

Preface

The text is intended to form a bridge between calculus and analysis. It is based on the author's lecture notes, notes used and revised nearly every year over the last decade or so. The students typically were a mixture of students intending to go on to graduate work in mathematics and students intending to teach mathematics in grades 9–12. The later students typically only take the first semester of the two semester sequence. In order to cover the material, the prospective teachers might need to teach one variable calculus in high school; the text is designed to comfortably allow coverage of the standard calculus topics including the Fundamental Theorem of Calculus in the first semester. The material needed to prepare the remaining students for a graduate level Real Analysis course can comfortably be covered in the second semester.

To learn something new, for example, some mathematical topic or a foreign language, requires exposure to many examples, practice, and the passage of time. To quote one of the famous mathematicians of the twentieth century:

"... in mathematics you don't understand things. You just get used to them." – John Von Neumann

Hence, to help the reader learn from the text, the text includes many examples and a variety of interesting applications are included, several dealing with surprising properties of irrational numbers. The applications include some of the “jewels” of analysis, for example, e is transcendental, π is irrational, a space filling curve, and examples of nowhere differentiable continuous functions. Many of the applications are not standard, but of interest to the students. There are exercises embedded in the text and problem sections at the end of each chapter. The exercises in the text are intended to slow the reader down and allow immediate engagement with some aspect of the material being discussed. Essential ideas related to limits and continuity are treated early and revisited in greater depth later. Topics are broken into small easily digestible modules containing detailed explanations. Brief biographical material is included for many of the mathematicians who contributed to the development of the subject.

The text is basically a one variable treatment, in many places this variable is a complex variable. Using a complex variables (i) places emphasis on the triangle inequality, hence aids in the transition to more advanced analysis courses, (ii) keeps the level of abstraction at the same level as the standard one variable treatment, and (iii) some two (real) variable topics are easily accessible.

From Calculus to Analysis

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