



Code:	MAT/03	Credits: 6
Matter:	Introduction to Calculus	
Main language of instruction:	Italian	
Other language of instruction:	English	

Teaching Staff

Head instructor

Prof.DANIELE D'ANGELI - daniele.dangeli@unicusano.it

Introduction *The aim of the course is to provide students with the mathematical tools necessary to tackle the training courses provided for in the degree course. In particular, the basics of algebraic calculus and mathematical language will be presented as well as the first rudiments of mathematical analysis. The activities associated with the course develop the skills necessary to achieve all the training objectives indicated below.*

Objectives *Objective of the course : The course has the following educational objectives*

- 1. Review some fundamental themes such as elementary algebra and number sets.*
- 2. Explain the main properties of complex numbers.*
- 3. Illustrate and solve the main types of equations and inequalities of a variable.*
- 4. Introduce the elementary theory of numerical sequences.*
- 5. Introduce the elementary theory of numerical series.*

Competencies: *Not required*

Syllabus

- 1. Programme of the course:*

Module 1: Numerical sets and elementary algebra. Basics of set theory. Operations on sets. Numeric sets: natural, integer, rational, irrational. Real numbers: field axioms, order axioms, completeness axiom, geometric interpretation of real numbers. Some recalls of elementary algebra: elementary formulas of calculus (difference of squares, square and cube of a binomial, difference and sum of cubes,



Newton's binomial), polynomials of a real variable, root of a polynomial, factorization methods (common factor collection, Ruffini method), division between polynomials. E-tivity 1: Elementary Algebra.

Module 2: Complex numbers. Complex numbers: geometric, algebraic, polar and exponential representation of a complex number, properties of field, modulus, complex conjugate, power, n th roots of a complex number. E-tivity 2: Complex Numbers.

Module 3: Functions. Function theory: domain, codomain, injective, surjective functions. Bijective, inverse, compound, monotonous functions. Graph of a function. Elementary functions: linear, absolute value, powers. Roots, polynomial functions, quadratic functions, rational functions, exponential, logarithmic, trigonometric functions. Triangle theorems. E-tivity 3: Functions.

Module 4: Equations and inequalities. Equations and inequalities: linear and with absolute value, polynomials of second degree and degree above the second, rational, irrational, exponential, logarithmic, trigonometric. E-tivity 4: equations and inequalities.

Module 5: Numerical Sequences. Notion of limit. Uniqueness of the limit, convergent, divergent, oscillating, bounded sequences. Algebraic operations on limits. Indeterminate forms. Notable limits. Theorem de Carabinieri, comparison theorem. Infinitesimal sequences. Monotone sequences. Criterion of the relationship by succession. Infinites of increasing order. Asymptotic sequences. E-tivity 5: limits of numerical sequences.

Module 6: Numerical Series. Definitions and first properties. Necessary condition for convergence. Cauchy criterion. Sum and product (for a real number) of series. The geometric series. The harmonic series. The telescopic series. Convergence criteria for non-term series negative: comparison criterion, asymptotic comparison criterion, relationship criterion, root criterion. Criteria for series with terms of variable sign: Leibnitz criterion, absolute convergence. E-tivity 6: Numerical Series.

Evaluation system and criteria

The written exam consists of 6 exercises. The exam contains 28 points. The student can choose whether to take the exam in full or to divide it into two separate tests, according to the modalities that will be foreseen.

The electronic exam consists of a single-choice test consisting of 6 single-answer questions. The student can choose whether to take the exam in full or to divide it into two separate tests, according to the modalities that will be foreseen. The evaluation of the E-tivity from 0 to 3 points (each etivity 0.5 points), is carried out, in itinere, during the duration of the course.

Bibliography and resources



UNICUSANO
ROME

Professor's notes +

R.A. Adams and C. Essex Calculus: a complete course