



# SF1625 Calculus in One Variable

## 7.5 credits

### Envariabelanalys

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

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

### Establishment

Course syllabus for SF1625 valid from Autumn 2015

### Grading scale

A, B, C, D, E, FX, F

### Education cycle

First cycle

### Main field of study

Mathematics, Technology

### Specific prerequisites

Basic and specific requirements for engineering program.

**Mandatory for first year, can not be read by other students**

### Language of instruction

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

## Intended learning outcomes

After completing the course the student a passing grade to:

- Use, explain and apply fundamental concepts and problem solving methods of one variable calculus, especially:
  - Describe the fundamental characteristics of elementary functions, such as power laws, logarithm laws and trigonometric formulas and use them in problem solving and calculations
  - Calculating derivatives using, among other things, the product, quotient and the chain rule
  - Using derivatives to investigate the properties of a function, for example, decide questions of increasing and decreasing behavior, sketch function graphs, determine the tangent, prove inequalities and find extreme values
  - Using Taylor's formula to approximate functions with polynomials to desired degree of accuracy
  - Account for the definition of the Riemann Integral and its applications, as well as approximate integrals with Riemann sums
  - Calculate integrals using primitive functions, integration by parts, variable substitution and partial fractions
  - Account for the fundamental theorem of calculus about the relationship between the derivative and integral, and use it in problem solving and calculations
  - Solve some linear ordinary differential equations with constant coefficients and explain how they arise in applications
  - Calculate limits and use these to study the behavior of functions locally or asymptotically
  - Determine whether a given function is invertible and if possible calculate the inverse function
  - Determine if certain series converges or diverges and if possible calculate them
- Set up simple mathematical models for applications that can be described with the help of functions of one variable, and discuss such models relevance, plausibility and accuracy.
- Read and understand mathematical text about functions of one variable and their applications, communicate mathematical reasoning and computations within this field orally as well as in writing in such a way that they are easy to follow.

For higher grades, the student should be able to:

- Account for the theory of one variable calculus, with definitions, theorems and proofs
- Generalize and adapt methods to fit in new situations
- Solve problems requiring a combination of methods, or more extensive calculations in several steps
- Solve more advanced problems in, for example, limits, series, integrals and applications

## Course contents

Function, function graph, domain, range. Increasing and decreasing functions, odd and even functions. Inverse functions. The class of elementary functions. Unit circle, trigonometric

formulas and equations, exponential and logarithmic functions, power laws, logarithms. Limits, rules for calculating limits, standard limits. Continuity, theorems on continuous functions. Derivative, rules of differentiation and applications: rate of change, linear approximation, tangent, extreme value problems, sketching the graph of a function, inequalities etc. Taylor's formula with error estimates. Linear differential equations with constant coefficients and their applications. Riemann integral, primitive functions, variable substitution, integration by parts, partial fractions. Riemann sums, geometric and other applications of integrals, improper integrals. Something about sequences and series. Something about numerical methods (eg Newton's method).

## Course literature

Robert A. Adams, Christopher Essex, **Calculus - A Complete Course**, 8th edition. ISBN 978-0-321-78107-9.

## Examination

- TEN1 - Examination, 7.5 credits, grading scale: A, B, C, D, E, FX, 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.

## Other requirements for final grade

Written exam, possibly with the possibility of continuous examination.

## 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.