



## The Department of Mathematics

2022–23–B term

**Course Name** Linear Algebra ME

**Course Number** 201.1.9321

**Course web page**

<https://math.bgu.ac.il/en/teaching/spring2023/courses/linear-algebra-me>

**Lecturer** Prof. Michael Muzychuk, <muzychuk@bgu.ac.il>, Office 305

**Office Hours** <https://math.bgu.ac.il/en/teaching/hours>

### Abstract

### Requirements and grading<sup>1</sup>

### Course topics

- .1 The real numbers, inequalities in real numbers, the complex numbers, the Cartesian representation, the polar representation, the exponential representation, the Theorem of de Moivre, root computations.
- .2 Systems of linear equations over the real or complex numbers, the solution set and its parametric representation, echelon form and the reduced echelon form of a matrix, backwards substitution, forward substitution and their complexity, the Gauss elimination algorithm and its complexity, the reduction algorithm and its complexity.
- .3 Vector spaces, sub-spaces of vector spaces, linear combinations of vectors, the span of a set of vectors, linear dependence and linear independence, the dimension of a vector space, row spaces and column spaces of matrices, the rank of a matrix.
- .4 Linear mappings between vector spaces, invertible mappings and isomorphisms, the matrix representation of finite dimensional linear mappings, inversion of a square matrix, composition of mappings, multiplication of

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<sup>1</sup>Information may change during the first two weeks of the term. Please consult the webpage for updates



matrices, the algebra of matrices, the kernel and the image of a linear mapping and the computation of bases, changing of a basis, the dimension theorem for linear mappings.

- .5 Inner product spaces, orthogonality, the norm of a vector, orthonormal sets of vectors, the Cauchy-Schwarz inequality, the orthogonal complement of a sub-space, orthogonal sequences of vectors, the Gram-Schmidt algorithm, orthogonal transformations and orthogonal matrices.
- .6 The determinant of a square matrix, minors and cofactors, Laplace expansions of the determinant, the adjoint matrix and Laplace theorem, conjugation of a square matrix, similarity transformations and their invariants (the determinant and the trace).
- .7 Eigenvalues, eigenvectors, eigenspaces, diagonalization and similarity, the characteristic polynomial, the algebraic and the geometric multiplicities of an eigenvalue, the spectral theorem for Hermitian matrices.