

Subject card

Subject name and code	Elementary geometry, PG_00155380						
Field of study	Mathematics						
Date of commencement of studies	October 2025		Academic year of realisation of subject		2025/2026		
Education level	Master's studies		Subject group		Optional subject group Specialty subject group		
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		6.0		
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				
	Teachers		dr hab. Tomasz Człapiński				
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		10.0		80.0	150
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_W02] knows and understands well the role and importance of the construction of mathematical reasoning	The student knows and understands the basic 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 elementary geometry presented during the lecture.	[SW4] test/exam - oral or written
	[MATMU2_K01] is willing to acknowledge the limitations of his or her own knowledge and is willing to pursue further education	The student is ready to acknowledge the limitations of his or her own knowledge and to pursue further education.	[SK8] observation of student's independent or team work
	[MATMU2_W01] knows and understands in-depth the theory of selected areas of mathematics	The student knows and understands the basic 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 elementary geometry presented during the lecture.	[SW4] test/exam - oral or written
	[MATMU2_U01] can construct mathematical reasoning: prove theorems and refute hypotheses through construction and selection of counterexamples	The student is able to apply the methods and tools learned to solve more difficult problems in elementary geometry.	[SU4] test/exam - oral or written
	[MATMU2_K02] is ready to precisely formulate questions to deepen his/her understanding of a given topic or find missing elements of reasoning	The student is ready to precisely formulate questions concerning elementary geometry.	[SK1] oral statement/conversation/discussion
	[MATMU2_K05] is ready to independently search for information in literature, also in foreign languages	The student is ready to independently search for information in the literature.	[SK1] oral statement/conversation/discussion
	[MATMU2_K04] is ready to understand and appreciate the importance of intellectual honesty in one's own and other people's actions; ethical conduct	The student is ready to understand the importance of intellectual honesty and ethical conduct.	[SK8] observation of student's independent or team work
	[MATMU2_K06] is ready to formulate opinions on basic mathematical issues	The student is ready to formulate opinions on basic mathematical issues.	[SK1] oral statement/conversation/discussion
	[MATMU2_U06] is able to apply methods and examples from a selected field of mathematics in related fields	The student is able to use computer programs to assist in solving tasks or presenting geometric issues.	[SU2] presentation/project/paper/report
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. Steiner-Lehmus 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. 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. 8. Inversion in the plane and its properties. Images of lines and circles in inversion. 9. 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. 10. Vectors. Application of vector calculus to proving theorems of classical geometry.		
Prerequisites and co-requisites	N/A		

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	egzam	51.0%	50.0%
	project	51.0%	10.0%
	observation of student activity	51.0%	0.0%
	tests	51.0%	40.0%
Recommended reading	Basic literature	1. L. Gulowski, 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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