PREFACE

This text has been specially created for the course Mathematics B17 at Northwestern University. The subject matter is introductory linear algebra, which is covered in about six weeks in that course. Since time is limited, emphasis is on important basic concepts.

Linear algebra is somewhat more theoretical than some of the subjects you studied previously in your calculus courses. What you have to learn is a collection of basic concepts and algorithms. Some of these concepts are a bit subtle, and instead of memorizing formulas you need to learn moderately complex procedures for solving problems. In developing the subject matter, we have tried to keep things concrete by concentrating on illustrative examples. Such examples exhibit the important features of the theory. To describe a concept in complete generality will often require an extensive discussion and listing of many special cases and caveats. However, if you have a good understanding of the basic examples, you will usually be able to figure out what to do if you encounter something similar but not exactly the same as the example.

You won't find as many exercises as you are used to in a calculus text. Most of the exercises take somewhat more time than is usual, so try to glean as much as you can from each rather than relying on repetition to drive a point home. There are fairly complete answers at the end of the book. However, don't just try to get the right answers. It is more important to understand the methods and concepts. Also, don't concentrate so much on how to solve particular problems that you lose sight of the ideas these problems are meant to illustrate. There are also more 'theoretical' questions than you may be used to. Such problems are intended to get you to come to grips with important concepts in cases where just doing some more examples might not suffice. You need not write out formal proofs as long as you can give convincing explanations. The emphasis should be on understanding rather than on mathematical rigor.

Unfortunately, there isn't time in the syllabus to develop many of the beautiful and important applications of linear algebra. A few such applications are mentioned in the exercises, and two important applications are included at the end. However, linear algebra is one of the most essential mathematical tools in science, engineering, statistics, economics, etc., so we ask you to bear with us if the going gets a bit tough.

For completeness, we have included some proofs of crucial theorems, but they are not supposed to be a fundamental part of the course. Given that time is limited, it is not unreasonable to postpone the proofs for a more advanced course in linear algebra.

No one has ever written a perfect book. A publisher once told me that people still find typographical errors in the oft reprinted works of Charles Dickens. If you find

something that doesn't seem to make any sense, in either the text or the problems, please mention it to your instructor. More important, if you find some discussion particularly murky, please let me or your instructor know. The exposition will be revised with such contributions in mind, and you may help generations of calculus students yet to come.

I would like to thank Professor Daniel S. Kahn who has helped enormously with the preparation of this text but who doesn't want to be held responsible, as an author, for my misdeeds. I would also like to thank my teaching assistants for valuable comments. In particular, I incorporated a suggestion by Jason Douma which I hope clarifies the concept of eigenvector.

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Leonard Evens, December, 1994