

Subject card

Subject name and code	Linear algebra with geometry I, PG_00155214						
Field of study	Mathematics						
Date of commencement of studies	October 2025		Academic year of realisation of subject		2025/2026		
Education level	Bachelor's studies		Subject group		Obligatory subject group 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 polish or english		
Semester of study	1		ECTS credits		8.0		
Learning profile	academic		Assessment form		exam		
Conducting unit	Faculty of Mathematics, Physics and Informatics -> Rector						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. Ewa Tyszkowska				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	45.0	0.0	0.0	0.0	75
	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	75		10.0		115.0	200
Subject objectives	The aim of the course is to familiarize students with concepts, theorems, and methods of elementary algebra, vector spaces, and systems of linear equations. This is the student's first encounter with pure abstract methods.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[MATL3_W03] knows and understands the basic concepts, methods and theorems of linear algebra and analytical geometry, as well as basic examples both illustrating specific concepts in these fields and enabling the refutation of erroneous hypotheses or unauthorized reasoning	The student knows and understands ideas related to linear algebra and can apply them.	[SW4] test/exam - oral or written
	[MATL3_K06] is ready to formulate opinions on basic mathematical issues	The student is ready to formulate opinions on fundamental mathematical issues	[SK1] oral statement/conversation/discussion
	[MATL3_W04] knows and understands the basic concepts, methods and theorems of general algebra as well as basic examples that both illustrate specific concepts from these fields and enabling the refutation erroneous hypotheses or unauthorized reasoning	The student knows and understands basic concepts of linear algebra and can illustrate them by examples.	[SW4] test/exam - oral or written
	[MATL3_K01] is ready to accept the limitations of his/her own knowledge and understands the need for further education	The student is aware of the limitations of his knowledge and is willing to continue learning	[SK8] observation of student's independent or team work
	[MATL3_W09] knows and understands the role and importance of proof in mathematics, as well as the concept of the importance of assumptions	The student appreciates the role of proof in mathematics and the importance of assumptions	[SW1] oral statement/conversation/discussion
	[MATL3_U04] is able to correctly use the acquired concepts of general algebra, is able - at a simple and medium level of difficulty - to apply the known theorems and methods of these fields and is able to interpret the obtained results	The student is able to correctly use the concepts of linear algebra and geometry, can apply known theorems and methods from these fields at a basic and intermediate level of difficulty, and can interpret the obtained results.	[SU3] text preparation/written work
	[MATL3_U09] is able to plan how to solve a specific problem and prepare a correct record of this solution, providing strict and precise justification for the correctness of his reasoning	The student is able to solve linear algebra problems and justify his reasoning.	[SU5] implementation of a problem task
	[MATL3_U01] is able to correctly use the known concepts of mathematical logic and set theory, is able - at a simple and medium level of difficulty - to apply the known theorems and methods of these fields and is able to interpret the obtained results	The student is able to apply mathematical logic and set theory when studying linear algebra.	[SU1] oral statement/conversation/discussion
	[MATL3_K02] is ready to precisely formulate questions to deepen his/her own understanding of a given topic or to find missing elements of reasoning	The student is able to formulate questions aimed at deepening their own understanding of a given topic or identifying missing elements in their reasoning.	[SK1] oral statement/conversation/discussion
	[MATL3_K09] is ready to critically evaluate arguments, find gaps in reasoning and constructively criticize other people's reasoning	The student critically evaluates others' reasoning and checks whether it is correct	[SK1] oral statement/conversation/discussion
	[MATL3_W01] knows and understands the basic concepts, methods and theorems of mathematical logic and set theory, as well as basic examples illustrating specific concepts in these fields and enabling the refutation erroneous hypotheses or unauthorized reasoning	Student zna i umie zastosować pojęcia i metody logiki matematycznej i teorii mnogości w swojej wypowiedzi	[SW1] oral statement/conversation/discussion
	[MATL3_U08] is able to formulate definitions and theorems in an understandable way, both orally and in writing, and present correct mathematical reasoning regarding the acquired issues	The student is able to present mathematical reasoning when solving problems and correctly use mathematical symbols.	[SU4] test/exam - oral or written

	Course outcome	Subject outcome	Method of verification
	[MATL3_K04] is ready to understand and appreciate the importance of intellectual honesty in one's own and other people's actions; is willing to act ethically	The student understands and values intellectual honesty in their own actions and those of others, and conducts themselves ethically in scientific work.	[SK8] observation of student's independent or team work
	[MATL3_U03] is able to correctly use the acquired concepts of linear algebra and geometry, is able - at a simple and medium level of difficulty - to apply the known theorems and methods in these fields and is able to interpret the obtained results	The student is able to correctly use concepts from linear algebra and geometry, can apply the known theorems and methods of these fields at a basic and intermediate difficulty level, and is capable of interpreting the obtained results.	[SU3] text preparation/written work
	[MATL3_W08] knows and understands the structure of mathematical theories, is able to use mathematical formalism to build and analyze simple mathematical models in other fields of science	The student is able to use mathematical formalism in various fields.	[SW4] test/exam - oral or written
Subject contents	Basic algebraic structures: groups, rings, fields, and their examples. Field of complex numbers: algebraic and trigonometric forms of a complex number, De Moivre's theorem, exponentiation of complex numbers. Vector spaces, linear independence of vectors, basis and dimension of a linear space. Linear transformations. Transformation matrices, operations on matrices. Determinants: Cauchy's formula and Laplace expansion, inverse matrix. Systems of linear equations, Cramer's rule, matrix rank, Kronecker-Capelli theorem. Gaussian elimination method.		
Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	observation of the student's attitude	51.0%	0.0%
	obserwacja postawy studenta na zajęciach	51.0%	10.0%
	ocena wejściówek	51.0%	20.0%
	ocena prac egzaminacyjnych	51.0%	40.0%
	ocena kolokwίων	51.0%	30.0%
Recommended reading	Basic literature	1. A. Białynicki-Birula, <i>Algebra liniowa z geometrią</i> , PWN W-wa, 1976 2. Zbiór zadań z algebry, praca zbiorowa pod red. A. I. Kostrikin, PWN W-wa, 1995 3. T. Koźniewski, <i>Wykłady z algebry liniowej I</i> , Wydawnictwo Uniwersytetu Warszawskiego, 2008 4. J.Topp, <i>Algebra liniowa</i> , Wydawnictwo Uniwersytetu Gdańskiego, 2012 5. N. W. Jefimow, E. R. Rozendorn, <i>Algebra liniowa wraz z geometrią wielowymiarową</i> , PWN, W-wa 1974 6. J. Komorowski, <i>Od liczb zespolonych do tensorów, spinorów, algebr Liego i kwadryk</i> , PWN W-wa 1978 7. G. Banaszak, W. Gajda, <i>Elementy algebry liniowej</i> (cz. I i II) Wyd. Naukowo-Techniczne, W-wa 2002	
	Supplementary literature	Y. Manin, A. Kostrikin <i>Algebra liniowa i geometria</i> , PWN, W-wa, 1993	
	eResources addresses		
Example issues/ example questions/ tasks being completed	• Check the linear independence of the given vectors • Calculate the determinant of the given matrix • Solve the given system of linear equations		
Work placement	Not applicable		