

# Calculus with Sage

Main Author : Sang-Gu Lee

Co-Authors : Eung-Ki Kim, Yoonmee Ham, Ajit Kumar, Robert A. Beezer, Jae-Dong Sim, Phong Vu, S.-G. Hwang, Bong-Soo Jang, ...  
(not more than 10)

Reviewers : R. Sakthivel, K. Das, I. Hwang, J. Lee, ...



# Preface

Calculus is the mathematical foundation for much of university mathematics, science, and engineering curriculum. For the mathematics student, it is a first exposure to rigorous mathematics. For the engineer, it is an introduction to the modeling and approximation techniques used throughout an engineering curriculum. And for the future scientist, it is the mathematical language that will be used to express many of the most important scientific concepts.

In the first semester, that is for the beginners of calculus, we start with differential and integral calculus on functions of single variable and then study L'Hospital's theorem, concavity, convexity, inflection points, optimization problems, ordinary differential equations as applications of differential and integral calculus, parameter equations, polar coordinates, infinite sequences and infinite series accordingly. In the second semester of calculus, we cover vector calculus that includes vectors, coordinate space, partial derivatives and multiple integrals. Concepts, definitions, terminology, and interpretation in calculus should be as current as possible. This book has many problems presenting calculus as the foundation of modern mathematics, science and engineering.

Many recent calculus textbooks are using Computer Algebra System (CAS) including a variety of visual tools in it. But in most cases its use by students is limited. Therefore, for this book, we have adapted a wonderful free and open-source program, Sage. With the new learning environment of universities, students will take a full advantage of 21st century, state of the art technology to learn calculus easily and be better prepared for future careers. We can use Sage easily on popular web browsers such as Firefox or Chrome. The system language for Sage is Python, a powerful mainstream computer programming language.

More content and related materials will be added to be viewed on the web. When you see a CAS or web mark in the book, this means you will be able to find relevant information by clicking on the <http://math1.skku.ac.kr/> address. This will save you a lot of work.

Finally, the book also combines technology, reform, and tradition in a way that offers a wider view to students. Most importantly, we appreciate everyone who has contributed to the project of writing this book.

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References

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## Internet resources :

- **Sage-Reference:** <http://matrix.skku.ac.kr/2009-Sage/Sage-Reference.html>
- **Sage** Tutorial:  
[http://www.youtube.com/watch?v=GJcym7gMKrg&feature=results\\_main&playnext=1&list=PL9168C6B83FE306CE](http://www.youtube.com/watch?v=GJcym7gMKrg&feature=results_main&playnext=1&list=PL9168C6B83FE306CE)
- **2011-How to use Sage 1:** <http://matrix.skku.ac.kr/2011-Album/Sage-02.html>
- **2011-How to use Sage 2:** <http://matrix.skku.ac.kr/2010-Album/Math-talk-Sage.html>
- **2011-How to use Sage 3:** <http://matrix.skku.ac.kr/2011-Album/Sage-01.html>
- **William Stein demos sage math:** [http://www.youtube.com/watch?v=kIQZU\\_uZGlc](http://www.youtube.com/watch?v=kIQZU_uZGlc)
- **2011-Mobile Math with Sage:** <http://matrix.skku.ac.kr/2011-Sage/2011-Mobile-Math/MobileMath.html>
- **Sage Interact / ODE and Mandelbrot:** [http://www.youtube.com/watch?v=\\_258y4kMYyQ](http://www.youtube.com/watch?v=_258y4kMYyQ)
- **Sage Multivariable Calculus (1 of 2) by Travis:** <http://www.youtube.com/watch?v=rqACCzGYOm8>
- **Sage Multivariable Calculus (2 of 2) by Travis:** <http://www.youtube.com/watch?v=SwgFWKK0oCg>
- <http://bkmath.skku.ac.kr/bk21/index.html>
- <http://matrix.skku.ac.kr/sglee>

<http://matrix.skku.ac.kr/2013-Calculus-Sage/Cal-lab-0-3/cal-lab-ch0to3.htm>



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