

Introduction

Prior Knowledge

Prior knowledge in mathematics (and statistics) of students of the master programme in *economics* differ heavily:

- ▶ Students with courses in mathematics with a total of 25 ECTS points (or more) in their bachelor programme.
- ▶ Students who did not attend any mathematics course at all.

Prior knowledge differ in

- ▶ *Basic skills* (like computations with "symbols")
- ▶ *Tools* (like methods for optimization)
- ▶ *Mathematical reasoning* (proving your claim)

Knowledge Gap

The following problems cause issues for quite a few students:

- ▶ Drawing (or sketching) of graphs of functions.
- ▶ Transform equations into equivalent ones.
- ▶ Handling inequalities.
- ▶ Correct handling of fractions.
- ▶ Calculations with exponents and logarithms.
- ▶ Obstructive multiplying of factors.
- ▶ Usage of mathematical notation.

Presented "*solutions*" of such calculation subtasks are surprisingly often *wrong*.

Learning Objectives

This **bridging course** is intended to help participants to

- ▶ *close* possible knowledge gaps, and
- ▶ *raise* prior knowledge in **basic** mathematical **skills** to the *same higher* level.

Further courses:

- ▶ *Foundations of Mathematics* (Msc Economics):
Essential mathematical *tools*.
(matrix algebra, Taylor series, implicit functions, static optimization, Hessian, Lagrange multiplier, difference equations, ...)
- ▶ *Mathematics 1 and 2* (science track only):
Advanced (new) tools and mathematical reasoning.

Learning Methods

- ▶ *Revision* of mathematical notions and concepts by the instructor.
- ▶ Solve problems *collectively* during the course.
- ▶ Solve *homework problems*.
Solutions are discussed during the next course.
- ▶ The subject matter may not be presented in a linear way.
- ▶ There will be *no exams*.
- ▶ For a positive grade ("*erfolgreich teilgenommen*") you have to be **present** in at least **8 units**.

Solutions of Problems

- ▶ A problem is **solved** when the problem question is *answered*.
- ▶ It is *not sufficient* when you just present the computations that are *necessary* to answer the question.
- ▶ In particular, fragments of computations that start and end at some point are not considered as correct solution of a (homework) problem.
- ▶ You have to show that you can draw the right conclusions from your computations.

Maxima – Computer Algebra System (CAS)

Maxima is a so called **Computer Algebra System (CAS)**, i.e., one can

- ▶ handle algebraic expressions,
- ▶ solve (in-) equalities with parameters,
- ▶ differentiate and integrate analytically,
- ▶ handle abstract matrices,
- ▶ plot univariate and bivariate functions,
- ▶ ...

Program *wxMaxima* provides a GUI:

<http://wxmaxima.sourceforge.net/>

The manuscript *Introduction to Maxima for Economics* can be downloaded from the webpage of this course.

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Motivation
Learning Methods

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Sets
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Maps
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Terms
Sigma Notation
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Rational Terms

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Equations

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Equations with Powers or Roots

Algebraic Equations

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Real Functions

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Real Functions

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Bijectivity

Special Functions

Elementary Functions

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Paths

Generalized Real Functions

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Limit of a Function

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Derivatives

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Derivative

The Differential

Elasticity

Partial Derivatives

Gradient

Hessian Matrix

Jacobian Matrix

Monotone, Convex and Extrema

Monotone Functions

Convex and Concave

Extrema

Integration

Antiderivative

Riemann Integral

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Fundamental Theorem of Calculus

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May you do well!

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