

## Math 2275 Midterm I Info Sheet

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The purpose of this handout is to help you study by listing the concepts, definitions, and results you will need to know for the midterm.

**Midterm Information.** The midterm will be on Thursday, March 15, 2012. You will **not** be allowed to bring in any notes, use the text book, or use a calculator. **Bring your STUDENT ID.**

**Material Covered.** The exam will cover all the material discussed in class about Chapter 6 of the textbook.

I have given a breakdown of what you will need to know from each section.

**Section 6.1.** Know the definition of the inner product (dot product), norm of a vector, unit vector, and what it means for two vectors to be orthogonal to each other. Also know what it means for a vector to be orthogonal to a subspace. Know how to compute the distance between vectors, and how to find a unit vector. Also know Theorem 1. You do not need to know the material on angles (page 335).

**Section 6.2.** Know the terms orthogonal set, orthogonal basis, orthogonal projection, orthonormal set, orthonormal basis, and orthogonal matrix. Know the formula on page 340, and be able to do examples like Example 3. Also know Theorem 4, and how to use Theorem 5 (see Example 2). Know how to find an orthonormal set from an orthogonal set.

**Section 6.3.** The most important result in this section is Theorem 8. Be able to do problems like Example 2 and Example 3. Know Theorem 9, and what is meant by the best approximation to  $\mathbf{y}$  by elements of  $W$ . Theorem 10 is also useful.

**Section 6.4.** Know Theorem 11, the Gram-Schmidt Process. In particular, be able to do problems like Example 2. Know how to use the Gram-Schmidt Process to find orthonormal bases. Know what is meant by a QR-factorization (Theorem 12) and be able to find the QR-factorization of a matrix (like Example 4)

**Section 6.5.** Know the definition of a least-squares solution. Know how to find the normal equations for  $A\mathbf{x} = \mathbf{b}$  (see equation (3) on page 361) and how to use these equations to find least-squares solutions (Theorem 13). Know Theorem 14, and what we mean by the least-squares error. Also know how to use alternative calculations of least-squares solutions.

**Section 6.6** You will need to know what a design matrix, parameter vector and an observation vector are. You should be able to find the least-squares line that best fits a set of data points (like Example 1). You should also know how to use the least-squares method to find curves of best fit. You do not need to know the section “The general linear model” and the section “Multiple Regression”.

**Section 6.7.** Know the definition of an inner product, and know some examples of an inner product (like Example 1, Example 2, and Example 7). Know what an inner product space is, and how to compute the norm of a vector, and distance between vectors in a inner product space (e.g., see Example 4). Be able to use the Gram-Schmidt Process in an inner product space, and how to find projections in an inner product. Also know the Cauchy-Schwarz Inequality and Triangle Inequality.