# Mathematics

## Professor Anna Agliari

**Module I** – **General Mathematics**

Professor Anna Agliari

***COURSE AIMS AND INTENDED LEARNING OUTCOMES***

The course aims to teach students the formalism, terminology and logical tools of mathematics, essential prerequisites for correctly learning many degree programme subjects with economic, statistical and financial content. In addition to the use of mathematical computation, the aim of teaching is to initiate students into a rigorous and logically coherent approach to economic-financial problems, enabling their quantitative study, including through the construction and/or analysis of models.

***Learning OUTCOMES***

Upon completion of this module, students should be able to:

* Analyse both qualitatively and quantitatively the behaviour of economic variables represented by functions.
* Discuss and solve problems of choice expressed in terms of optimisation.
* Discuss and solve simple equilibrium problems using matrix algebra.

***COURSE CONTENT***

*Linear algebra*: Vectors, matrices and linear systems.

*Real functions of a real variable*: Differential calculus and graph of a function.

*Real functions of two real variables*: Constrained and unconstrained optimization.

*Elements of integral calculus*

***READING LIST***

Textbook:

A. Guerraggio, *Matematica,* Pearson Education Italia, Milan, 2020.

Further suggested reading:

A. Torriero- M. Scovenna - L. Scaglianti , *Manuale di matematica,* CEDAM, Padua, 2009.

M. Scovenna-R. Grassi, *Matematica. Esercizi e temi d’esame completamente risolti,* CEDAM, Padua, 2000.

F. Brega-G. Messineo, *Esercizi di Matematica Generale*, Giappichelli Editore, Turin, 2006.

***TEACHING METHOD***

Theoretical lectures and exercises.

During lectures, active participation of students is expected. Students may be asked to discuss and solve, individually or in small groups, some of the exercises that are the subject of the lecture and then share them, providing a uniform reading key.

In addition, in order to stimulate interaction and discussion, working groups will be organized to analyze and solve a problem of an economic-financial nature that requires the application of the mathematical tools covered in the course. The result of the work done will be presented collegially by the students and will contribute to the final assessment.

Teaching makes use of the Blackboard platform where a more detailed syllabus of the course will be made available, as well as additional teaching materials and all necessary information for organizing working groups.

***ASSESSMENT METHOD AND CRITERIA***

The exam is designed to assess both reasoning skills and analytical rigour on the topics covered by the course. For a sufficient evaluation, the student must show knowledge of concepts and theorems and know how to apply them, as well as a basic understanding of mathematical reasoning.

To this end, the final exposition of the group work will allow the assessment of the skills in understanding the mathematical procedure applied to a particular problem, in solving it, and the expository ability achieved. Such work will contribute 33% on the overall assessment (i.e., up to 10 points). The remaining 67% of the evaluation is based on a final exam, consisting of 3 exercises related to the different parts of the course. These exercises will be equally weighted, scored from 0 (in case of no answer) to 7 (in case of a perfect answer).

In case of non-delivery of the homework, the evaluation will be based 100% on the final exam, composed of 4 exercises related to the different parts of the course. The fourth exercise will be scored from 0 (in case of no answer) to 10 (in case of a perfect answer).

The score achieved at the end of the exam is 8/13 of final evaluation.

***NOTES AND PREREQUISITES***

The course is accompanied by 18 hours of Pre-Course, in which participation is strongly recommended. During the General Mathematics Pre-Course the following *Preliminary Topics* will be recalled, as fundamental requirements for a successful attendance of the course and for passing the exam: rational and irrational equations and inequalities; overview of set theory and logic; numerical sets: from natural to real numbers; plane analytic geometry: straight lines, circle, hyperbola and parabola; exponential and logarithmic functions.

Information on office hours available on the teacher's personal page at <http://docenti.unicatt.it/>.

**Module II - Mathematics of Finance**

Professor Anna Agliari

***COURSE AIMS AND INTENDED LEARNING OUTCOMES***

The objective of this course is to provide the basic elements of classical financial mathematics and the evaluation of the simplest type of bonds (these elements are of primary importance nowadays in several applied fields).

At the end of this course, the student will be able to:

* know relevant professional topics, such as the laws of capitalization and assessment, savings plans and loan amortization;
* know some techniques of great importance in modern finance, such as the management of a securities portfolio, and knowledge of how to use analysis tools to choose between various financial projects.

***COURSE CONTENT***

Financial Laws

Annuities and amortization plans

Financial flows

Bonds

Spot and forward rate, term structure

***READING LIST***

Textbook:

R. Cesari, *Introduzione alla Finanza Matematica*, McGraw-Hill, Milano, 2012.

Suggested reading list

E. Allevi- G. Bosi-R. Riccardi-M. Zuanon, *Matematica Finanziaria e Attuariale,* Pearson, Milano, 2017.

S. Stefani-A. Torriero-G.M. Zambruno, *Elementi di Matematica Finanziaria e cenni di Programmazione Lineare,* Giappichelli, Torino, 2003.

G. Bolamperti-G. Ceccarossi, *Elementi di Matematica Finanziaria e cenni di Programmazione Lineare, esercizi,* Giappichelli, Torino, 2003.

***TEACHING METHOD***

Theoretical lectures and exercises.

During lectures an active participation of the students is expected. Students may be asked to discuss and solve, individually or in small groups, some of the exercises that are the subject of the lecture and then share them, providing a uniform reading key. Teaching also uses the Blackboard platform, where a more detailed course syllabus and additional teaching material will be made available.

***ASSESSMENT METHOD AND CRITERIA***

The exam is designed to assess both reasoning skills and analytical rigour on the topics covered by the course. For a sufficient evaluation, the student must show knowledge of concepts and methods of calculation and be able to apply them even in several applied fields.

To this end, during the course two homework assignments will be made individually or in pairs, one in the middle of the course and the other at the end of the lectures. These works will contribute to 25% of the final evaluation and will be intended to test the ability to solve financial problems, using convenient calculation tools, and discuss the results obtained. The remaining 75% of the evaluation is based on a final examination, consisting of 3 exercises related to the different parts of the course.

In case of non-delivery of the homework, the evaluation will be based 100% on the final exam, composed of 4 exercises related to the different parts of the course.

The exercises of the final test will be equally weighted, scored from 0 (in case of no answer) to 8 (in case of a perfect answer).

The grade achieved is the 5/13 of the final evaluation.

***NOTES AND PREREQUISITES***

Knowledge of the topics of the General Mathematics module is required.

Information on office hours available on the teacher's personal page at h[ttp://docenti.unicatt.it/](http://docenti.unicatt.it/).