Preface for Instructors

The preface in the published version of *Linear Algebra* is written for students. This is the online preface for instructors.

I wrote the book because I was unhappy with the book that was being used for linear algebra at Brigham Young University. We have nine parallel sections each semester, about 40 students each, and there is a common book for all sections. The book we were using is 555 pages long, but nonetheless omits significant proofs suitable to a first course in linear algebra, such as orthogonal diagonalization and the Cayley-Hamilton theorem. Worse, the problems were boring and trivial.

There were two challenges, then: firstly, present all the results that instructors would like to prove in a first course, but without making the course too difficult for average students. Secondly, provide a mix of routine skill-building problems, and more interesting problems that would not be too hard for most students. I think I have accomplished both these goals. Students-almost without noticing-learn to prove results for themselves in the problem sets.

A third goal that I set myself was to halve the length of the course book, and in fact I managed to say everything in 274 pages. There are two great advantages: students who are serious about their work are able to read the book from cover to cover; and students will find it easy to review the text for a test without sifting through a lot of excess material.

I still managed to find space for three interesting applications of linear algebra: electric circuits, Markov chains and systems of linear differential equations. My students like all of these. They provide links to other subject areas, and they reinforce skills-for example, Jordan form is very useful in the last topic. When I field-tested the book, students finished the course convinced of the power of linear algebra.

I do not use software. It seems to me that interesting problems can be constructed that are easy enough to solve by hand. The time saved in mastering software is the reward. A second course, in numerical linear algebra, is the right place for software. I am sure many instructors will disagree here!

The reason that many texts on linear algebra have become so long is that authors want to build up the requirement for abstraction slowly and carefully. I agree with this goal, even if I do not think a long book is needed to accomplish it. My students are a wonderful mix of majors in music, history, chemistry, biology as well as math education, engineering and mathematics. They cannot, and will not, struggle with concepts like vector space early in the semester. I start by building skills in R^2 and R^3, with emphasis on inner product as a tool. Most of the book is set in R^n. At the end, I introduce complex numbers, simple examples of fields, and vector spaces over a field. By this stage, their skill with n-dimensional thinking is strong enough that they are not intimidated.

Please take a look at the excerpts from the book on this website. I hope you will want to order an examination copy. I would like to get as much feedback as possible, whether favorable or unfavorable. I am happy to come to any college in the U.S.A. and deliver a talk "An Englishman's view of linear algebra" which is a (hopefully) entertaining lecture on my way of teaching linear algebra. My email address is: baker@math.byu.edu.