Name	MATHEMATICS FOR ECONOMICS
Component Modules	Module 1: Mathematics Module 2: Financial Mathematics
Subject area	ECON-06/A
Academic year and semester	Module 1: First year; First semester Module 2: First year; Second semester
Language of instruction	English
ECTS	12 CFU Module 1: 6 CFU Module 2: 6 CFU
Number of hours of total assisted teaching activities divided between DE and DI	Module 1: 42 hours, including 36 hours of Expository Teaching (DE) and 6 hours of iInteractive Teaching (DI) Module 2: 42 hours, including 36 hours of Expository Teaching (DE) and 6 hours of iInteractive Teaching (DI)
Teachers	Module 1: Fabio Vito Difonzo Module 2: Fabio Vito Difonzo
Expected learning outcomes	**Module 1 – Mathematics** – Knowledge of the basic concepts required to formalize problems and solution processes with mathematical tools. – Ability to contextualize the acquired knowledge with other personal skills to facilitate an analytical reading of natural, social and economic phenomena – Ability to autonomously search for methodological tools that support the modelling of an application problem and the definition of approaches for its solution. – Ability to critically analyze the assumptions that determine the validity of mathematical tools in individual application contexts. – Ability to communicate with clarity, expositional rigor and logical correctness the process that leads to a given solution. **Module 2 – Financial Mathematics** – Knowledge and understanding of mathematical and numerical problems related to classical and deterministic financial mathematics. – Ability to understand and apply the main methodologies. – Autonomy of judgement in the analysis of the methodologies to be used in solving the questions. – Communication skills through the ability to analyse, synthesize and clearly explain in relation to the quantitative results obtained.

Syllabus	**Module 1 – Mathematics** Premises: references to the concepts of set; set operations; relationships, functions and their characterizing properties (injectivity, surjectivity); Introduction to demonstrative principles, logical connectives. Real functions: equations and inequalities; monotony; definition of continuity and discontinuity; convexity. Limits of sequences and functions: definitions, properties; examples of notable limits and their application; asymptotic behaviors; Orders of infinity and infinitesimal Derivatives and their geometrical interpretation: definition and properties; derivative of products and compositions of functions; higher-order derivatives; application of derivatives for the study of monotonicity and convexity of a function; Introduction to applications for optimization and graphical representation of real functions. Definite and indefinite integrals. Introduction to multidimensional spaces: vectors, matrices, scalar product, determinant, methods of solving linear systems and applications. Introduction to discrete probability. **Module 2 – Financial Mathematics** Financial Laws: Capitalization and Discounting. Relative rates and their relationships, amount and interest, discount. Financial regimes. Strength of interest. Severability. Periodic rates. Models of annuities and their present and total value. Capital build-up and pension-related problems. Newton's method. Amortization of loans: Italian, French and American models. Valuation of receivables, annuities and debts. Selection criteria under conditions of certainty: R.E.A. criterion and T.I.R. criterion for the comparison of investment plans. Government bonds. Portfolio Management and CAPM (Capital Asset Pricing Model), efficient portfolio, Markowitz frontier, risk minimization. For both modules, DI will cover practical applications and will provide research projects in financial mathematics.
Teaching and learning methods	**Module 1 – Mathematics** Teaching is mainly delivered through lectures. In addition to lectures, the course also involves a number of hours of interactive teaching (at least one hour for each ECTS). The course will combine lectures that concentrate on the theoretical bases of the fundamental mathematical principles and exercise sessions dedicate to solving application problems. Weekly tutoring is available upon reservation. **Module 2 – Financial Mathematics** Teaching is mainly delivered through lectures. In addition to lectures, the course also involves a number of hours of interactive teaching (at least one hour for each ECTS). The lectures develop theoretical topics, but also concentrates on the solution of practical-applicative exercises are solved. Weekly tutoring is available upon reservation.
Evaluation methods	**Module 1 – Mathematics** The exam is carried out in written form. Attending and non-attending students have the opportunity to support: – a written Intermediate Test on the contents covered in the first part of the Module, to be taken on the date that will be communicated during the course; – a Final Written Exam on the contents covered in the second part of the Module, to be taken on one of the exam dates of the January, February, or March-April session – Students who obtain an insufficient grade (less than 18/30) in the Intermediate Exam will have to take a General Final Exam in written form on the entire program of the Module. If the final exam is insufficient, it can be repeated only once. Alternatively, students can take a General Final Exam in written form on the entire program of the Module. The exam (Intermediate, Final and General Final) contains questions of a methodological nature, the resolution of problems of an applicative nature and the concise exposition of the knowledge acquired in relation to theoretical questions. The intermediate and final exams take 60 minutes. The final general test, on the other hand, takes 120 minutes. The second midterm exam must be taken in the first exam date. For the application questions, the correctness of the starting hypotheses, the correct methodology applied, the

	accuracy of the final result of the question with particular regard to its numerical accuracy will be evaluated. **Module 2 – Financial Mathematics** The exam is carried out in written form. Attending and non-attending students have the opportunity to support sit: – a written Intermediate Test on the contents covered in the first part of the Module, to be taken on the date that will be communicated during the course; – a Final Written Exam on the contents covered in the second part of the Module, to be taken at your choice on one of the dates of the session of June, July and the first session of September. – Students who obtain an insufficient grade (less than 18/30) in the Intermediate Exam or in the Final Exam will have to take a General Final Exam on the entire program of the Module. Alternatively, students can take a General Final Exam in written form on the entire program of the Module. The exam (Intermediate, Final and General Final) contains questions of a methodological nature, the resolution of problems of an applicative nature and the concise exposition of the knowledge acquired in relation to theoretical questions. The intermediate and final exams take 60 minutes. The final general exam, on the other hand, takes of 120 minutes. The second midterm exam must be taken in the first exam date. For the questions on application problems, the correctness of the starting hypotheses, the correct methodology applied, the accuracy of the final result of the question with particular regard to its numerical accuracy will contribute to the final assessment.
Assessment methods	**Modules 1 and 2 – Mathematics e Financial Mathematics** The final grade is expressed in thirtieths. The sum of the marks of the questions is set at 31 in order to award honours to students who have obtained a grade higher than 30. For students taking the Mid-term Exam and the Final Exam, the grade will be equal to the arithmetic average of the marks of the two tests rounded up.
Prerequisites	There are no prerequisites. For the Financial Mathematics module, it is advisable to have prior knowledge of the Mathematics module.
Teaching materials	**Module 1 – Mathematics** Bittinger, Marvin L, Ellenbogen, David J, Surgent, Scott Adam, Calculus and its applications, 11th edition, Pearson, 2015. The suggested text will be supplemented by teaching material shared by the teacher and based on the lessons held. **Module 2 – Financial Mathematics** Steve Roman, Introduction to the Mathematics of Finance From Risk Management to Options Pricing (https://sites.math.rutgers.edu/~feehan/teaching/math612/papers/RomanFin493.pdf) The suggested text will be supplemented by teaching material shared by the teacher and based on the lessons held.