UNIVERSITY OF CALGARY

FACULTY OF SCIENCE
Department of Mathematics and Statistics

Mathematics 213 Honours Linear Algebra I

(see Course Descriptions for the applicable academic year: http://www.ucalgary.ca/pubs/calendar/)

Syllabus

Topics	**Number of Hours**
Systems of linear equations, matrices, reduced row echelon form matrix multiplication, inverses.	8
Vector spaces, subspaces, bases and dimension.	4
Linear transformations, kernel and image, isomorphism, matrix representation, linear functionals.	8
Determinant functions, permutations, uniqueness of determinants, properties of determinants.	8
Eigenvalues, eigenvectors, characteristic polynomials.	6
Optional topics.	2
TOTAL HOURS	36

MATH 213- Honours Linear Algebra I

Course Outcomes

This course is a sophisticated introduction to vector spaces and operations on vector spaces. Students are expected to understand both the theory of vector spaces and linear transformations, as well as the arithmetic required for their manipulation. Specifically, by the end of this course students are expected to be able to perform these algebraic operations:

1. associate a system of linear equations to its coefficient matrix, and manipulate this matrix to obtain solutions.
2. produce linear transformations and compute their kernel and image (null space and image space).
3. compute the characteristic polynomial of a matrix, its eigenvalues and eigenvectors, and diagonalize the matrix.
4. identify criteria for the invertibility of a linear transformation or its associated matrix, obtain the inverse when it exists.

In addition, by the end of this course students should be able to demonstrate mastery of the theory by:

5. interpreting a linear transformation as a map from one vector space to another, and to be able to construct such maps given a basis of the domain and interpret them geometrically in dimensions 1, 2 and 3.

6. reading and recreating proofs of theorems covered in the course, such as theorems governing the number of solutions of a linear system, the properties of the
inverse ma-trix, criteria for subspaces, independence of dimension and the rank-nullity theorem, change of basis, the determinant, and eigenvalues, eigenvectors and diagonalization.

7. restating all of the technical definitions and named theorems covered in the course and using these definitions and theorems from memory to construct original solutions to problems and/or proofs.
8. constructing mathematical proofs using a variety of methods, including direct proofs, inductive proofs, proof by contrapositive and proof by contradiction.
9. verifying that an abstract mathematical object satisfies a given definition, or is a counterexample.

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