MAT 219: LINEAR ALGEBRA (Spring 2022)

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Office Hours: MWF 9:30 – 10:30, MWF 1:00 – 3:00, also by appointment
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COURSE ANNOUNCEMENT

CLASSES: MWF 8:00 – 9:15, at SH 1013B.

See back page for more details.

WebAssign: Everyone is required to register for WebAssign (www.webassign.net). In addition to being an e-textbook, HW/Q will be done through this system. Access information will be given separately.

PARTICIPATION: Students are expected to attend classes and engage themselves. Of course, it will matter to your overall grade. When you are in class, please be courteous to others (e.g. turn off your cell phones).

An assignment will be given almost every class (through WebAssign). You are expected to do all of these assignments. Multiple attempts to improve your score is completely all right. If you need more time, then just ask for an extension.

WORKSHEET: From time to time, in addition to the online assignments, you may get some separate problems sets ("Worksheets"). Full answers will be provided after they are collected.

EXAMS: We plan to have three midterm exams, and a comprehensive final exam. The tentative dates for the midterm exams are: Feb 16 (W), Apr 1 (F), Apr 29 (F), though they may change. The date for the final exam will be chosen by the College.

GRADING: Total (700) = HW/WS (200) + Exams (3 × 100) + Participation (50) + Final (150)

ACADEMIC ACCOMMODATIONS: The Griff Center – Student Accessibility Services (SAS) serves as the College’s advocate for students with disabilities and is responsible for arranging any necessary accommodations and/or supports. A student in need of academic accommodations should contact Student Accessibility Services at (716) 888-2485 or stop by Old Main 317 to arrange a meeting to discuss their needs, the necessary support documentation and to register with the office. Upon registration, including provision of required documentation, SAS will notify the students professors of the necessary academic accommodations via the iAdvise portal. Please note that a student may register for accommodations at any point throughout the semester.
**OVERVIEW:** Linear Algebra is concerned with the study of *vector spaces* and *linear transforms*. We will begin with the study of Euclidean vectors, but over time, we will develop abstract aspects. Study of vector spaces is among the major topics in modern mathematics, and therefore, Linear Algebra is closely tied with Abstract Algebra and Functional Analysis. In addition, it has a wide range of applications in various sciences (including physics, probability, computer science, and even the social sciences), where various real-life situations can be often approximated by linear models.

**TOPICS:** We will generally follow Chapters 1 – 7 of the textbook. But some topics will be rearranged in order, and some may be skipped.

- Vectors in Euclidean spaces (Ch 1)
- Solving systems of linear equations via Gaussian elimination method (2.1) – (2.2)
- Introduction to matrices and matrix operations (3.1) – (3.4)
- Span, Linear independence (2.3)
- Subspaces, Basis, Dimension (3.5)
- Row space, Column space, Null space (3.5)
- Linear transformation, Matrix representation (3.6)
- Determinants, Compatibility issues of linear systems (4.2)
- Eigenvalues and Eigenvectors, Diagonalization (4.1) – (4.4)
- Orthogonality (5.1) – (5.2)
- Least squares method (7.3)
- Gram–Schmidt process, Orthogonal matrix (5.3)
- Orthogonal diagonalization, Quadratic forms (5.4), (5.5)
- Abstract vector space theory: Subspaces, Basis, Dimension (6.1), (6.2)
- Coordinate vectors, Matrix representation, Change of bases (6.3)
- Range, Kernel, Rank, Nullity (6.4), (6.5)
- Inner product space (7.1)
- Singular value decomposition (7.4)

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**DEPARTMENTAL GOALS and OBJECTIVES:**

- [Goal 1: Objective A: Statements]
  - The Department expects students to understand the different types of mathematical statements. Such a mathematical statement might be a definition, an axiom, an assumption or hypothesis, a conclusion, a theorem, corollary, or lemma, or a conjecture. Students must understand the differences between these roles and their use in mathematics. Students should also know the basic definitions and axioms of each major mathematical field and the statements of the most important theorems.
- [Goal 1: Objective B: Methods of proof]
  - The Department expects students to understand several methods of proof, including direct proof, proof by contraposition, proof by contradiction, proof by induction, and disproof by counterexample.

- [Goal 2: Objective A: Basic skills]
  - The Department expects students to master basic mathematical manipulation techniques. These include substitutions, transformations, functions of functions, limits, and the concepts of the argument of a function and independent versus dependent variables.

- [Goal 2: Objective B: Basic knowledge]
  - The Department expects students to know the basic definitions and concepts of the main fields of mathematics. These include functions, relations, derivatives, and integrals. Students are also expected to know basic set theory and logic, through DeMorgan’s laws. They should be able to negate a statement and find its converse and contrapositive. Depending on the track the student has chosen, he/she should also be familiar with the fundamental ideas in abstract algebra, real analysis, and/or probability and statistics.

- [Goal 3: Objective B: Computation]
  - The department expects students use technology to perform tedious and complicated tasks using modern technology (computers and/or calculators). This allows students to see the applied and practical side of mathematics. Students will be expected to master some software program in a manner that allows calculation of the otherwise “impossible” calculation.

- [Basic skills specific to MAT 219]
  - To be able to solve or classify systems of linear equations by using Gaussian elimination and matrix manipulation; to compute determinants and use them to solve linear systems; to be familiar with vector spaces, their properties and the linear transformations between vector spaces; to compute various quantities that pertain to vector spaces.

ADDITIONAL INFORMATION:

- Last day to drop/add is Jan 22.

Academic Integrity: Please note that Canisius College has a Code of Academic Integrity, which can be found at http://catalog.canisius.edu/undergraduate/academics/academic-policies/code-academic-integrity/

It is expected that the work submitted is the result of your own endeavors. It is very much all right to ask for help in understanding the course material, but any homework assignments or exams must be done without outside assistance. This policy will be strictly enforced.

Difficulties: If you have any personal difficulties (illness, or any emergency), please let me know so that we can make appropriate arrangements.

(*). We are going through a very special and difficult time. Please always take precautions in and out of the classroom, to protect yourself and the others.