

Introduction

Calculus has been widely applied to an incredible number of disciplines since its inception in the seventeenth century. In particular, the marvelous Maxwell equations revealed the laws that govern electric and magnetic fields, which led to the forecasting of the existence of the electromagnetic waves. The industrial revolution witnessed the many applications of calculus. The power of calculus never diminishes, even in today's scientific world. For this reason, there is no doubt that calculus is one of the most important courses for undergraduate students at any university in the world.

On the other hand, during the past century, especially since the 2000s, many Chinese and other non-English speaking people have gone to English speaking countries to further their studies, and more are on their way. Also, as global cooperations and communications become important for people to tackle big problems, there are needs for people to know and understand each other better. Fortunately, Sichuan University has a long history of global connections. Its summer immersion program is well known for its size and popularity. Each year, it sends and hosts thousands of students from different parts of the world. We believe that there are other similar situations where students come and go to different places or countries without disrupting their studies. For those students, a suitable textbook is helpful.

However, there are many challenges in developing such a suitable book. First of all, for most freshmen whose English is not their first language, the textbook should employ English as plain as possible. Second, the textbook should take into account what students have learned in high school and what they need in a calculus course. Third, there must be a smooth transition from the local standards to those globally accepted. Furthermore, such a book must have some new insights to inject new energy into the many already existing texts. This includes, but is not limited to, addressing discovery over rote learning; being as concise as possible while covering the essential content required by most local and global universities; and being printed in color as most texts in English are. The book *Single Variable Calculus: A First Step*, which was the first such calculus text in China, has provided a response to these challenges since it was published by the World Publishing Company in 2015 and by De Gruyter in 2018. The present book, *Multivariable calculus: a first step*, makes sure that these efforts continue.

With more than 10 years in teaching calculus courses to students at the Wu Yuzhang honors college at Sichuan University, I have had the chance to work with local students using books and resource materials in English. We adopted or referred students to many calculus books, for example *Thomas' Calculus*, 10th edition, by Finney, Weir, and Giordano; *Calculus*, 5th edition, by Stewart; *Calculus*, by Larson, Edwards, and Hostetler; *Calculus: Ideas and Applications*, by Hannonas and Howard; *Calculus: Early Transcendentals*, 2nd edition, by Briggs, Cochran, and Gillett; and other books in

Chinese, including the calculus books published by the Mathematics departments at Sichuan University and Tongji University. They are all good textbooks, and I acknowledge that I was inspired much by them, not only by their structure that builds the contents, but also by the nice problems that enhance understanding. Most of the exercises in this text were developed over the past decade. My many teaching assistants contributed a lot by helping create or collecting resources in the past years. Among them are Zengbao Wu, Liang Li, Mengxin Li, Bo Qian, Xi Zhu, and Yang Yang. Most of the exercises were inspired by the books mentioned before. Some are original, while others we think original may be similar to those found in existing books or other resources. Those are usually classic problems and can be found in many places.

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We have been working hard on this version; however, there might still be typos and even mistakes. The responsibility for those errors in this book lie entirely with me. I will be happy to receive comments and feedback anytime whenever they arise. I can be reached via zouyz@scu.edu.cn.

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