

## Syllabus Course Description

<b>Course title</b>	Mathematics for Economists TSE (modular)
<b>Course code</b>	30162
<b>Scientific sector</b>	SECS-S/06
<b>Degree</b>	Bachelor in Tourism, Sport and Event Management
<b>Semester and academic year</b>	1 <sup>st</sup> and 2 <sup>nd</sup> Semester 2023/24
<b>Year</b>	1 <sup>st</sup> year
<b>Credits</b>	12
<b>Modular</b>	Yes

<b>Total lecturing hours</b>	72
<b>Total lab hours</b>	-
<b>Total exercise hours</b>	72
<b>Attendance</b>	suggested, but not required
<b>Prerequisites</b>	Not requested; the "Preparatory course in Mathematics" is recommended
<b>Course page</b>	<a href="https://www.unibz.it/en/faculties/economics-management/bachelor-tourism-sport-event-management/course-offering/?academicYear=2023">https://www.unibz.it/en/faculties/economics-management/bachelor-tourism-sport-event-management/course-offering/?academicYear=2023</a>

<b>Specific educational objectives</b>	<p>The first module refers to the basic educational activities and belongs to the scientific area of Statistics-Mathematics.</p> <p>The second module refers to typical educational activities and belongs to the scientific area of Statistics-Mathematics.</p> <p>The course gives an introduction to scientific content in Mathematics and is designed to acquire skills for the solution of basic mathematical tasks as well as for modeling economic systems.</p> <p>The first module is the first part of an introductory course which covers basics in mathematical language (sets, relations, functions) as well as one-variable calculus. The course is intended as a first step in providing students with solid mathematical foundations to be of use in modelling economical systems, in market research and in the analysis of consumer behaviour. The students will be provided with the basic facts needed to follow modern courses in economics, business and administration. The focus is on understanding the mathematical problems and ideas for their solutions. Solution procedures for several standard problems (for example, find a derivative, the equation of a tangent to a function, an indefinite integral or perform Newton's method) will be introduced. The course is aimed at generating familiarity with and</p>
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	<p>proficiency in applying these solution procedures.</p> <p>A graphical approach is chosen if possible and (economic) examples will be discussed.</p> <p>The second module is the second part of an introductory course that covers improper integrals, an introduction to linear algebra as well as multivariable calculus and optimization. The course is intended as a second step in providing students with solid mathematical foundations to be of use in modelling economic systems, in market research and in the analysis of consumer behaviour. The students will be provided with the basic facts needed to follow modern courses in economics, business and administration. The focus is on understanding the mathematical problems and ideas for their solutions. Solution procedures for several standard problems (for example, find solutions for systems of linear equations, gradients of multi-variable functions, solutions of (constrained) multi-variable optimization problems, probabilities for events) will be introduced. The course is aimed at generating familiarity with and proficiency in applying these solution procedures. A graphical approach is chosen if possible and (economic) examples will be discussed.</p>
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<b>Module 1</b>	M-1 Mathematics for Economists TSE
<b>Lecturer</b>	<p>Prof. Dr. rer. nat. habil. Andreas Hamel  E-mail: <a href="mailto:Andreas.Hamel@unibz.it">Andreas.Hamel@unibz.it</a>, Phone: 0474 013651  Campus Bruneck- Brunico, 1<sup>st</sup> Floor, Room 1.11;  <a href="https://www.unibz.it/en/faculties/economics-management/academic-staff/person/33708-andreas-heinrich-hamel">https://www.unibz.it/en/faculties/economics-management/academic-staff/person/33708-andreas-heinrich-hamel</a></p>
<b>Scientific sector of the lecturer</b>	SECS-S/06
<b>Teaching language</b>	English
<b>Office hours</b>	<a href="https://www.unibz.it/en/timetable/?department=26&amp;degree=13009%2C13134">https://www.unibz.it/en/timetable/?department=26&amp;degree=13009%2C13134</a>
<b>Lecturing assistant</b>	<p>dr. Daniel Kostner  E-mail: <a href="mailto:Daniel.Kostner@unibz.it">Daniel.Kostner@unibz.it</a>, Phone: 0471 013507  Campus Bruneck-Brunico, 1<sup>st</sup> Floor, Room 1.09  <a href="https://www.unibz.it/it/faculties/economics-management/academic-staff/person/35134-daniel-kostner">https://www.unibz.it/it/faculties/economics-management/academic-staff/person/35134-daniel-kostner</a></p> <p>Dott. Benjamin Weißing  E-mail: <a href="mailto:Benjamin.Weissing@unibz.it">Benjamin.Weissing@unibz.it</a>  Campus Bruneck-Brunico, 1<sup>st</sup> Floor, Professors Room 1.08  <a href="https://www.unibz.it/en/faculties/economics-management/academic-staff/person/35796-benjamin-weissing">https://www.unibz.it/en/faculties/economics-management/academic-staff/person/35796-benjamin-weissing</a></p>
<b>Teaching assistant</b>	-

<b>Office hours</b>	-
<b>List of topics covered</b>	<ol style="list-style-type: none"> <li>1. Basic mathematical concepts: sets, relations, functions, numbers, limits, series, absolute values.</li> <li>2. Elementary probability measures over algebras of sets, the binomial market model.</li> <li>3. Functions of one variable: basic properties, derivatives and their calculus, Taylor approximations, Newton's method. A brief introduction of partial derivatives.</li> <li>4. Elasticities and other economic applications.</li> <li>5. Single-variable optimization (Fermat's rule and sufficient optimality conditions, convexity/concavity). Applications to cost minimization, profit maximization.</li> </ol>
<b>Teaching format</b>	Lectures, homework and class exercises.

<b>Module 2</b>	M-2 Mathematics for Economists TSE
<b>Lecturer</b>	<p>Prof. Dr. rer. nat. habil. Andreas Hamel  E-mail: <a href="mailto:Andreas.Hamel@unibz.it">Andreas.Hamel@unibz.it</a>, Phone: 0474 013651  Campus Bruneck- Brunico, 1<sup>st</sup> Floor, Room 1.11  <a href="https://www.unibz.it/en/faculties/economics-management/academic-staff/person/33708-andreas-heinrich-hamel">https://www.unibz.it/en/faculties/economics-management/academic-staff/person/33708-andreas-heinrich-hamel</a></p>
<b>Scientific sector of the lecturer</b>	SECS-S/06
<b>Teaching language</b>	English
<b>Office hours</b>	<a href="https://www.unibz.it/en/timetable/?department=26&amp;degree=13009%2C13134">https://www.unibz.it/en/timetable/?department=26&amp;degree=13009%2C13134</a>
<b>Lecturing assistant</b>	<p>Dott. Benjamin Weißing  E-mail: <a href="mailto:benjamin.weissing@unibz.it">benjamin.weissing@unibz.it</a>, Phone: 0471 013507  Campus Bruneck-Brunico, 1<sup>st</sup> Floor, Room 1.09  <a href="https://www.unibz.it/en/faculties/economics-management/academic-staff/person/35796-benjamin-weissing">https://www.unibz.it/en/faculties/economics-management/academic-staff/person/35796-benjamin-weissing</a></p>
<b>Teaching assistant</b>	-
<b>Office hours</b>	-
<b>List of topics covered</b>	<ol style="list-style-type: none"> <li>1. Elements of integration.</li> <li>2. Matrix calculus, rank and linear independence, vectors and hyperplanes, systems of linear equations, Gaussian elimination, applications.</li> <li>3. Functions of several variables: gradients, Hesse matrices, Taylor approximation, convexity.</li> <li>4. Multivariable optimization, Lagrange method.</li> <li>5. Basics in probability theory</li> </ol>
<b>Teaching format</b>	Lectures, homework and class exercises.

<b>Learning outcomes</b>	<p><b><u>Knowledge and understanding</u></b></p> <p><u>Mathematics for Economists M1:</u></p> <ul style="list-style-type: none"> <li>• Knowledge and understanding of basic mathematical concepts: sets and set operations, relations and their properties, general functions, numbers and elementary equations/inequalities.</li> </ul>
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- Knowledge and understanding of functions of one real variable: basic properties, derivatives and their calculus including 1<sup>st</sup> order partial derivatives.
- Knowledge and understanding of single-variable optimization problems: optimality notions and conditions, convexity, algorithmic approach.
- Knowledge and understanding of integrals for single-variable functions: indefinite integrals, definite integrals and area, integral calculus.
- Knowledge and understanding of the mathematical lexicon in English.

Mathematics for Economists M2:

- Knowledge and understanding of basic concepts in linear algebra: matrices and matrix calculus, vectors and their geometrical applications, systems of linear equations.
- Knowledge and understanding of functions of several variables: partial derivatives and gradients, convexity.
- Knowledge and understanding of optimization problems for several variables: optimality concepts and conditions for the unconstrained as well as the constrained case, Lagrangian method.

**Applying knowledge and understanding**

Mathematics for Economists M1:

- Understanding of the basic facts needed to follow modern courses in economics, business and administration.
- Understanding mathematical problems and model.
- Ability to differentiate and integrate real functions, ability to solve single-variable optimization problems.
- Ability to define economic problems in a formalized approach; to find (optimal) solutions and to interpret results, being informed by existing theories.
- Ability to use mathematical tools for the analysis of static and dynamic models.

Mathematics for Economists M2:

- Understanding of the basic facts needed to follow modern courses in economics, business and administration.
- Understanding mathematical problems and ideas for their solutions.
- Ability to define economic problems with several variables in a formalized approach; ability to find (optimal) solutions and to interpret results, being informed by existing theories.

- Ability to use mathematical tools for the analysis of static and dynamic multi-variable models.
- Ability to use matrices for data representation and how to manage them for transformations and calculus.

### **Making judgments**

#### Mathematics for Economists M1:

- Ability to make informed judgments about the relevance of sets vs. relations vs. functions in economic models
- Ability to interpret results obtained for single-variable mathematical models for economic systems

#### Mathematics for Economists M2:

- Ability to interpret results obtained for linear mathematical models for economic systems involving matrix structures
- Ability to interpret results obtained for multi-variable mathematical models for economic systems

### **Communication skills**

#### Mathematics for Economists M1:

- Basic understanding of fundamental mathematical language
- Understanding of and ability to communicate ideas, problems and solutions for mathematical models involving single-variable real functions

#### Mathematics for Economists M2:

- Understanding of matrix calculus and ability to communicate ideas, problems and solutions for linear models
- Understanding of multi-variable **economic** models and the ability to communicate ideas, problems and solutions for such models

### **Learning skills**

#### Mathematics for Economists M1:

- Develop skills for the study of basic mathematical structures in an **economic** environment
- Develop skills for the solution of basic mathematical problems related to economical models

#### Mathematics for Economists M2:

- Develop skills for the study of more complex linear and nonlinear mathematical structures in an

	<p>economic environment</p> <ul style="list-style-type: none"> <li>• Develop skills for the solution of more advanced mathematical problems related to economical models</li> </ul>
<b>Assessment</b>	<p>Written and independent problem solving work: written exam of maximal 120min at the end of each module; take home assignments in each module.</p> <p>There is no different assessment for attending and non-attending students; the assignments will be posted online (on Reserve Collection, OLE).</p>
<b>Assessment language</b>	English
<b>Evaluation criteria and criteria for awarding marks</b>	<p>Three assignments throughout each module (count 30% toward the final grade) and a final exam (counts 70% toward the final grade). Enrolled students who do not attend the classes still have to hand in the solutions of the assignments and attend the final exam.</p> <p>Results of assignments are only valid for the academic cycle in which these activities have taken place and results of these activities cannot be carried over beyond that time frame.</p>
<b>Required readings</b>	<p>Lecture notes/slides will be provided during the course. Further readings will be announced at the beginning of the course.</p>
<b>Supplementary readings</b>	Will be announced in due course if necessary.