MATH 2210Q
Fall 2010
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## Exam 2 Guidelines: Material and Review Suggestions

**Date and place**: Tuesday, November 9, in class
**Additional Office Hours Before Exam**: Monday, November 8, 1:00 – 2:00
**Policies**: No MAKE-UPS.
This is a one-hour exam, but all students may stay for as long as they need to finish the exam.

**Material:**

- Chapter 1, Sections: Exam 1 material retested: 1.8, new material 1.9
  Chapter 2, Sections: 2.1, 2.2, 2.3
  Chapter 3, Sections: 3.1, 3.2
  Chapter 4, Sections: 4.1, 4.2,
- Homework points total = 11 points (1 point for each new section, 3 points for the 3 group-works)
- Exam 2 total points = 89 points
- You may bring a Scientific Calculator (but not a programmable or symbolic calculator)
- You may not bring any notes or handouts
  The Invertible Matrix Theorem (Section 2.3) will be given to you as a handout during the exam.

The exam will cover the material from the sections mentioned above, that we discussed in class and studied in the homework assignments. Suggested practice exercises: THE PRACTICE PROBLEMS at the end of each section, and exercises in the same groupings as those assigned as homework problems.

**Section by section highlights you should master:**

### Chapter 1

**Section 1.8**
Definitions: Linear Transformation, Matrix Transformation
Skills: Use linearity of matrix vector multiplication to compute A(**u**+**v**) or A(c**u**), and the linearity of a transformation T to calculate T(c**u**+d**v**). Determine if a specified vector is in the range of a linear transformation.

**Section 1.9**
Definitions: Standard matrix of a linear transformation
Theory: Theorem 10 (existence of a unique standard matrix for a linear transformation, page 83)
Skills: Find the standard matrix of a linear transformation

### Chapter 2

**Section 2.1**
Definitions: Identity matrix, zero matrix, diagonal of a matrix, triangular matrix, diagonal matrix, matrix multiplication (both ways), power of a matrix, the transpose of a matrix
Theory: Theorem 1, 2, 3 (Properties of operation with matrices, page 108, 113, 115)

Skills: Add, subtract and multiply matrices, multiply a matrix by a scalar, calculate powers and transposes of matrices

**Section 2.2**
Definitions: Inverse of a matrix, invertible matrix
Theory: Theorem 5 (uniqueness of solution of $A\mathbf{x} = \mathbf{b}$ for invertible matrix A, page 120), Theorem 6 (properties of inverses, page 121), Theorem 7 (characterization of invertible matrices, page 123—you need not know the proof)
Skills: Algorithm for finding the inverse of a matrix

**Section 2.3**
Theory: Theorem 8 (The Invertible Matrix Theorem, page 129), Theorem 9 (inverse of a linear transformation, page 131, this is the material in the group-work)
Skills: Use the Invertible Matrix Theorem to decide if a matrix is invertible or not, and employ the invertibility of the matrix to decide spanning and independence properties of its columns, find the inverse of a linear transformation (if it exists)

## Chapter 3

**Section 3.1**
Definitions: determinant of a square matrix, cofactor, cofactor expansion
Theory: Theorem 1, 2 (cofactor expansion formula, determinants of triangular matrices, page 188, 189)
Skills: Calculate determinants

**Section 3.2**
Theory: Theorem 4 (characterization of invertible matrices by determinants, page 194), Theorem 5, 6 (determinants of transpose and multiplication of matrices, page 196)
Skills: Use determinants to decide independence and spanning properties of vectors, use properties of determinants to simplify calculations of determinants

## Chapter 4

**Section 4.1**

Definitions: vector space, subspace of a vector space, a subspace spanned by a set of vectors
Theorems: Theorem 1 (spanning set theorem, page 221)
Skills: determine if a set with addition and scalar multiplication is a vector space, determine if a set of vectors span $R^n$, determine if a set is a subspace

**Section 4.2**

Definitions: The null space of a matrix, Null A; the column space of a matrix, Col A (both descriptions)
Theorems: Theorems 2, 3 (Null A and Col A are subspaces, pages 227,229), and highlighted remark on page 230.
Skills: Determine if a vector is in Null A or Col A, find a non-zero vector in Null A or Col A, find a spanning set for Null A or Col A