

MATRIX ALGEBRA, MATH 221 JANUARY-APRIL, 2024

1. General Information

- Course: Math 221 (Matrix Algebra), 2023W Term 2
- Sections 202 and 204: Jingyi Chen, jychen@math.ubc.ca
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- Text: <https://personal.math.ubc.ca/~tbjw/ila/index.html>

1.1. **Homework.** Online homework for the course will be provided via the WeBWorK system (which is accessible through Canvas). There will be one assignment posted per week, each due the following week, as per the course schedule. Please note the following items:

- (1) You may attempt most questions more than once. There is no penalty for a wrong answer. This is to help you correct your own mistakes, and to get instant feedback on your attempts.
- (2) The questions are generated randomly, and the numbers are different for each student.
- (3) Please try to do the problems by yourself, and without the use of other calculators or software. Since calculators and software are not allowed in the exams, you should practice working without them.
- (4) If you really get stuck, you can request help by clicking the email instructor button. However, it may take some time to get a response, so please do not wait till the last minute.
- (5) In general, it is a good idea to start the assignments early rather than waiting till the last minute. The deadlines are enforced by the system, and it will shut down automatically when time is up, so give yourself plenty of extra time in case of problems.

1.2. **Tests.** There will be two midterm exams (in class) and a final exam. The tests will be closed book-closed notes tests. Calculators will not be allowed. The dates for the two midterms are:

- First midterm:
Thursday February 15 for Sections 202 and 204
Friday February 16 for Section 203
- Second midterm:
Thursday March 28 for Sections 202 and 204
Wednesday March 27 for Section 203

1.3. **Grades.** Course grades will be computed as the maximum of the following:

- Homework 10%, Midterms 20%+20%, Final exam 50% or
- Homework 10%, Best midterm score 20%, Final exam 70%.

The grades of those students who miss a midterm will be computed by the second method. The lowest WeBWorK score will be dropped.

1.4. **Synopsis.** The course will cover more or less the whole book (with some minor exceptions). Linear algebra is a fundamental and extremely important topic in mathematics. In fact, many other areas attempt to reduce more complicated questions to problems in linear algebra. For example, calculus tries to reduce questions about curves and surfaces (or higher dimensional shapes) to ones about their tangent lines or tangent planes. These lines and planes are concepts in linear algebra. Perhaps another way of saying this is that the derivative, the key concept in calculus, is a linear map. This course is a study of linear maps. We will learn what they are, how to manipulate them as well as tools (determinants, eigenvectors/eigenvalues, diagonalization) to better visualize them. Along the way we will also touch on various applications.

1.5. **Help Rooms.** The Math Learning Centre schedule will be available at <http://www.math.ubc.ca/MLC/> Drop-in tutorials begin during the second week of term and are located in LSK Rooms 301 and 302.

2. Schedule

Here is a rough course schedule, subject to later adjustments.

- Week 1. §1.1,1.2: Vectors, Vector Equations and Spans
- Week 2. §2.1-2.3: Systems of Linear Equations, Row reduction, Parametric Form
- Week 3. §2.4,3.1-3.2: Matrix Equations, Solution Sets, Linear Independence
- Week 4. §3.3-3.5: Subspaces, Basis and Dimension, Bases as Coordinate Systems
- Week 5. §3.6,4.1-4.2: The Rank Theorem, Matrix Transformations, One-to-one Transformations
- Week 6. §4.2-4.3: Onto Transformations, Linear Transformations
- Week 7. §4.4-4.6: Matrix Multiplication, Matrix Inverses, the Invertible Matrix Theorem
- Week 8. §5.1-5.3: Determinants: Definition, Cofactor Expansions, Determinants and Volumes
- Week 9. §6.1-6.4: Eigenvalues, Eigenvectors, the Characteristic Polynomial, Similarity, Diagonalization
- Week 10. §6.4-6.6: Diagonalization, Complex Eigenvalues, Discrete Dynamical Systems
- Week 11. §7.1-7.3: Dot Products, Orthogonality, Orthogonal Complements, Orthogonal Projection
- Week 12. §7.4-7.5: Orthogonal Sets, Gram-Schmidt Process, The Method of Least Squares
- Week 13. Finish up the course materials and review

3. Official statement about the University's values and policies

UBC provides resources to support student learning and to maintain healthy lifestyles but recognizes that sometimes crises arise and so there are additional resources to access including those for survivors of sexual violence. UBC values respect for the person and ideas of all members of the academic community. Harassment and discrimination are not tolerated nor is suppression of academic freedom. UBC provides appropriate accommodation for students with disabilities and for religious, spiritual and cultural observances. UBC values academic honesty and students are expected to acknowledge the ideas generated by others and to uphold the highest academic standards in all of their actions. Details of the policies and how to access support are available here: <https://senate.ubc.ca/policies-resources-support-student-success>