Introduction

Many difficult problems can be handled easily once relevant information is organized in a certain way. This text aims to organize information, where certain mathematical structures are present. Linear algebra is, in general, the study of those structures. Namely, it is the study of vectors and linear functions. In broad terms, vectors are things you can add and linear functions are functions of vectors that respect vector addition. The goal of this text is to organize information about vector spaces in a way that makes problems involving linear functions of many variables easy. So these are lecture notes for a first course in linear algebra. To get the general idea of vectors and linear functions each chapter covers a brief theoretical material and gives the detailed analysis of illustrating examples.

The notes are quite informal, but they have been carefully read and criticized by students, and their comments and suggestions have been incorporated. Although we have tried to be careful, there are undoubtedly some errors remaining. If you find any, please let us know. The material in these notes is absolutely fundamental for all mathematicians, physical scientists, and engineers. You will use everything you learn in this course in your further studies.

Thus this textbook consists of seven chapters of extended lecture notes of the lecture we held at the Lviv Polytechnic National University. It comprises basic linear algebra and analytical geometry needed in engineering sciences (for a more detailed account, see the contents). Especially we would like to emphasize three important chapters – the systems of linear equations (chapter 4), vectors (chapter 5), and lines and planes in space (chapter 6). The theory is supplemented with illustrating examples. Problems for individual study are formulated at the end of each chapter. The only prerequisite for reading this textbook is elementary algebra and geometry in the extent of the secondary school curricula. Bibliography is included at the end of the textbook.