

Subject card

Subject name and code	Linear algebra with geometry II, PG_00155381						
Field of study	Algebra liniowa z geometrią II						
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		
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. Michał Stukow				
	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		5.0		60.0	125
Subject objectives	The aim of the course is to introduce students to the concepts, theorems and methods of linear algebra, including orthogonalization, quadratic forms and their applications in mathematical analysis and geometry.						

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	n/a	[SW4] test/egzamin - ustny lub pisemny
	[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 knows and understands the concept of a quadratic form, methods of reducing it to canonical form, and applications in geometry and analysis.	[SW4] test/egzamin - ustny lub pisemny
	[MATL3_K06] is ready to formulate opinions on basic mathematical issues	The student is ready to formulate opinions on basic mathematical issues.	[SK1] wypowiedź ustna/rozmowa/dyskusja
	[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 orthogonal and unitary matrices, knows what an orthonormal system is and is able to find it.	[SW4] test/egzamin - ustny lub pisemny
	[MATL3_K01] is ready to accept the limitations of his/her own knowledge and understands the need for further education	The student is ready to acknowledge the limitations of his or her own knowledge and is ready for further education.	[SK1] wypowiedź ustna/rozmowa/dyskusja
	[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 correctly use the concepts of linear algebra and geometry, is able to apply the theorems and methods of these fields at a simple and medium level of difficulty, and is able to interpret the obtained results.	[SU3] opracowanie tekstowe/praca pisemna
	[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 is ready to understand and appreciate the importance of intellectual honesty in one's own and other people's actions; ethical conduct.	[SK8] obserwacja samodzielnej lub zespołowej pracy studenta
	[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 the concepts of linear algebra and geometry, is able to apply the theorems and methods of these fields at a simple and medium level of difficulty, and is able to interpret the obtained results.	[SU3] opracowanie tekstowe/praca pisemna
	[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 knows and understands the concept of a quadratic form, methods of reducing it to canonical form, applications in geometry and analysis, knows the equations of lines and planes in R^3 in various configurations.	[SW4] test/egzamin - ustny lub pisemny
	[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, is able to apply the theorems and methods of these fields at a simple and medium level of difficulty, and is able to interpret the obtained results.	[SU3] opracowanie tekstowe/praca pisemna
	[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 ready to precisely formulate questions that serve to deepen one's understanding of a given topic or to find missing elements of reasoning.	[SK1] wypowiedź ustna/rozmowa/dyskusja

	Course outcome	Subject outcome	Method of verification
	[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 create mathematical models of various phenomena using the language of linear algebra.	[SU4] test/egzamin - ustny lub pisemny
	[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 create mathematical models of various phenomena using the language of linear algebra.	[SU4] test/egzamin - ustny lub pisemny
	[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	The student knows and understands orthogonal and unitary matrices, knows what an orthonormal system is and is able to find it.	[SW4] test/egzamin - ustny lub pisemny
	[MATL3_K09] is ready to critically evaluate arguments, find gaps in reasoning and constructively criticize other people's reasoning	The student is ready to critically evaluate arguments, find gaps in reasoning and constructively criticize the reasoning of others.	[SK1] wypowiedź ustna/rozmowa/ dyskusja
Subject contents	1. Systems of linear equations, Cramer's rule, rank of matrices, Kronecker-Capelli theorem. Gaussian elimination method 2. Canonical form of linear transformations, eigenvectors, eigenvalues and characteristic polynomial 3. Scalar product, Hermitian product, orthogonal and orthonormal systems, norm, metric, angle and its measure 4. Quadratic forms and their reduction to canonical forms, applications in geometry (quadrics) 5. Selected topics in analytic geometry		
Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	tests	51.0%	40.0%
	observation of the student's attitude	51.0%	0.0%
	activity	51.0%	10.0%
	egzam	51.0%	50.0%
Recommended reading	Basic literature	1. A. Białynicki-Birula, <i>Algebra liniowa z geometrią</i> , PWN W-wa, 1976 2. N. W. Jefimow, E. R. Rozendorn, <i>Algebra liniowa wraz z geometrią wielowymiarową</i> , PWN, W-wa 1974 3. J. Komorowski, <i>Od liczb zespolonych do tensorów, spinorów, algebr Liego i kwadryk</i> , PWN W-wa 1978 4. G. Banaszak, W. Gajda, <i>Elementy algebry liniowej</i> (cz. I i II) Wyd. Naukowo-Techniczne, W-wa 2002 5. <i>Zbiór zadań z algebry</i> , praca zbiorowa pod red. A. I. Kostrikin, PWN W-wa, 1995 6. T. Koźniewski, <i>Wykłady z algebry liniowej I</i> , Wydawnictwo Uniwersytetu Warszawskiego, 2008 7. J.Topp, <i>Algebra liniowa</i> , Wydawnictwo Uniwersytetu Gdańskiego, 2012	
	Supplementary literature	none	
	eResources addresses		
Example issues/ example questions/ tasks being completed	not included		
Work placement	Not applicable		

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