MATH 2210Q
Spring 2009
Sarah Glaz

Exam 3 Guidelines: Material and Review Suggestions

Date and place: Thursday, April 16, in class
Additional Office Hours Before Exam: Wednesday, April 15, 12:00 – 1:00
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:

- **New Material: Chapter 4: Sections 4.1, 4.2, 4.3, 4.5, 4.6; Chapter 5: Sections 5.1**
- Material you were tested on in Exam 1 and Exam 2 that you need to know:
  Chapter 1, Sections 1.3, 1.4, 1.7 (on Exam 2 Guidelines page)
  Chapter 2, Sections: 2.1, 2.2, 2.3, Chapter 3, Sections: 3.1, 3.2 (on Exam 2 Guideline page)
- Homework points total = 8 points (1 point per section of new material, 2 points for two group-works)
- Exam 2 total points = 92 points
- You may bring a Scientific Calculator (but not a programmable or symbolic calculator)
- You may not bring any notes or handouts

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 of the new material you should master:

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); kernel and range of a linear transformation
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

Section 4.3

Definitions: linearly independent and dependent vectors in a vector space, basis of a vector space
Theorems: Theorem 4 (characterization of linearly independent vectors, page 237), Theorem 5 (The Spanning Set Theorem, page 239), Theorem 6 (basis for Col A, page 241),
Skills: determine if a set is a basis of a subspace, find a basis for Null A, Col A, and other subspaces.

Section 4.5

Definitions: finite dimensional vector space, infinite dimensional vector space, dimension of a vector space
Theorems: Theorem 9, 10, 11 (number of elements in an independent set, or a basis of a space or subspace), pages 256, 257, 259), Theorem 12 (The Basis Theorem, page 259), highlighted remark on page 260.
Skills: find the dimensions of Null A, Col A, and other subspaces, dimension of R^n and all subspaces of R^n, geometric meaning of subspaces of R^n of dimensions 0, 1, 2, and 3.

Section 4.6

Definitions: the row space of a matrix, Row A; the rank of a matrix, rank A;
Theorems: Theorem 13 (basis for Row A, page 263), Theorem 14 (The Rank Theorem, page 265), Theorem (The Invertible Matrix Theorem (continued), page 267)
Skills: Find the dimensions and bases for Null A, Col A, Row A, Col A^T , and other subspaces, determine the rank of a matrix, use the Rank Theorem

Chapter 5

Section 5.1

Definitions: eigenvector, eigenvalue, eigenspace
Theorems: Theorem 1 (eigenvalues of a triangular matrix, page 306), Theorem 2 (eigenvectors of distinct eigenvalues, page 307). The remarks following Example 5, page 306: When is 0 an eigenvalue of a matrix
Skills: determine if a number (respectively a vector) is an eigenvalue (respectively an eigenvector) of a matrix, find the eigenvalues of a triangular matrix, find a basis for an eigenspace