

Contents

1. Linear space	3
1.1. The definition of linear space. Examples. Elementary theory	3
1.2. Finite dimensional linear spaces.	16
2. Matrices, determinants, systems of linear equations	26
2.1. The multiplication of matrices	26
2.2. The rank of a matrix	28
2.3. The inverse matrix	32
2.4. Determinants	37
2.5. Systems of linear equations	49
3. Linear transformations	77
3.1. Introduction. Basic examples	77
3.2. Linear transformations given by determining the images of bases	84
3.3. The matrix of linear transformation with respect to bases	86
3.4. Isomorphic spaces (only dimension matters!)	93
4. The linear space V_3 of “free” vectors and applications in geometry	101
4.1. Testing one’s memory – how does one pass from “geometric vectors” to “free” vectors?	101
4.2. Scalar product of vectors	104
4.3. The vector product in V_3	106
4.4. Linear varieties in E_3 (applications of scalar product and vector product)	109
4.5. Analytic geometry in E_3	111

5. Appendix 1: Mathematical Induction	131
6. Appendix 2: Polynomials and rational functions	136
6.1. Preliminaries	136
6.2. Dividing a polynomial by a polynomial	137
6.3. Horner's schema	139
6.4. Roots of polynomials (multiplicity of roots)	141
6.5. Decomposition of a rational function into partial fractions	150
6.6. The proof of decomposition theorem	157