Linear Algebra Forevers

Forevers are theory components that you will be expected to know well not only for tests in this course but also for future courses. Be able to define terms and state properties and theorems concisely and completely. Be able to prove indicated theorems and properties.

Chapter 1

Define

- consistent system of equations
- inconsistent system of equations
- elementary row operations
- row echelon form
- reduced row echelon form

Chapter 2

Define

- matrix operations (addition, multiplication, scalar multiplication)
- identity matrix
- inverse of a matrix
- elementary matrix
- row equivalent matrices

State

- Properties of Matrix Addition and Scalar Multiplication [Prove]
- Properties of Zero Matrices
- Properties of Matrix Multiplication [Prove]
- Uniqueness* of the Inverse Matrix [Prove]

  * There will be several **uniqueness proofs** during the semester. Know the method of working through a uniqueness proof in general as well as these proofs in specific
- Inverse of a Product Theorem [Prove]
- Cancellation Properties [Prove]
- Equivalent Conditions Theorem

Chapter 3

Define

- minor and cofactor

State

- Elementary Row Operations and Determinants Theorem [*Prove*]
- Determinant of a Product Theorem [*Prove*]
- Equivalent Conditions for a Nonsingular Matrix Theorem

Ma 300 Linear Algebra

Chapter 4

Define

- vector space
- subspace
- linear combination
- span of a set, spanning set, spans (the verb)
- linear independence
- dimension of a vector space
- row space, column space, and null space of a matrix
- coordinate matrix relative to a basis
- transition matrix

Be able to prove:

- a given set under defined operations is or is not a vector space
- a given subset of a known vector space is itself a vector space
- the Null Space of a matrix is a vector space

Chapter 5

Define

- inner product
- dot product
- norm, distance, and angle
- orthogonal and orthonormal
- Gram-Schmidt Orthonormalization Process

Theorems

- Cauchy-Schwarz inequality
- Triangle Inequality
- Pythagorean Theorem

Other Concepts

- Gram-Schmidt Orthonormalization Process

Ma 300 Linear Algebra

Chapter 6

Define

- linear transformation
- domain, range, kernel
- one-to-one, onto
- isomorphism
- similar matrices

Other Concepts

- Properties of Linear Transformations(Theorem 6.1)
- Know how to prove a transformation is linear
- Know how to prove a linear transformation is 1 -1
- Know how to prove a linear transformation is onto
- Prove the kernel is a subspace of the Domain.
- Given a Transformation for R_n to R_m, be able to write it as a matrix operation.
- Find Transition matrices with respect to different basis.

Chapter 7

Define

- eigenvalues, eigenvectors
- characteristic equation