General information	
Academic subject	***Complementary Mathematics***
Degree course	*LM-40 Mathematics*
Academic Year	*second*
European Credit Transfer and Accumulation System (ECTS)	7
Language	*Italian*
Academic calendar (starting and ending date)	*First semester*
Attendance	*Not compulsory*

Professor/ Lecturer	
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Virtual headquarters	*Codice Teams:* bghr19g
Tutoring (time and day)	To be agreed with the teacher by e-mail

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Syllabus	
Learning Objectives	*The course aims to provide some basic knowledge of mathematics, framing them in the historical context of origin and development, as well as tools for critical reflection in a didactic perspective. In particular, it intends to deal with some themes, drawn from different fields of mathematics, fundamental for the development of mathematical thought, chosen for their cultural interest and their possible connections with the themes taught in the school.*
Course prerequisites	*Knowledge that is generally acquired in the courses of an L-35 class degree.*
Contents	*1) The numerical sets: the extensions from N to R; the introduction of real numbers. The parallelism between the extension of numerical sets and the transition from arithmetic to algebra.* *2) Diophantine equations: definition; compatibility theorem; Euler's method. Pythagorean triples.* *3) The equations of the third and fourth degree: some possible methods of resolution.* *4) Lattices and Boolean Algebras: order relations; definition, characterization and properties of lattices; definition of Boolean Algebra and Boolean Ring; link between Boolean Algebra and Boolean Ring.* *5) Elements of graph theory: planar graphs; connected graphs; trees; oriented graphs; applications.* *6) The classical problems of geometry: squaring the circle, duplication of the cube and trisection of the angle.* *7) The role of geometry in teaching mathematics. Euclidean geometry and Hilbert's axioms for geometry. Klein's Erlangen Program. The history of the fifth postulate and non-Euclidean geometries.* *8) Definitions, conjectures, argumentations, proof and proving, examples and counter examples in mathematics and mathematics education.* *9) Introduction to dynamic geometry.* *10) The fundamental notions of mathematical analysis for teaching in secondary schools: successions and functions; notion of limit; continuity and differentiability of a function.*
Books and bibliography	*- Courant R., Robbins H., Che cosa è la matematica?, Bollati Boringhieri*

	- Ore O., I grafi e le loro applicazioni, Zanichelli, Bologna. *- Agazzi E., Palladino, D., Le geometrie non euclidee e i fondamenti della geometria, ed. La Scuola.* *- Villani V., Cominciamo da zero, Pitagora Editrice, Bologna.* *- Villani V., Cominciamo dal punto, Pitagora Editrice, Bologna.* *- Villani, Bernardi, Zoccante, Porcaro, Non solo calcoli, Springer Verlag Italia, Milano.*
Additional materials	*Indications relating to the reference texts and any additional supporting materials will be provided during the course.*

Work schedule			
Total	Lectures	Hands on (Laboratory, working groups, seminars, field trips)	Out-of-class study hours/ Self-study hours
Hours			
60	*52*	*8*	*115*
ECTS			
7	*6.5*	*0.5*	

Teaching strategy	
	The course will be mainly delivered in frontal teaching (in blended mode in case there are requests from students). Group work will be organized during the hours of laboratory practice and in some moments dedicated to the critical analysis of some contents and the preparation of the paper that will be discussed during the oral interview
Expected learning outcomes	
Knowledge and understanding on:	○ Expand the basic knowledge of the Bachelor's Degree, developing abstraction skills and mastery of the scientific method ○ Acquire a theoretical and historical-cultural preparation necessary for teaching mathematics ○ Critically analyse the course contents
Applying knowledge and understanding on:	○ Be able to describe specific topics of study and popular expositions ○ Develop autonomously examples of didactic activities for secondary school ○ Discuss different points of view on educational applications of course content
Soft skills	• *Making informed judgments and choices* ○ Reflect on the change in mathematical methodologies and tools throughout history. ○ Initiate research activities on specific issues and investigate new problems in groups and independently. • *Communicating knowledge and understanding* ○ Ability to present mathematical arguments with clarity and accuracy and in forms appropriate to the recipients • *Capacities to continue learning* ○ Develop a flexible and analytical mentality that allows to independently identify which knowledge to deepen and to be acquired for the management of a problem in the mathematical field, in the teaching of mathematics and also in other working areas

Assessment and feedback	
Methods of assessment	*Learning assessment will take place by means of an oral interview during which a*

	written paper, to be delivered within 5 days before the exam, will also be discussed. The subject of the paper will be agreed during the course or in any case before the exam.
Evaluation criteria	• *Knowledge and understanding* ○ Knowledge of the contents and of the specialized vocabulary ○ Critical reasoning skills on the course contents • *Applying knowledge and understanding* ○ Ability to correctly and adequately expose the topics to the addresses ○ Ability to design teaching applications related to the course contents • *Autonomy of judgment* ○ Ability to analyse the change in mathematical methodologies and tools over the course of history ○ Ability to analyse didactic applications related to the course contents • *Communication skills* ○ Quality of exposure with respect to different types of addressees and in terms of competence in the use of the specialist vocabulary • *Capacities to continue learning* ○ Ability to independently identify which knowledge to deepen and to acquire for the management of a problem in the mathematical field, in the teaching of mathematics and also in other work areas
Criteria for assessment and attribution of the final mark	*The final grade will be awarded taking into account the evaluation criteria at the end of the oral interview on the course contents, as well as the paper presented and the related discussion.*
Additional information	