

海外优秀数学类教材系列丛书

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# Thomas' CALCULUS

(Eleventh Edition)

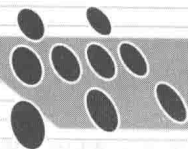
## 托马斯微积分 (第11版)

(上册)

- WEIR
- HASS
- GIORDANO



高等教育出版社



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# Thomas' CALCULUS

(Eleventh Edition)

## 托马斯微积分 (第11版)(上册)

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2014年2月

# PREFACE

**OVERVIEW** In preparing the eleventh edition of *Thomas' Calculus*, we have worked to capture the style and strengths of earlier editions. Our goal has been to revisit the best features of the *Thomas' Calculus* classic editions while listening carefully to the suggestions of our many users and reviewers. With these high standards in mind, we have reconstructed the exercises and clarified some difficult topics. In the words of George Thomas, "(We) have tried to write the book as clearly and precisely as is possible." In addition, we have restructured the contents to be more logical and in alignment with the standard syllabus. In looking backward, we have learned much to help us create a useful and appealing calculus text for the next generation of engineers and scientists.

In the eleventh edition the text introduces students not just to the methods and applications of calculus, but also to a mathematical way of thinking. From the exercises to the examples to the narrative that develops the concepts and reveals the theory in readable language, this book is about thinking and communicating mathematical ideas. Calculus contains many of the key paradigms of mathematics, and it marks the real beginnings of how to think about physical and mathematical subjects in a precise and logical way. We try to help students achieve the mathematical maturity required to master the material and apply its power. The insights that come from a deep understanding are well worth the effort.

After completing this book, students should be well versed in the mathematical language needed for applying the concepts of calculus to numerous applications in science and engineering. They should also be well prepared for courses in differential equations, linear algebra, or advanced calculus.

## Changes for the Eleventh Edition

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**EXERCISES** Exercises and examples play a crucial role in learning calculus. We have included in this new edition many of the exercises that appeared in previous editions of *Thomas' Calculus*, and which constituted a great strength of those editions. Within each section we have organized and grouped the exercises by topic, progressing from computational problems to applied and theoretical problems. This arrangement gives students the opportunity to develop skills in using the methods of calculus and to deepen their appreciation and understanding of its applications and coherent mathematical structure.

**RIGOR** The level of rigor, while comparable to earlier editions, is more consistent throughout. We give both formal and informal discussions, making clear the distinction between the two, and we include precise definitions and accessible proofs for the students.



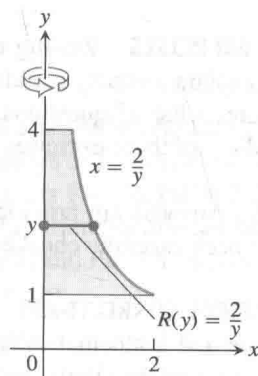
The text is organized so the material can be covered informally, giving the instructor a degree of flexibility. For example, while we do not prove that a continuous function on a closed and bounded interval has a maximum there, we do state this theorem carefully and use it to prove several subsequent results. Moreover, the chapter on limits has been substantially reorganized, with greater attention to both clarity and precision. As in previous editions, the limit concept is still motivated by the important idea of obtaining the slope of the line tangent to a curve at a point on it.

**CONTENT** During the preparation of this edition, we have paid considerable attention to the suggestions and comments from users of previous *Thomas' Calculus* editions and from our reviewers. This has resulted in extensive revisions and changes to several chapters.

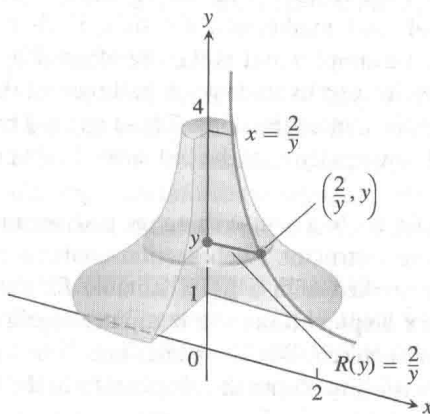
- **Preliminaries** We have rewritten Chapter 1 as a brief review of the elementary functions. While many instructors may choose to skip the chapter, it allows for easy reference and review by the student, standardizes notation, and indicates what is assumed as background material. It also contains some helpful material that many students may not have seen, such as the pitfalls of relying entirely on a calculator or computer to give the graph of a function.
- **Limits** Included in Chapter 2 are epsilon-delta definitions, proofs of many theorems, limits at infinity and infinite limits (and their relationship to asymptotes of a graph).
- **Antiderivatives** We present the derivative and its important applications in Chapters 3 and 4, concluding with the antiderivative concept, which sets the stage for integration.
- **Integration** After discussing several examples of finite sums, we introduce in Chapter 5 the definite integral in its traditional setting of the area under a curve. Following the treatment of the Fundamental Theorem of Calculus, bridging derivatives and antiderivatives, we present the indefinite integral, along with the Substitution Rule for integration. The traditional chapter on applications of definite integrals follows.
- **Techniques of integration** The main techniques of integration, including numerical integration, are presented in Chapter 8. This follows the introduction of the transcendental functions, where we define the natural logarithm as an integral and the exponential function as its inverse.
- **Differential equations** The bulk of the material on solving basic differential equations is now organized into a single Chapter 9. This organization allows for greater instructor flexibility in the coverage of those topics.
- **Conics** At the request of many users, Chapter 10 on the conic sections has been fully restored. This chapter also completes the material on parametric equations by giving parametrizations of parabolas, hyperbolas, and cycloids.
- **Series** In Chapter 11 we have restored the more complete development of the series' convergence tests that appeared in the ninth edition. We also include a brief section introducing Fourier series (which may be omitted) at the end of the chapter.
- **Vectors** To avoid repetition of the central algebraic and geometric ideas, we have combined the treatment of two- and three-dimensional vectors into a single Chapter 12. This presentation is followed by a chapter on vector-valued functions in the plane and in space.
- **The real numbers** We have written a brief new appendix on the theory of real numbers as it applies to calculus.

**ART** We realize that figures and illustrations are a critical component to learning calculus, so we have taken a fresh look at all of the figures in the book. When revising existing figures and creating new ones, we worked to improve the clarity with which the figures illustrate their associated concepts. This is especially evident with the three-dimensional graphics, where we were able to better indicate depth, layering, and rotation (see figures below). We also attempted to ensure a consistent and pedagogical use of color and assembled a team dedicated to proofreading the completed pieces.

**FIGURE 6.11, page 402**  
 Finding the volume of the solid generated by revolving the region (a) about the  $y$ -axis.

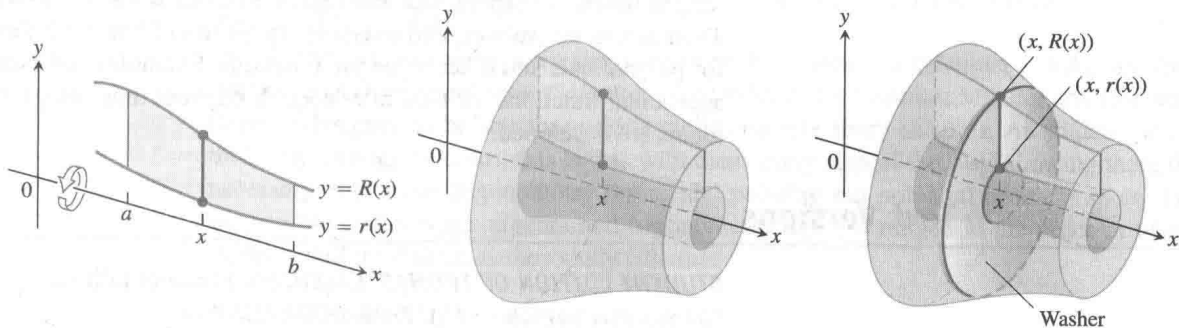


(a)



(b)

**FIGURE 6.13, page 403**  
 The cross-sections of the solid of revolution generated here are washers, not disks.



## Continuing Features

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**END-OF-CHAPTER REVIEWS AND PROJECTS** In addition to problems appearing after each section, each chapter culminates with review questions, practice exercises covering the entire chapter, and a series of Additional and Advanced Exercises serving to include more challenging or synthesizing problems. Most chapters also include descriptions of several student projects that can be worked on by individual students, or groups of students, over a longer period of time. These projects require the use of a computer and additional material that is available over the Internet at [www.aw-bc.com/thomas](http://www.aw-bc.com/thomas).

**WRITING EXERCISES** Writing exercises placed throughout the text ask students to explore and explain a variety of calculus concepts and applications. In addition, each chapter end contains a list of questions for students to review and summarize what they have learned. Many of these exercises make good writing assignments.

**ANSWERS** Answers are provided for all odd-numbered exercises when appropriate, and these have been carefully checked for correctness.

**MATHEMATICAL CORRECTNESS** As in previous editions, we have been careful to say only what is true and mathematically sound. Every definition, theorem, corollary, and proof has been reviewed for clarity and mathematical correctness.

**WRITING AND APPLICATIONS** As always, this text continues to be easy to read, conversational, and mathematically rich. Each new topic is motivated by clear, easy-to-understand examples and is then reinforced by its application to real-world problems of immediate interest to students. A hallmark of this book has been the application of calculus to science and engineering. These applied problems have been updated, improved, and extended continually over the last several editions.

**TECHNOLOGY** In a course using the text, technology can be incorporated according to the taste of the instructor. Each section contains exercises requiring the use of technology; these are marked with a **T** if suitable for calculator or computer usage or are labeled **Computer Explorations** if a computer algebra system (CAS, such as *Maple* or *Mathematica*) is required. While we continue to provide support for technology, we have toned down its visibility within the chapters from the tenth edition.

**EARLY TRANSCENDENTALS** For instructors who require an earlier treatment of the calculus of transcendental functions, we have prepared an *Early Transcendentals* version of this text, in which the exponential and logarithmic functions are introduced in the first chapter. Their limits, derivatives, and integrals are given in Chapters 2 through 5, along with those for polynomials and other algebraic functions. Examples and exercises involving the transcendental functions are then interlaced throughout those chapters as the various calculus topics are developed.

## Text Versions

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**STUDENT EDITION OF THOMAS' CALCULUS**, Eleventh Edition

Complete (Chapters 1–16), ISBN 0-321-18558-7

Part One, Single Variable Calculus (Chapters 1–11), ISBN 0-321-22642-9

Part Two, Multivariable Calculus (Chapters 11–16), ISBN 0-321-22651-8



**STUDENT EDITION OF THOMAS' CALCULUS: EARLY TRANSCENDENTALS**, Eleventh Edition Complete (Chapters 1–16), ISBN 0-321-19800-X  
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Part Two, Multivariable Calculus (Chapters 11–16), ISBN 0-321-22651-8  
The *Early Transcendentals* version of *Thomas' Calculus* introduces and integrates transcendental functions (such as inverse trigonometric, exponential, and logarithmic functions) into the exposition, examples, and exercises of the early chapters alongside the algebraic functions. Part Two for *Thomas' Calculus: Early Transcendentals* is the same text as Part Two for *Thomas' Calculus*.

## Print Supplements

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### **INSTRUCTOR'S SOLUTIONS MANUAL**

Part One (Chapters 1–11), ISBN 0-321-22653-4

Part Two (Chapters 11–16), ISBN 0-321-22650-X

The *Instructor's Solutions Manual* by William Ardis, Joseph Borzellino, Linda Buchanan, Alexis T. Mogill, and Patricia Nelson contains complete worked-out solutions to all of the exercises in the text.

### **ANSWER BOOK**

ISBN 0-321-22649-6

The *Answer Book* by William Ardis, Joseph Borzellino, Linda Buchanan, Alexis T. Mogill, and Patricia Nelson contains short answers to most of the exercises in the text.

### **STUDENT OUTLINES**

Part One (Chapters 1–11), ISBN 0-321-22640-2

Part Two (Chapters 11–16), ISBN 0-321-22641-0

Organized to correspond to the text, the *Student Outlines* by Joseph Borzellino and Patricia Nelson reinforces important concepts and provides an outline of the important topics, theorems, and definitions, as well as study tips and additional practice problems.

### **STUDENT'S SOLUTIONS MANUAL**

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The *Student's Solutions Manual* by William Ardis, Joseph Borzellino, Linda Buchanan, Alexis T. Mogill, and Patricia Nelson is designed for the student and contains carefully worked-out solutions to all the odd-numbered exercises in the text.

### **JUST-IN-TIME ALGEBRA AND TRIGONOMETRY FOR CALCULUS**, Third Edition

ISBN 0-321-26943-8

Sharp algebra and trigonometry skills are critical to mastering calculus, and *Just-in-Time Algebra and Trigonometry for Calculus*, Third Edition, by Guntram Mueller and Ronald I. Brent is designed to bolster these skills while students study calculus. As students make their way through calculus, this text is with them every step of the way, showing them the necessary algebra or trigonometry topics and pointing out potential problem spots. The easy-to-use contents has algebra and trigonometry topics arranged in the order in which students will need them as they study calculus.

### **ADDISON-WESLEY'S CALCULUS REVIEW CARD**

The Calculus Review Card is a resource for students containing important formulas, functions, definitions, and theorems that correspond precisely to *Thomas' Calculus*. This card

can work as a reference for completing homework assignments or as an aid in studying and is available bundled with a new text. Contact your Addison-Wesley sales representative for more information.

## Media and Online Supplements

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### **TECHNOLOGY RESOURCE MANUALS**

*Maple Manual* by Donald Hartig, California Polytechnic State University

*Mathematica Manual* by Marie Vanisko, California State University Stanislaus, and Lyle Cochran, Whitworth College

*TI-Graphing Calculator Manual* by Luz DeAlba, Drake University

These manuals cover *Maple* 9, *Mathematica* 5, and the TI-83 Plus/TI-84 Plus, TI-85/TI-86, and TI-89/TI-92 Plus, respectively. Each manual provides detailed guidance for integrating a specific software package or graphing calculator throughout the course, including syntax and commands. These manuals are available to qualified instructors through <http://suppscentral.aw.com>.

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#### **WebWork®**

WebWorK is an Internet-based method for delivering homework problems to students online. It automatically grades homework and provides immediate feedback, allowing students to correct mistakes while they are still working on the problem. WebWorK works with personal computers using any recent operating system and browser.

#### **TESTGEN WITH QUIZMASTER**

TestGen enables instructors to build, edit, print, and administer tests using a computerized bank of questions developed to cover all the objectives of the text. TestGen is algorithmically based, allowing instructors to create multiple but equivalent versions of the same question or test with the click of a button. Instructors can also modify test bank questions or add new questions by using the built-in question editor, which allows users to create graphs, import graphics, and insert math notation, variable numbers, or text. Tests can be printed or administered online via the Internet or another network. TestGen comes packaged with QuizMaster, which allows students to take tests on a local area network. The software is available on a dual-platform Windows/Macintosh CD-ROM.

#### **DIGITAL VIDEO TUTOR**

The Digital Video Tutor features an engaging team of mathematics instructors who present comprehensive coverage of topics in the text. The lecturers' presentations include examples and exercises from the text and support an approach that emphasizes visualization and problem solving. The video lectures are available on CD-ROM, making it easy and convenient for students to watch the videos from a computer at home or on campus. The complete digitized video set, affordable and portable for students, is ideal for distance learning or supplemental instruction.

#### **WEB SITE [www.aw-bc.com/thomas](http://www.aw-bc.com/thomas)**

The *Thomas' Calculus* Web site provides the expanded historical biographies and essays referenced in the text. Also available is a collection of *Maple* and *Mathematica* modules that can be used as projects by individual students or groups of students.

#### **ADDISON-WESLEY MATH TUTOR CENTER**

The Addison-Wesley Math Tutor Center is staffed by qualified mathematics and statistics instructors who provide students with tutoring on examples and odd-numbered exercises from the textbook. Tutoring is available via toll-free telephone, toll-free fax, e-mail, and the Internet. Interactive, Web-based technology allows tutors and students to view and work through problems together in real time over the Internet. The Addison-Wesley Math Tutor Center is available to qualified adopters. For more information, please visit our Web site at [www.aw-bc.com/tutorcenter](http://www.aw-bc.com/tutorcenter) or call us at 1-888-777-0463.

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