Math 313 Final Exam Competencies

Exam Content

The exam for this course is comprehensive. This is in alignment with university policy, which states: "Student learning is enhanced by final examinations and other comparable culminating experiences. These afford students an opportunity to review, synthesize, and demonstrate an understanding of a course as a unified whole. " Faculty are given the responsibility of providing a culminating experience in their classes.

The format of the final exam will be similar to the format of the midterms - there will be a multiple choice section and a free response section. However, the free response section will only cover material in sections 6.4-6.8, 7.1-2, and 7.4. the multiple choice questions will cover the other material in the course.

For the final exam, you will be allowed to bring one 4" by 6" card of notes. it must be handwritten, and readable with your normal eyewear (if any). You can fill both sides.

Because the exam is comprehensive, the learning outcomes for the previous exams still apply. Review the material in the previous reviews. this review covers material since Exam 3.

Specific Learning Outcomes for the Final

in addition to the learning outcomes for the other exams you will need to be able do the following:

1. Given a basis for a subspace of a vector space V and an inner product, create an orthogonal or orthonormal basis for the same subspace.
2. Given a matrix A with linearly independent columns, find the QR factorization of A.
3. Know what is meant by the least squares solution, and how it is the "closest".
4. Know how to calculate the least squares solution of an over-determined system $A\mathbf{x} = \mathbf{b}$.
5. Know how to set up a least squares system to calculate the best fit line in a set of data.
6. Know when the least squares solution is unique.
7. Know how to use the QR factorization of a matrix A to calculate the least squares solution.
8. Know how to find the least squares solution of $A\mathbf{x} = \mathbf{b}$ if the columns of A are orthonormal.
9. Understand what is meant by an inner product.
10. Given any bivariate function, be able to determine if it is an inner product.

11. Be able to use inner products to find lengths and distances.

12. Be able to use inner products to determine orthogonality and to be able to create orthogonal bases.

13. Be able to find projections into subspaces and their orthogonal components using inner products.

14. Know the properties of symmetric matrices (real eigenvalues, orthogonally diagonalizeable, etc.)

15. Be able to orthogonally diagonalize symmetric matrices.

16. Know what is meant by Quadratic forms.

17. Understand the connection between quadratic forms and conic sections.

18. Understand the classifications of positive definite, positive semidefinite, negative definite, negative semidefinite, and indefinite for quadratic forms.

19. Understand how eigenvalues of the matrix relate to the positive or negative definiteness of the quadratic form.

20. Know how to construct the singular value decomposition of a matrix.

21. Know what is meant by the compact form of the singular value decomposition and be able to construct it. (The book calls this a reduced singular value decomposition.)