

Midterm II Study Guide

Math 20

April 6, 2006

Midterm II is (Good) Friday, April 14 in class. It covers all topics covered in class between March 6 and April 7. The format will be much like Midterm I.

Skills

These are some of the things you should be able to do. This is not to say the the test will ask you to do these things!

- Use Gaussian elimination to ...
 - ... solve systems of linear equations.
 - ... find the inverse of a matrix.
 - ... determine the rank or nullity of a matrix.
 - ... determine whether a set of vectors is linearly independent.
 - ... determine whether a set of vectors in R^m spans R^m .
- Find determinants of $n \times n$ matrices. You can use the various shortcuts in small cases (2×2 or 3×3) to save time. In general, use the method of expansion by cofactors.
- Show whether an operation on a set V is closed. *Note:* in the textbook this is strangely displayed. An operation \oplus on V is closed exactly when $\mathbf{v} \oplus \mathbf{w} \in V$ whenever \mathbf{v} and \mathbf{w} are in V . This is condition (α) in Definition 1 in Section 6.1. Conditions (a)–(d) are not subcases of (α) ; we don't have to verify them to claim that (α) is true! They are extra conditions to V being a vector space. Likewise for (β) and (e)–(h).
- Show whether a subset W of a vector space V is a subspace. Notice that by Theorem 6.2, we need only check that the operations are closed when restricted to W . Notice that by the above note, we need only check conditions (α) and (β) and not (a)–(h).
- Basis business:
 - Find bases and constraint equations for the row space, column space, and null space of a matrix.

- Given a subspace defined as the span of a certain set, find a basis for that subspace.
- Given a subspace defined as the common solution to a set of equations, find a basis for that subspace.
- Find the dimension of a vector space (or subspace) by counting the number of elements in a basis.
- Given an n -dimensional vector space V , a basis S for V , and a vector \mathbf{v} in V , find the coordinate vector $[\mathbf{v}]_S$ in R^n . I won't ask you to find the transition matrix between bases for this test.
- Determine if a set of vectors is orthogonal or orthonormal.
- Given a finite set of vectors, find an orthonormal set of vectors with the same span.

Old Exams

No previous Math 20 exam I've given covers the exact same material as this one. I do have some of my old exams on the course web site. Here are the ones which have problems relevant to this exam:

- Fall 2005, Midterm I: 5
- Fall 2005, Midterm II: 1,2
- Fall 2004, Midterm II: 1–5
- Spring 2004, Midterm II: 1, 2
- Spring 2004, Midterm I: 2, 3, 5, 6
- Fall 2003, Midterm I: 1, 3, 5, 6, 7, 9

Solutions will be posted next week.

Practice Problems

There is a trove of good exercises in Kolman and Hill. I'll list the relevant ones. Practice as many as you feel like until you feel confident. Answers to the odd-numbered problems are in the back of the book.

- Section 1.6: 1–30, T.4, T.9, T.11
- Section 1.7: 1–26, T.3, T.8, T.9
- Section 2.4: all problems

- Section 2.5: 1–15
- Section 3.2: 1–7, 15–19
- Section 6.1: 1–20
- Section 6.2: 1–13, T.5–10
- Section 6.3: 1–13, T.10–12
- Section 6.4: 1–37, T.1, T.3, T.4, T.8–12

For sections 6.6–6.8 the sample problems are listed on Problem Set 9.