MATH 2210Q
Fall 2016
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Exam 2 Guidelines: Material and Review Suggestions

Date and place: Thursday, November 10, 6:00 – 8:00 PM, MONT 320

Additional office hours before exam: Thursday, November 10, 3:30 – 4:30 PM.

Policies: No MAKE-Ups, unless there is a documented serious reason, in which case make-up date is Friday, November 11. Talk to me a week before the exam about the time.

This is a one-hour exam, but all students may stay for as long as they need to finish the exam.

<u>Material:</u>

- Chapter 1: Sections 1.8, 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 = 12 points (1 point for each section, 3 points total for the 3 group-works)
- Exam 2 total points = 88 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.

<u>Section by section highlights you should master:</u>

<u>Chapter 1</u>

Section 1.8
<u>Definitions</u>: Linear Transformation, Matrix Transformation
<u>Skills</u>: 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, and find all the vectors **x** satisfying T(**x**) = **b**.

Section 1.9
<u>Definitions</u>: Standard matrix of a linear transformation
<u>Theory</u>: Theorem 10 (existence of a unique standard matrix for a linear transformation, page 71)
<u>Skills</u>: 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 93, 97, 99)
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 104), Theorem 6 (properties of inverses, page 105), Theorem 7 (characterization of invertible matrices, page 107—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 112)
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.

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 166, 167)
Skills: Calculate determinants

Section 3.2
Theory: Theorem 3 (effect of elementary row operations on the determinant, p 169), Theorem 4 (characterization of invertible matrices by determinants, page 171), Theorem 5, 6 (determinants of transpose and multiplication of matrices, page 172, 173)
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 194)
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 199, 201), and highlighted remark on page 202
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