COMPANION NOTES
A Working Excursion to Accompany Baby Rudin

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Preface

These notes have been prepared to assist students who are learning Advanced Calculus/Real Analysis for the first time in courses or self-study programs that are using the text *Principles of Mathematical Analysis* (3rd Edition) by Walter Rudin. References to page numbers or general location of results that mention "our text" are always referring to Rudin's book. The notes are designed to

- encourage or engender an interactive approach to learning the material,
- provide more examples at the introductory level,
- offer some alternative views of some of the concepts, and
- draw a clearer connection to the mathematics that is prerequisite to understanding the development of the mathematical analysis.

On our campus, the only prerequisites on the Advanced Calculus course include an introduction to abstract mathematics (MAT108) course and elementary calculus. Consequently, the terseness of Rudin can require quite an intellectual leap. One needs to pause and reflect on what is being presented; stopping to do things like draw pictures, construct examples or counterexamples for the concepts the are being discussed, and learn the definitions is an essential part of learning the material. These *Companion Notes* explicitly guide the reader/participant to engage in those activities. With more math experience or maturity such behaviors should become a natural part of learning mathematics. A math text is not a novel; simply reading it from end to end is unlikely to give you more than a sense for the material. On the other hand, the level of interaction that is needed to successfully internalize an understanding of the material varies widely from person to person. For optimal benefit from the combined use of the text (Rudin) and the *Companion Notes* first read the section of interest as offered in Rudin, then work through the relevant section or sections in the *Companion Notes*, and follow that by a more interactive review of the section from Rudin with which you started.

One thing that should be quite noticeable is the higher level of detail that is offered for many of the proofs. This was done largely in response to our campus prerequisite for the course. Because most students would have had only a brief exposure to some of the foundational material, a very deliberate attempt has been made to demonstrate how the prerequisite material that is usually learned in an introduction to abstract mathematics course is directly applied to the development of mathematical analysis. You always have the elegant, "no nonsense" approach available in the text. Learn to pick and choose the level of detail that you need according to your own personal mathematical needs.

0.0.1 About the Organization of the Material

The chapters and sections of the *Companion Notes* are not identically matched with their counterparts in the text. For example, the material related to Rudin's Chapter 1 can be found in Chapter 1, Chapter 2 and the beginning of Chapter 3 of the *Companion Notes*. There are also instances of topic coverage that haven't made it into the *Companion Notes;* the exclusions are due to course timing constraints and not statements concerning importance of the topics.

0.0.2 About the Errors

Of course, there are errors! In spite of my efforts to correct typos and adjust errors as they have been reported to me by my students, I am sure that there are more errors to be found and I hope for the assistance of students who find things that look like errors as they work through the notes. If you encounter errors or things that look like errors, please sent me a brief email indicating the nature of the problem. My email address is emsilvia@math.ucdavis.edu. Thank you in advance for any comments, corrections, and/or insights that you decide to share.