Contents

1
An Overview of Linear Algebra

1.1	Introduction	1
1.2	The Vector Space R_3	8
1.3	Linear Combinations of Vectors in R_3	18
1.4	Systems of Linear Equations	19
1.5	Linear Independence and Bases in R_3	26
1.6	The Scalar Product in R_3	32
1.7	Lines in E_3	39
1.8	Planes in E_3	44
1.9	The Vector Product in E_3	49
1.10	Linear Transformations in R_3	53
1.11	Matrix Algebra for R_3	58
1.12	Quadratic Forms in E_3	65
1.13	A Few Applications (Optional)	70

2
Vector Spaces

2.1	Vector Spaces and Subspaces	84
2.2	Linear Independence	92
2.3	Bases and Dimension	96
2.4	Real Inner Products	104
2.5	Orthogonality	109

3
Linear Mappings and Matrices

3.1	Linear Mappings	115
3.2	Rank and Nullity	123
3.3	Special Linear Transformations	128
3.4	Matrix Representation of a Linear Mapping	134
3.5	Matrix Algebra	141
3.6	Special Matrices	147

4
Systems of Linear Equations

4.1	Gaussian Elimination	152
4.2	Elementary Row Operations	159
4.3	Computation of A^{-1}	164
4.4	Equivalence of Matrices	168
4.5	Geometry of Linear Systems	173
4.6	Determinants	176
4.7	Expansions for det A	182
4.8	Some Applications of Determinants (Optional)	188

5
Diagonalization (Optional)

5.1	Similarity of Matrices	193
5.2	Characteristic Vectors	199
5.3	Diagonalization of Transformations	207

5.4 Quadratic Forms 214
5.5 Diagonalization of Quadratic Forms 221

Greek Alphabet 228

Suggestions and Answers for Exercises 229

Index 265