BASIC MATHEMATICAL TOOLS

Course manual 2017/2018

This manual provides most of the relevant information on organization and setup of the course Basic Mathematical Tools, SCI1010.

Student profile

This course is aimed at students who have only taken basic level Mathematics in High School. Although the level of high school mathematics required for this course is basic, the pace of this course exceeds high school levels. Also, the course topics cover, but also digress beyond high school mathematics. Thus, since the emphasis of this course is on computational rather than conceptual issues, students that take this course are required to have at least some affinity with quantitative skills and application of mathematical techniques.

Students who are not sure whether this course is appropriate for them are welcome to contact the course coordinator. It is strongly suggested that students who have taken the highest level of mathematics in high school consider taking relevant 2000-level courses directly.

Objectives

- To provide students with a thorough mathematical basic toolbox.
- To train students in computation and analytic reasoning.
- To demonstrate why mathematics is extremely useful in many disciplines.

To prepare students for more advanced courses in mathematics. SCI1010.

Description of the course

Students learn to analyze mathematical problems from various fields in mathematics, such as analysis, algebra, and probability theory. Thus, students are trained to model and solve quantitative problems from a wide variety of disciplines.

The course is intended in particular for students with only a limited mathematical background from pre-university education that need to refresh their skills in mathematics and calculus. The first three weeks recap topics that are already covered in secondary school. The remaining weeks cover more advanced topics to prepare students for further quantitative courses.

The course guides students through a wide variety of topics in mathematics and its applications. Topics range through solving equations and inequalities, techniques for differentiation , function analysis, probability theory, geometry and approximation techniques.

Material

All material needed for this course is contained in a reader. The reader will be available to students in pdf format via Eleum.

Format

The course comprises 6 weeks. In each week 1 lecture and 2 tutorials will be given. In week 7 a written exam will be scheduled. During the tutorials, the exercises will be discussed. In one part of the tutorial students have to present solutions on the whiteboard. Presentations will be graded by the tutor. In the second part, students work on exercises, and can ask questions and clarification on solutions from the tutor.

Level

The material covers several topics that are taught also in basic mathematics courses in secondary school. For example simplification of mathematical expressions and solving inequalities are also discussed in most secondary school basic level mathematics classes. The course also comprises a few topics that may not be taught in basic mathematics classes in secondary school, such as differentiation and parameter representation.

As such, the level of this course may for the larger part be thought of as a refresher course. Still, the pace of this course exceeds that of high school, and may at times slightly more challenging than secondary school intermediary mathematics classes.

Examination

Students should be present in at least 10 out of 12 tutorials. Failure to meet this requirement results in a fail for the exam.

The exam consists of a written exam, attendance of tutorials, plus participation during tutorials. In order to receive a grade higher than 5.0, students should attend at least 10 out of 12 tutorials. In case of sufficient attendance, students receive a grade (PG) for participation during the tutorials, and a grade (EG) for the written exam. The participation grade will be based on the part of the tutorials where students have to explain solutions to exercises. Both grades are computed on a 10-point scale. The final grade (FG) is then computed via the formula

$$FG = \frac{PG + 3 \cdot EG}{4}.$$

Written exam. The written exam takes place in week 7. The exam is closed-book, and consists of open questions.

Resit. In case of failure of attendance, a student is required to hand in an additional assignment. To qualify for an additional assignment, a student may not have missed more than 4 tutorials. In that case, the student will be given a provisional overall grade, but will not receive credits for the course until the additional assignment is successfully completed. An additional assignment can be requested by handing in a completed request form "additional assignment because of insufficient attendance" to the Office of Student Affairs. The request should be filed within 10 working days after completion of the course.

A sufficient participation grade is only valid until (and including) the following written resit. If a student does not pass the course during the current academic year, all parts of the course have to be followed and passed again.

Contact information

For further information on this course, please contact:

Dries Vermeulen

Email: d.vermeulen@maastrichtuniversity.nl

Topics per week

Week 1. Basics of calculus

Sections 0 and 1. Mathematical notation, calculations with fractions.

Section 2. Calculations with powers and logarithms.

Week 2. Solving equations and inequalities

Section 3. Computations with quadratic and higher order expressions.

Section 4. Solving equations and inequalities.

Week 3. Functions

Section 5. Definition, graphs, and properties of polynomial functions.

Section 6. Definition, graphs, and properties of exponential and logarithmic functions.

Week 4. Differentiation

Section 7. Definition and computation of the derivative of a function.

Section 8. Applications of differentiation.

Week 5. Probability theory

Section 9. Draws from a jar. Dependence and independence of events.

Section 10. Random variables and probability distributions.

Week 6. Geometry in the plane

Section 11. Vectors. Parameter representations of lines.

Section 12. Solving equations. Transformations.

Tutors

Veerle Timmermans   v.timmermans@maastrichtuniversity.nl

Dries Vermeulen   d.vermeulen@maastrichtuniversity.nl