

MA 322-021
2nd Summer Session
Review for Final Exam

I. Definitions:

1. Solution set
2. Augmented matrix
3. Consistent/Inconsistent systems
4. Row equivalent
5. (Reduced) Echelon form
6. Pivot/Pivot column/Pivot position
7. Parametric form of solutions
8. Vector, scalar, vector addition, scalar multiplication, column/row vector
9. Linear combination
10. Span/spanning set
11. Matrix equation/vector equation/linear system
12. Matrix addition/multiplication/inversion/equality/transpose/similarity/diagonal
13. Homogeneous and non-homogeneous systems
14. Parametric vector form of a line and plane
15. Linear independence, linear dependence
16. Linear dependence relation
17. Linear transformation
18. Onto & one-to-one
19. domain, codomain, range
20. Matrix transformations
21. Determinant
22. Elementary matrix
23. Triangular, square, symmetric, and diagonal matrices

24. Vector space and subspace
25. Null space and column space
26. Basis
27. Dimension of a vector space
28. Rank
29. Examples of vector spaces other than \mathbb{R}^n , for example P_n, \mathbb{P} and their dimension
30. Eigenvalue, eigenvector, eigenspace
31. Characteristic equation and polynomial
32. Inner product of two vectors
33. Length or norm of a vector
34. distance between two vectors
35. Orthogonal vectors
36. W^\perp
37. Orthogonal set
38. Orthogonal basis
39. Orthogonal project of a vector onto a line
40. Orthogonal projection of a vector onto a subspace
41. Orthonormal set
42. Orthonormal basis

II. Theorems and (other things you should know how to do):

1. Solve a system of equation with row reduction
2. Determine existence/uniqueness about systems
3. Vector and matrix algebra
4. Explain the parallelogram law for addition of vectors
5. Use row reduction to express a vector and a linear combination of other vector

6. Determine the span of a set of vectors
7. Solve the homogeneous equation $A\mathbf{x} = \mathbf{0}$ and the non-homogeneous equation $A\mathbf{x} = \mathbf{b}$ and understand the relationship between the two solution sets.
8. Answer existence/uniqueness by looking at an echelon form of a matrix
9. Statements of Theorem 4, page 43
10. Write a solution in parametric vector form
11. Find linear dependence relations among a group of vectors
12. Determine if a set of vectors is linear independent
13. Find the standard matrix of a linear transformation
14. Show that a given function is a linear transformation
15. Apply theorems 11 and 12, pgs 88, 89
16. $[a_{i,j}]$ description of a matrix
17. Properties of the transpose of a matrix
18. How to find the inverse of a square matrix
19. How to apply the inverse of a matrix to solve $A\mathbf{x} = \mathbf{b}$ and answer existence uniqueness questions
20. The inverse of a product of matrices and of the transpose of a matrix
21. The statements of the Invertible Matrix Theorem (all statements, not just those in Chapter 2) and how to apply them to problems
22. Find the determinant of a matrix
23. Properties of determinants
24. Given a vector space V and a subset U of V , determine whether or not U is a subspace of V
25. Examples of vector spaces other than \mathbb{R}^n
26. Find bases for null space and column space
27. Determine whether or not a given set is a basis for a subspace
28. Apply the Spanning Set Theorem
29. The Basis Theorem (pg. 179)

30. Find the dimension of the column space and null space of a matrix A
31. The rank of a matrix
32. The Rank Theorem
33. Find the eigenvalues, eigenvectors, and a basis for eigenspaces of a matrix A
34. The eigenvalues of a diagonal matrix occur on the diagonal
35. Using the characteristic equation
36. Diagonalize a matrix
37. The Diagonalization Theorem
38. Inner product algebra
39. Find the length and a vector, finding the distance between two vectors
40. Decide if two (or more) vectors are orthogonal
41. The Pythagorean Theorem for \mathbb{R}^n
42. Given a subspace W of \mathbb{R}^n , decide if a vector is in W^\perp
43. Calculate the orthogonal projection of a vector y onto a vector U or a subspace W of \mathbb{R}^n
44. Given \mathbf{y} and \mathbf{u} , express \mathbf{x} as the sum of two vectors—one is in $\text{Span}\{\mathbf{u}\}$ and the other orthogonal to \mathbf{u}
45. Do the same, but for a subspace W instead of a line
46. Find the distance between a vector and a line and between a vector and a subspace W
47. The Best Approximation Theorem
48. Solving the Least-Squares problem
49. Diagonalize symmetric matrices