathematics)

#### Course Approval

The syllabus was approved by the Faculty of Health, Science and Technology 2018-02-06, and is valid from the Autumn semester 2018 at Karlstad University.

#### Prerequisites

Mathematics 30 ECTS cr, including the courses Foundation Course in Mathematics, 7.5 ECTS cr. Calculus Na Geometry, 7.5 ECTS cr, 7.5 ECTS cr, and Fundamental Concepts and Truths, 6.0 ECTS cr, or equivalent. Single Variable Calculus EA2 (MAGA02) and Elementary Algebra (MAGA03), or equivalent.

#### Learning Outcomes

Upon completion of the course the student should be able to

i. prove and use the following theorems:

- Existence of supremum and infimum, the Nested Intervals Theorem
- Convergence of monotone sequences
- Bolzano-Weierstrass' lemma, the Cauchy criterion
- The equivalence between Cauchy's and Heine's definitions of limits of functions
- Root localization theorem, Intermediate value theorem
- The boundedness theorem, Max/min theorem
- The uniform continuity theorem
- The mean value theorem
- Taylor's theorem
- Riemann's criterion for integrability, integrability of continuous functions and monotone functions
- Fundamental theorem of calculus
- Continuity, integrability and differentiability of the limits of sequences of functions
- Weierstrass' M-test (uniform convergence test)

ii. use the definitions, concepts, arguments and techniques used in the theorem proofs to solve mathematical problems;

iii. demonstrate understanding to combine the concepts, theorems and experiences of examples, see

analogies and make generalisations;

iv. solve mathematical problems independently and report the solution orally and in writing

### **Content**

-Real numbers, completeness axiom.

-Bounded sets, supremum and infimum.

-Convergence of sequences and Cauchy's criterion.

-Limits and continuity, uniform continuity, continuous functions on intervals.

-Monotone functions, inverse of a function.

-Derivation, mean value theorem, integration, the fundamental theorem of calculus.

-Numerical series, series of functions, sequences of functions and uniform convergence.

Instruction is in the form of lectures and exercises. One assignment is performed individually and reported orally and in writing.

### **Reading List**

See separate document.

### **Examination**

Assessment is based on a written exam and oral and written reports of an individual assignment.

### **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.