University of Gdańsk

Subject card

Subject name and code	Geometry, PG_00206878		
Field of study	Mathematics		
Date of commencement of studies	October 2026	Academic year of realisation of subject	2026/2027
Education level	Master's studies	Subject group	Obligatory subject group in the field of study Optional subject group Subject group related to scientific research in the field of study
Mode of study	full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	2	ECTS credits	5.0
Learning profile	academic	Assessment form	exam
Conducting unit	Institute of Mathematics -> Faculty of Mathematics, Physics and Informatics -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. Tomasz Człapiński, prof. UG	
	Teachers		

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	30.0	0.0	0.0	0.0	60

E-learning hours included: 0.0

Learning activity and number of study hours

Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
Number of study hours	60	3.0	62.0	125

Subject objectives

Preparing students of the teaching section to solve more difficult geometric problems and familiarizing them with the most important methods and theorems of elementary geometry. Acquiring computer visualization skills for various issues, solving more advanced and unusual tasks in elementary geometry.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[MATMU2_W01] knows and understands in depth the theory of selected areas of mathematics or related fields, the complex relationships between them and their development trends	The student knows and understands the definitions and properties of synthetic geometry of the plane and space presented during the lecture; the contents and proofs of the most important theorems of geometry presented during the lecture.	[SW4] test/exam - oral or written
[MATMU2_U01] is able to construct mathematical reasoning: prove theorems, formulate, test and refute hypotheses by constructing and selecting counterexamples, choosing, if necessary, methods and tools from various areas of mathematics	The student is able to apply the methods and tools learned to solve more difficult problems in geometry.	[SU3] text preparation/written work
[MATMU2_W02] knows and understands in depth the role and importance of the construction of mathematical reasoning	The student knows and understands the definitions and properties of synthetic geometry of the plane and space presented during the lecture; the contents and proofs of the most important theorems of geometry presented during the lecture.	[SW4] test/exam - oral or written

Subject contents	1. Triangle geometry. Theorems of sines and cosines. Ceva's theorem (also in trigonometric form) and the converse of Ceva's theorem. Corollaries from this theorem. 2. Theorems about a quadrangle. A circle inscribed in a quadrangle and a circle circumscribed about a quadrangle. Ptolemy's theorem, Brahmagupta's theorem, Euler's theorem about a quadrangle. 3. The power of a point with respect to a circle. Theorem about secants of a circle, theorem about a power line of two circles, Euler's theorem about the distance between the center of the circle circumscribed about a triangle and the center of the circle inscribed in a triangle. 4. Isometric transformations in the plane Fixed points of isometric transformations, axial symmetry and composition of axial symmetries, types of isometries of the plane and classifications of isometric transformations. 5. Homogeneity and similarity in the plane. Definition of homothety, properties and applications of homothety to prove Euler's line theorem and the nine-point circle theorem. Similarity and properties of similarity. 6. Axial affinity and affine transformations. Properties of affine transformations. 7. Axiomatic approach to plane geometry. Cartesian model of Euclidean geometry. 8. Geometry in space. The law of sines and the law of cosines for a trihedral angle. Euler's theorem for polyhedra and regular polyhedra. Isometric transformations in space. 9. Inversion in the plane and its properties. Images of lines and circles in inversion. 10. Geometric constructions. The concept of a construction task in the classical sense, methods of solving construction tasks, application of inversion to solving classical construction tasks. Constructibility of regular polygons. 11. Vectors. Application of vector calculus to proving theorems of classical geometry. 12. Non-Euclidean geometries. History of origin. Basic properties and models of hyperbolic and elliptic geometry.
Prerequisites and co-requisites	N/A
Assessment methods and criteria	

Subject passing criteria	Passing threshold	Percentage of the final grade
tests	51.0%	40.0%
observation of student activity	51.0%	0.0%
project	51.0%	10.0%
egzam	51.0%	50.0%

Recommended reading	Basic literature	1. L. Gulgowski, Geometria elementarna, Skrypt UG. Gdańsk, 1990. 2. R. Doman, Wykłady z geometrii elementarnej, Wydawnictwo Naukowe UAM, Poznań 2001. 3. Materiały internetowe zapoznające z możliwościami programu komputerowego GeoGebra, zwłaszcza ze strony: www.geogebra.org. 4. Podręczniki do nauczania matematyki w zakresie rozszerzonym w liceum, arkusze zadań maturalnych z zakresu rozszerzonego.
	Supplementary literature	1. S. I. Zetel, Geometria trójkąta, Wydawnictwo Aksjomat, Toruń 2022. 2. M. Kordos, L. W. Szczerba, Geometria dla nauczycieli, PWN Warszawa, 1976. 3. Z. Krygowska, Konstrukcje geometryczne na płaszczyźnie, PWN, Warszawa, 1958.
	eResources addresses	
Example issues/ example questions/ tasks being completed	not included	
Work placement	Not applicable	

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