

Math 313 Exam 3 competencies

Exam Content

This exam will cover material specifically from sections 4.5-4.6, 5.1-5.3, 5.5, 6.1-6.3. There will be two types of questions: multiple choice and free response. The format of the exam will be similar to exams 1 and 2. Note that some material from previous exams will be needed, but not tested directly. For example, solving systems, finding determinants, inverses and coordinates.

Specific Learning Outcomes for Exam 3

1. Know how to find the dimension of a vector space.
2. Know the theorems dealing with dimension of a vector space.
3. Be able to find the dimension of any subspace of a vector space V .
4. Know the theorems about basis.
5. Know how to find bases for the Null space, Column space, and Row space, and how to find the rank and the nullity.
6. Know the rank theorem, and how to prove it using pivots.
7. Be able to find the eigenvalues and eigenvectors of a matrix (both real and complex).
8. Know how to find the eigenvalues of a triangular matrix.
9. Know the theorem dealing with linear independence of eigenvalues.
10. Know what is meant by similar matrices.
11. Know the properties of similar matrices.
12. Know how to find whether a matrix is diagonalizable, and be able to construct the diagonalizing matrix if it is.
13. Be able to find powers of a diagonalizable matrix.
14. Know the properties of complex eigenvalues and eigenvectors, and be able to find them.
15. Know the invertible matrix theorem and the extensions to it.
16. Be able to find the inner product (dot product), norm (length), and angle of two vectors in \mathbb{R}^n .
17. Be able to tell if two vectors are orthogonal (first definition).
18. Know the theorems about orthogonal vectors.

19. Be able to construct the orthogonal projection of a vector onto another vector, as well as its orthogonal complement.
20. Know what is meant by the orthogonal complement of a vector space.
21. Be able to describe the orthogonal complement of any vector space in \mathbb{R}^n .
22. Know the fundamental subspaces theorem (Thm 3, p. 335).
23. Know what is meant by an orthogonal set (second definition).
24. Know when an orthogonal set is linearly independent.
25. Know what is meant by an orthonormal set.
26. Be able to write a linear combination of orthogonal sets using the dot product.
27. Know what is meant by an orthogonal matrix (third definition).
28. Know the properties of matrices with orthonormal columns (including orthogonal matrices).
29. Know the Orthogonal Projection theorem, and the Best Approximation theorem.
30. Be able to construct the orthogonal projection of a vector onto a subspace, as well as its complement, from an orthogonal basis of the subspace.
31. Be able to use the orthogonal projection to find distance from a vector (or point) to a subspace.