

Subject card

Subject name and code	Linear Algebra with Geometry II, PG_00204250						
Field of study	Mathematics						
Date of commencement of studies	October 2026	Academic year of realisation of subject			2026/2027		
Education level	Bachelor's studies	Subject group			Obligatory subject group in the field of study 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. 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		3.0		62.0	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 at an advanced level selected concepts, methods and theorems of linear algebra and analytic geometry, as well as basic examples both illustrating specific concepts in this field and allowing to refute false hypotheses or invalid reasoning		The student knows and understands selected concepts, methods and theorems concerning linear spaces and linear and bilinear mappings.			[SW4] test/exam - oral or written	
	[MATL3_U03] is able to correctly use the concepts of linear algebra and analytic geometry, is able to apply the 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.			[SU4] test/exam - oral or written [SU6] demonstration of practical skills	
	[MATL3_U06] can formulate definitions and theorems in an understandable manner, both orally and in writing, and present correct mathematical reasoning on the learned topics		The student is able to create mathematical models of various phenomena using the language of linear algebra			[SU4] test/exam - oral or written	
	[MATL3_W07] knows and understands at an advanced level the role and importance of proof in mathematics, as well as the concept of the importance of assumptions		The student knows proofs and understands their significance for selected theorems in linear algebra and geometry.			[SW4] test/exam - oral or written	

Subject contents	<ol style="list-style-type: none"> 1. Quotient spaces. 2. Linear mappings. Examples of linear mappings, kernel, image, structure theorem of linear mappings. 3. Matrices of linear mappings in various bases. Transition matrices. 4. Eigenvalues and eigenvectors. Characteristic polynomial. 5. Bilinear mappings and dot products. Symmetric bilinear mappings and their associated quadratic forms. Matrices of forms. Definiteness of a quadratic form. 6. Elements of geometry in Euclidean spaces - angle between vectors, orthogonality, norm, distance. Euclidean, normed, and metric spaces. Gram-Schmidt orthogonalization. 7. Hermitian product. 8. Classification of quadrics. 		
Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	egzam	51.0%	50.0%
	observation of the student's attitude	51.0%	0.0%
	activity	51.0%	10.0%
	tests	51.0%	40.0%
Recommended reading	Basic literature	<ol style="list-style-type: none"> 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 (cz. I i II)</i> 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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