

Vector Spaces

Vector Spaces

Subspaces

Linear Independence and
Spanning Sets

Bases

Dimension

Properties of Dimension

Determinants

Determinant of a Matrix

Properties of Determinants of
Matrices**Eigenvalues**

Eigenvalues and Eigenvectors

Properties of Eigenvalues and
Eigenvectors

Similarity and Diagonalization

Linear Transformations

Linear Transformations

Injective Linear
TransformationsSurjective Linear
TransformationsInvertible Linear
Transformations**Representations**

Vector Representations

Matrix Representations

Change of Basis

Orthonormal Diagonalization

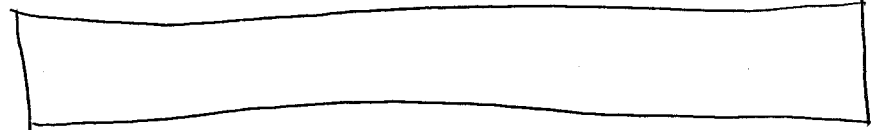
Preliminaries

Complex Number Operations

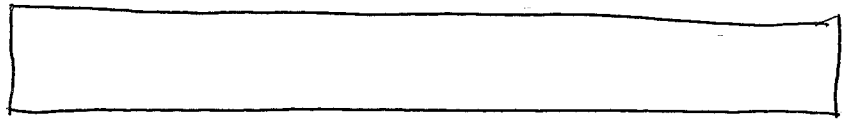
Sets

We will have theorems in this section that connect nonsingular matrices with systems of equations, creating more opportunities for confusion. Convince yourself now of two observations, (1) we can decide nonsingularity for any square matrix, and (2) the determination of nonsingularity involves the solution set for a certain homogeneous system of equations.

Theorem



Proof



Notice that it makes no sense to call a system of equations nonsingular (the term does not apply to a system of equations), nor does it make any sense to call a 5×7 matrix singular (the matrix is not square).

Example S A singular matrix, Archetype A**Example S A singular matrix, Archetype A**

Example HISAA shows that the coefficient matrix derived from Archetype A, specifically the 3×3 matrix,

$$A = \begin{bmatrix} 1 & -1 & 2 \\ 2 & 1 & 1 \\ 1 & 1 & 0 \end{bmatrix}$$

is a singular matrix since there are nontrivial solutions to the homogeneous system $\mathcal{LS}(A, \mathbf{0})$.

(in context)

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Example NM A nonsingular matrix, Archetype B