Syllabus

Course Description

Course Title	Mathematics for Economists TSE
Course Code	30162
Course Title Additional	
Scientific-Disciplinary Sector	SECS-S/06
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)
Lab Hours	72 EXE
Individual Study Hours	-
Planned Office Hours	36 (18 M1 + 18M2)
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	Knowledge and understanding basic mathematical concepts (sets and operations on sets, relations and their properties, general functions, numbers and elementary equations/inequalities) of functions of a real variable: basic properties, derivatives and their calculation including first-order partial derivatives of optimisation problems for one variable: concepts and optimality conditions, convexity, algorithmic approach. of integrals for functions of one variable: indefinite integrals, definite integrals and areas, integral calculus. of mathematical terminology in English. of basic concepts of linear algebra: matrices and matrix calculus, vectors and their geometric applications, systems of linear equations. of functions with several variables: partial derivatives and gradient, convexity. of optimisation problems for several variables: concepts and optimality conditions, for unconstrained and constrained cases, Lagrange's method. of descriptive statistics and how to summarise data: variables, frequency distributions, measures of central tendency and variability. of the concept of uncertainty and the basic elements of probability theory. of the basic concepts of sample theory. of the basic concepts of inferential statistics: point estimate; confidence interval; hypothesis testing; linear regression. of the relationships between variables and basic concepts in hypothesis testing. of statistical terminology of the software available for data analysis in the social sciences. of the basics of linear programming in economics and management. of the basics of the concepts of uncertainty, ambiguity and

	robustness in the context of data analysis. of the basics of order theory specifically partial and total (linear) order relations. of the implications of non-total order relationships on decision-making models of Excel's 'best practices' and main functions for collecting, processing and visualising data of the mechanisms for creating and using big data, and the implications in the business environment. of the monetary value of personal and corporate data. of the fundamental methods and algorithms for data analysis, as well as machine learning methods. of the concept of data security from a legislative and technical point of view. Ability to apply knowledge and understanding basic concepts useful for taking courses in economics, business and administration economic problems with several variables in a formalised manner; ability to identify (optimal) solutions and to interpret the results on the basis of existing theories. Calculate differentials and integrals of real functions. Ability to solve optimisation problems with one variable. define economic problems in a formalised way; to find (optimal) solutions and interpret results on the basis of existing theories. use mathematical tools for the analysis of static and dynamic models. mathematical problems and models and ideas for solving them. use mathematical tools for the analysis of static and dynamic models with several variables. using matrices to represent data and handling them for transformations and calculations. statistical methods as research tools useful in the social sciences. descriptive and inferential statistics to synthesise information, to analyse and interpret relationships between variables and for hypothesis testing. at least one statistical application to develop a simple data analysis. the use of algorithms/applications to find solutions to linear programmes and their dual problems.

	solving zero-sum games via linear programming solving linear programmes for business management problems: cost and revenue optimisation, logistics design and optimisation, warehouse flow planning, etc. using mathematical methods to model risks (uncertainties) and to solve expected utility maximisation problems. distinguishing between decision situations with complete and non-complete preferences and then using the appropriate model. use of Excel for data collection, processing and visualisation. use of web services for online data analysis. understanding the basic principles of modern data analysis concepts, e.g. machine learning. dealing with data security issues in business realities. Autonomy of judgement identify the most relevant variables to be used when making decisions in complex situations; find the necessary additional information in databases, regulatory sources and scientific bibliography; adopt logical arguments and relate information and analytical tools to find solutions. Communication skills Achievement of this objective will be assessed by means of written examinations, individual and group assignments and the final dissertation. Learning skills ability to find the information required to keep abreast of changes in the service sector in general and in the tourism, sports and events sector in particular ability to find and make use of information from databases, research studies, laws, regulations and standards that are applied in professional life; ability to analyse, critically evaluate and integrate data, information and experience; ability to develop possible solutions for economic and management problems in the operational contexts of reference to the graduates' occupational outlets.
Specific Educational	M1 Knowledge and understanding of

Objectives and Learning Outcomes (additional info.)	- 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.
Evaluation Criteria	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. 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.
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	SECS-S/06
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
Lab Hours	36 exercises
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	SECS-S/06
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
Teaching Assistant	
Semester	Second semester
CP	6
Responsible Lecturer	
Teaching Hours	36
Lab Hours	36 (lecturer to be defined)
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.