UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Mathematics

2223-1-E1601N060

Learning objectives

Introduction to the basic concepts of algebra, mathematical analysis, analytical geometry and combinatorics.

To understand and learn how to handle the concepts and tools of mathematics presupposed in the teaching of statistics, economics and quantitative methods, to be able to manage the most technical aspects of the program.

Contents

Set theory; Elementary functions; Graphs of real functions; Linear and quadratic functions; Equations and inequalities of first and second degree, fractal, irrational, exponential, logarithmic and with absolute value; Combinatorial calculation; Limits; Derivatives; Study of functions; Successions and series; Systems of linear equations.

Detailed program

Set theory.
Functions; Inverse and compound functions; Numerical sets; Graphs of real functions; Increasing and decreasing functions; Concave and convex functions.
Linear functions; First degree equations; First degree inequalities.
Quadratic functions and equation of the parabola; Second-degree equations; Second degree inequalities.
Equation of equilateral hyperbola and inversely proportional quantities; Fractional equations; Fractional inequalities; Power functions with full and fractional exponent.
Irrational equations; Irrational inequalities; Exponential functions; Exponential equations; Exponential inequalities; Simple, compound and continuous capitalization.

Logarithmic functions; Logarithmic equations; Logarithmic inequalities.
Absolute value of a real number; Equations and inequalities with absolute value; Triangular inequality.
Combinatorial calculation: simple dispositions, permutations, simple combinations and binomial coefficient; dispositions with repetition, combinations with repetition.
Limit: definition, existence, uniqueness and calculation; Derivatives: definition and calculation; De l'Hôpital theorem; Taylor's theorem.
Functional study: concavity, convexity and inflection points; first and second order conditions for minimums and maximums.
Summation; Successions and series; Convergent and divergent series; Geometric series; Convergence criteria.
Systems of linear equations.

Prerequisites

Algebra and basic notions of calculus.

Teaching methods

(Video)lectures.
Self-assessment tests and Q&A forum.

Assessment methods

No intermediate tests.

The written exam is made up of closed questions and problems.
Each question/problem assigns from 0 (no answer or answer completely wrong) to max 2-4 points for a total of max 30 points.

Students must take the exam in max 90 minutes. They can take with them a basic scientific calculator and use notes containing formulas, concept maps, graphs, etc.

The types of questions/problems in the exam are going to be discussed and analyzed with the students in tutorship lectures during the course.
Students can also download from the website mock exams and all the past exams with the solutions.

Results are uploaded no later than 7 days after the exam. Students can accept or reject the mark. In case of rejection of a sufficient mark, students can ask for an oral integration.

Failing the exam does not make the student ineligible to retake the test on the following date.

In the **remote written exam** (for authorized students only), students need:

- a PC/Mac/tablet with a webcam and audio input/output compatible with the video-conference software Webex;
- a scanner.
  Students without a scanner can install free software on their smartphone or tablet to scan their work and

produce a single PDF file (e.g. CamScanner, Adobe Scan, Genius Scanner, PDF Scanner, etc.) .
On the platform EsamiOnLine, the students who are regularly enrolled on SegreterieOnLine will find the course with the details of the meeting and an activity containing the pdf document of the test.
Before the exam, students must:

- try to produce a single pdf file made up of two or more images with the scanning software they are going to use in the exam;
- try to use the video conferencing software and make sure that everything works;
- prepare the location where the exam is taken in a room without other people and monitors.

Students must have with them blank sheets, pen with a clearly visible line and an identification document.
Students must keep the smartphone or tablet with which the scans will be made, always visible on the table, turned off and face down. The presence of other hardware (e.g. smartwatch, earphones) besides that described above is not allowed.
Students must keep their webcam and mic on throughout the test.
Participation in the videoconference implies acceptance to be filmed.
If needed, more than one exam session will be organized during the same day.

After identification (done by showing the identification document via webcam), students are given access to the text of the test on on EsamiOnLine.

Upon delivery at the end of the exam session, students must:

- move the pens away and show all the written works on the webcam (this can be done simultaneously, since everything is recorded);
- scan their sheets and produce a single file of their test named "SurnameNameID.pdf";
- submit the file by uploading the file using the activity on EsamiOnLine.

For the oral exam, another video conference session is going to be scheduled via Webex.

Textbooks and Reading Materials

Textbook: Guerraggio, A. (2014), *Matematica*, 2nd ed., Pearson Prentice Hall, Milan, Chapters 1-9, 12.
Slides, additional references, exercises, and further material available at the course page on the e-learning platform.

Sustainable Development Goals

QUALITY EDUCATION