Syllabus

Course Description

Course Title	Mathematics for Economists TSE
Course Code	30162
Course Title Additional	
Scientific-Disciplinary Sector	STAT-04/A
Language	English
Degree Course	Bachelor in Tourism, Sport and Event Management
Other Degree Courses (Loaned)	
Lecturers	Prof. Dr. rer. nat. habil. Andreas Heinrich Hamel, Andreas.Hamel@unibz.it https://www.unibz.it/en/faculties/economics-management/academic-staff/person/33708 Dott. Benjamin Weißing, Benjamin.Weissing@unibz.it https://www.unibz.it/en/faculties/economics-management/academic-staff/person/35796
Teaching Assistant	
Semester	All semesters
Course Year/s	1
CP	12
Teaching Hours	72 (36 M1 + 36 M2) Prof. Andreas Hamel
Lab Hours	72 EXE (M1 - 36h Dr. Benjamin Weißing, M2 - 18h Dr. Benjamin Weißing, 18h Prof. Andreas Hamel)
Individual Study Hours	-
Planned Office Hours	36 (18 M1 + 18M2) Prof. Andreas Hamel
Contents Summary	The course gives an introduction to Mathematics necessary to understand quantitative models in Economics and Management and is designed to acquire skills for the solution of basic mathematical tasks as well as for modeling economic/managerial systems. The students will be provided with the basic mathematical concepts and procedures to follow modern courses in economics,

	business administration and data analytics. 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. Solution procedures for several standard problems (differentiation, integration, approximation) will be introduced. The course is aimed at generating familiarity with and proficiency in applying these solution procedures. The second module gives an introduction to linear algebra as well as multivariable calculus and optimization. Solution procedures for several standard problems (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.
Course Topics	The course Mathematics for Economics M1 provides knowledge about the following topics: • Sets, relations, functions and their (economic) applications • Numbers, sequences, series and real functions • Derivatives, rules for differentiation and (economic) applications • Taylor polynomials, Newton's method and basic optimization techniques • Economic applications of derivatives, e.g., market equilibrium, elasticities, profit maximization The course Mathematics for Economics M2 provides knowledge about the following topics: • Integrals, rules for integration and applications to consumer/producer surplus • Matrices, matrix calculus and systems of linear equations • Functions of several variables and their differentiation • Optimization techniques with applications to regression analysis • Optimization with constraints, budget constraints and demand functions • Basics in probability theory
Keywords	Sets, relations, functions, calculus, linear algebra, integral,

	optimization, multivariable functions, gradients, Lagramge method, regression, probability
Recommended Prerequisites	
Propaedeutic Courses	
Teaching Format	Frontal lectures and exercises.
Mandatory Attendance	-
Specific Educational Objectives and Learning Outcomes	ILO (Intended Learning Outcomes) ILO 1 - Knowledge and understanding ILO 1.1 Basic mathematical concepts (sets and operations on sets, relationships and their properties, general functions, numbers and elementary equations/inequalities) ILO 1.2 Functions of a real variable: basic properties, derivatives and their calculation, including first-order partial derivatives ILO 1.3 Optimisation problems of a variable: concepts and conditions of optimality, convexity, algorithmic approach. - Integrals for functions of a variable: indefinite integrals, integrals and defined areas, integral calculus ILO 1.4 Mathematical terminology in English ILO 1.5 Basic concepts of linear algebra: matrices and matrix calculus, vectors and their geometric applications, linear systems of equations ILO 1.6 Functions of several variables: partial derivatives and gradient, convexity ILO 1.7 Optimisation problems for multiple variables: optimality concepts and conditions, for the unrestricted and restricted case, Lagrange method ILO 1.8 The basics of linear programming in economics and management ILO 1.9 The basis of order theory, in particular partial and total (linear) order relations. ILO 1.10 The effects of non-total order relations on decision models ILO 2 - Ability to apply knowledge and understanding ILO 2 .1 Basic concepts that are useful for attending courses in economics, business administration and management ILO 2 .2 Economic problems with multiple variables in a formalised manner; Ability to identify (optimal) solutions and interpret the

	results on the basis of existing theories ILO 2.3 Calculate differentials and integrals of real functions. Ability to solve optimisation problems with one variable ILO 2.4 Define economic problems in a formalised manner; find (optimal) solutions on the basis of existing theories and interpret results ILO 2.5 Use mathematical tools to analyse static and dynamic models ILO 2.6 Mathematical problems and models, as well as ideas for solving them ILO 2.7 Use mathematical tools to analyse static and dynamic models with multiple variables ILO 2.8 Use matrices to represent data and manage it for transformations and calculations ILO 2.9 Use algorithms/applications to solve linear programmes and their dual problems ILO 2.10 Distinguish between decision situations with complete and incomplete preferences and then use the appropriate model ILO 3 - Making judgements ILO 3.1 Identify the most important variables to be used in decision-making in complex situations ILO 3.2 Select the most appropriate quantitative and qualitative analysis tools to support decision-making ILO 3.3 Find solutions by using logical reasoning and combining information and analytical tools ILO 4 - Communication skills ILO 4.1 The educational activities in the first year include courses in all three official languages of instruction, covering communication and presentation strategies and techniques, as well as the acquisition of various skills for the cultural environment related to language. The second year includes a language course in a fourth language. Case studies, projects and exercises within the courses, as well as written examinations at the end of each course, also contribute to the development of students' communication skills ILO 4.2 The achievement of this objective is assessed by means of written examinations, group work, homework assignments, presentation of case studies and projects, and the final thesis

Specific Educational Objectives and Learning Outcomes (additional info.)	M1 Knowledge and understanding of - basic mathematical concepts: sets and set operations, relations and their properties, general functions, numbers and elementary equations/inequalities. - functions one real variable: basic properties, derivatives and their calculus including 1st & 2nd order derivatives. - single-variable optimization problems: optimality notions and conditions, convexity, algorithmic approach. - integrals for single-variable functions: indefinite integrals, definite integrals and area, integral calculus. M2 Knowledge and understanding of - basic concepts in linear algebra: matrices and matrix calculus, vectors and their geometrical applications, systems of linear equations. - functions of several variables: partial derivatives and gradients, Hesse matrix, convexity. - optimization problems for several variables: optimality concepts and conditions for the unconstrained as well as the constrained case, Lagrangian method. M1/M2 Applying knowledge and understanding to - follow modern courses in economics, business and administration, - establish and analyze mathematical problems and models in Economics and Management, - define economic problems in a formalized mathematical approach; to find (optimal) solutions and to interpret results, being informed by existing theories. - differentiate and integrate single- and multivariable functions, ability to solve single- and multivariable optimization problems. - use matrices for data representation and how to manage them for transformations and calculus. M1/M2 Making judgements - to make informed decisions about the relevance of sets vs. relations vs. functions in economic models. - to interpret results obtained for single-variable mathematical models for economic systems. - to interpret results obtained for linear mathematical models for economic systems involving matrix structures.

	- to interpret results obtained for multli-variable mathematical models for economic systems. M1/M2 Communications skills - to master the mathematical vocabulary and formalism in English. - to communicate ideas, problems and solutions for mathematical models involving single-variable real functions. - to understand matrix formalism and ability to communicate ideas, problems and solutions for linear models. - to understand multi-variable economic models and the ability to communicate ideas, problems and solutions for such models. M1/M2 Learning skills for - the study of basic mathematical structures in an economic environment. - for the solution of basic mathematical problems related to economical models. - the study of more complex linear and nonlinear mathematical structures in an economic environment. - the solution of more advanced mathematical problems related to economical models.
Assessment	Written exam of maximal 120min at the end of each module; take home assignments in each module. There is no different assessment method for attending and non-attending students; the assignments will be posted and their solutions can be submitted online. ILOs checked: 1-4. Plus all addtitional educational objectives and learning outcomes outlined above.
Evaluation Criteria	Three assignments within the first 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. 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. The final written exam for the second module counts 100% toward the final grade.
Required Readings	Lecture slides made available on OLE.

Supplementary Readings	Will be announced in classes.
Further Information	
Sustainable Development Goals (SDGs)	Quality education

Course Module

Course Constituent Title	M-1 Mathematics for Economists TSE
Course Code	30162A
Scientific-Disciplinary Sector	STAT-04/A
Language	English
Lecturers	Prof. Dr. rer. nat. habil. Andreas Heinrich Hamel, Andreas.Hamel@unibz.it https://www.unibz.it/en/faculties/economics-management/academic-staff/person/33708 Dott. Benjamin Weißing, Benjamin.Weissing@unibz.it https://www.unibz.it/en/faculties/economics-management/academic-staff/person/35796
Teaching Assistant	
Semester	First semester
CP	6
Responsible Lecturer	
Teaching Hours	36 Prof. Andreas Hamel
Lab Hours	36 EXE Dr. Benjamin Weißing
Individual Study Hours	-
Planned Office Hours	18
Contents Summary	The course Mathematics for Economics M1 provides knowledge about the following topics: • Sets, relations, functions and their (economic) applications • Numbers, sequences, series and real functions • Derivatives, rules for differentiation and (economic) applications • Taylor polynomials, Newton's method and basic optimization techniques

	• Economic applications of derivatives, e.g., market equilibrium, elasticities, profit maximization
Course Topics	The course Mathematics for Economics M1 provides knowledge about the following topics: • Sets, relations, functions and their (economic) applications • Numbers, sequences, series and real functions • Derivatives, rules for differentiation and (economic) applications • Taylor polynomials, Newton's method and basic optimization techniques • Economic applications of derivatives, e.g., market equilibrium, elasticities, profit maximization
Teaching Format	Frontal lectures and exercises.
Required Readings	Lectures slides available on OLE.
Supplementary Readings	Will be announced in class.

Course Module

Course Constituent Title	M-2 Mathematics for Economists TSE
Course Code	30162B
Scientific-Disciplinary Sector	STAT-04/A
Language	English
Lecturers	Prof. Dr. rer. nat. habil. Andreas Heinrich Hamel, Andreas.Hamel@unibz.it https://www.unibz.it/en/faculties/economics-management/academic-staff/person/33708 Dott. Benjamin Weißing, Benjamin.Weissing@unibz.it https://www.unibz.it/en/faculties/economics-management/academic-staff/person/35796
Teaching Assistant	
Semester	Second semester
CP	6
Responsible Lecturer	

Teaching Hours	36 Prof. Andreas Hamel
Lab Hours	36 EXE (18h Dr. Benjamin Weißing, 18h Prof. Andreas Hamel)
Individual Study Hours	-
Planned Office Hours	18
Contents Summary	The course Mathematics for Economics M2 provides knowledge about the following topics: • Integrals, rules for integration and applications to consumer/producer surplus • Matrices, matrix calculus and systems of linear equations • Functions of several variables and their differentiation • Optimization techniques with applications to regression analysis • Optimization with constraints, budget constraints and demand functions • Basics in probability theory
Course Topics	The course Mathematics for Economics M2 provides knowledge about the following topics: • Integrals, rules for integration and applications to consumer/producer surplus • Matrices, matrix calculus and systems of linear equations • Functions of several variables and their differentiation • Optimization techniques with applications to regression analysis • Optimization with constraints, budget constraints and demand functions • Basics in probability theory
Teaching Format	Frontal lectures and exercises.
Required Readings	Lecture slides available on OLE.
Supplementary Readings	Will be announced during classes.