

Preface

I have taught elementary analysis many times. It is a difficult course for students and instructor alike. Students lack basic techniques such as manipulations of simple inequalities with elementary functions. For instance, most students will have trouble finding upper and lower numerical bounds for $\frac{1}{1+x^2}$ when $-4 < x < -2$; they also lack mathematical culture at this stage. Many students have no idea why we need limits, why series are important, what the number π is, and so on. These gaps are actually not that surprising given how little theory students have been exposed to up to that point.

To decrease the failure rate in analysis and make it a less traumatic experience for both the students and the instructor, we have offered a pre-analysis course for the last several years at the University of Colorado at Colorado Springs. Students are strongly advised to take one semester of pre-analysis, and they then take the required one semester of analysis. The experiment has been remarkably successful. The failure rate in analysis has dropped significantly, and I get many more positive comments about the whole learning experience. The only problem is that there are rather few textbooks available for a pre-analysis course. The main goal of this work is to provide such a textbook.

I use Chaps. 1 through 4 for my pre-analysis course. My goal is to get students comfortable at estimating simple algebraic expressions and at the same time increase their mathematical culture. In order to achieve these two goals simultaneously, the order in which topics appear is not the traditional one, and many concepts are introduced several times. For instance, I compute derivatives in Chap. 3 long before differentiation is defined in Chap. 5.

I have also used my notes that evolved into this book for a classical elementary analysis course (1.3, 2.1, 2.2, Chaps. 5 and 6, and selected topics from Chaps. 7, 8, and 9). Chapter 7 is a short introduction to uniform convergence. It also contains the proofs of the classical results on differentiation and integration of power series that are used in Chaps. 3 and 4. Chapters 8 and 9 are introductions to decimal representations of the reals and countability, respectively. Chapter 8 is the closest we get to constructing the reals, and Chap. 9 contains important ideas and results that

students need to be exposed to at this point in their mathematical education and career. The chapters of the book are largely independent from each other, and the only prerequisite is a standard calculus course.

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