



# SF1652 Introductory Course in Mathematics 2 3.0 credits

Förberedande kurs i matematik 2

This is a translation of the Swedish, legally binding, course syllabus.

## Establishment

Course syllabus for SF1652 valid from Spring 2010

## Grading scale

P, F

## Education cycle

First cycle

## Main field of study

Mathematics, Technology

## Specific prerequisites

- **General requirements** i.e. completed upper secondary education including documented proficiency in Swedish and English (for courses given in Swedish) or including documented proficiency in English (for courses given in English).
- **Specific requirements:** knowledge of Mathematics corresponding to Mathematics C

## Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

## Intended learning outcomes

This course is the continuation of SF1651 Introductory Course in Mathematics and consists of three main parts each worth 1 credit. The sections go through some of the basic knowledge important to have fully updated for upcoming higher education studies. The course is web based and flexible, i.e. the student studies in a pace that suits him or her best.

After the course the student should be able to;

- Understand the derivative as the slope of an integral
- Understanding the derivative as the instantaneous rate of change of a physical quantity
- Know that the derivative can be characterized with  $f'$  or  $df/dx$  and that there are functions that are not derivable
- Derivate  $x^a$ ,  $\ln x$ ,  $e^x$ ,  $\cos x$ ,  $\sin x$ ,  $\tan x$  and sums/differences of such terms
- Decide the tangent and normal of an integral
- In principle derivate any elementary function
- Understand the definition of strictly increasing function, strictly decreasing function, local maximum, local minimum, global maximum, global minimum
- Decide the areas where a function is strictly increasing and decreasing by studying the derivatives character
- Decide the local maximum and minimum points and terrace point by studying the character of the derivative
- Sketch the function curve by making a character table of the derivative
- Know where the local/global maximum and minimum points occur
- Decide local maximum and minimum points character by looking at the character of the second order derivative
- Interpret integrals as area and understand other interpretations of integrals
- Decide primitive function for and decided integral of  $x^a$ ,  $1/x$ ,  $e^x$ ,  $\cos x$ ,  $\sin x$  and the sum/difference of such terms
- Calculate the area under a curve and between two curves
- Know that some functions primitive functions can't be described as a analytically closed expression, e.g.  $e^{x^2}$ ,  $(\sin x)/x$ ,  $\sin \sin x$
- Understand the origin of the formula for variable substitution
- Solve simpler integration problems which need rewriting and/or substitution in one step
- Describe how the integration boundaries change during variable substitution and when a variable substitution is allowed
- Understand the origin of the formula for partial integration
- Solve integration problems which need partial integration in one or two steps

- Solve integration problems which need partial integration followed by a substitution (or the other way round)
- Calculate expressions that contain complex numbers and are built up of the four rules of arithmetic
- Solve complex first degree equations
- Transform some complex numbers between the form  $a+ib$  and polar form
- Calculate powers of complex numbers with de Moivres formula
- Calculate roots of some complex numbers by rewriting them into polar form
- Solve binomic equations
- Completing the square of complex second degree expressions
- Solve complex second degree equations and factorize complex second degree expressions
- Perform polynomial division
- Understand the connection between factors and zero of polynomial
- Know that a polynomial equation of degree  $n$  has  $n$  roots (counted with multiplicity)
- Know that real polynomial equations have conjugated roots

## Course contents

- Derivatives  
Introduction, rules of differentiation, maximum and minimum problems
- **Integrals**  
Introduction, variable substitution, partial integration
- **Complex numbers**  
Calculations with complex numbers, polar form, exponentiation and roots, complex polynomials

## Course literature

Electronic course material free of charge is available on the internet for those who apply for the course.

## Examination

- TEN3 - Examination, 1.0 credits, grading scale: P, F
- TEN2 - Examination, 1.0 credits, grading scale: P, F
- TEN1 - Examination, 1.0 credits, grading scale: P, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

If the course is discontinued, students may request to be examined during the following two academic years.

## **Ethical approach**

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.