Preface

The third edition of *Calculus: Early Transcendentals* supports a three-semester or four-quarter calculus sequence typically taken by students studying mathematics, engineering, the natural sciences, or economics. The third edition has the same goals as the first edition:

- to motivate the essential ideas of calculus with a lively narrative, demonstrating the utility of calculus with applications in diverse fields;
- to introduce new topics through concrete examples, applications, and analogies, appealing to students' intuition and geometric instincts to make calculus natural and believable; and
- once this intuitive foundation is established, to present generalizations and abstractions and to treat theoretical matters in a rigorous way.

The third edition both builds on the success of the previous two editions and addresses the feedback we have received. We have listened to and learned from the instructors who used the text. They have given us wise guidance about how to make the third edition an even more effective learning tool for students and a more powerful resource for instructors. Users of the text continue to tell us that it mirrors the course they teach—and, more important, that students actually read it! Of course, the third edition also benefits from our own experiences using the text, as well as from our experiences teaching mathematics at diverse institutions over the past 30 years.

New to the Third Edition

Exercises

The exercise sets are a major focus of the revision. In response to reviewer and instructor feedback, we've made some significant changes to the exercise sets by rearranging and relabeling exercises, modifying some exercises, and adding many new ones. Of the approximately 10,400 exercises appearing in this edition, 18% are new, and many of the exercises from the second edition were revised for this edition. We analyzed aggregated student usage and performance data from MyLab™ Math for the previous edition of this text. The results of this analysis helped us improve the quality and quantity of exercises that matter the most to instructors and students. We have also simplified the structure of the exercises sets from five parts to the following three:

1. **Getting Started** contains some of the former Review Questions but goes beyond those to include more conceptual exercises, along with new basic skills and short-answer exercises. Our goal in this section is to provide an excellent overall assessment of understanding of the key ideas of a section.
2. **Practice Exercises** consist primarily of exercises from the former Basic Skills, but they also include intermediate-level exercises from the former Further Explorations and Application sections. Unlike previous editions, these exercises are not necessarily organized into groups corresponding to specific examples. For instance, instead of separating out Product Rule exercises from Quotient Rule exercises in Section 3.4, we

have merged these problems into one larger group of exercises. Consequently, specific instructions such as "Use the Product Rule to find the derivative of the following functions" and "Use the Quotient Rule to find the derivative of the given functions" have been replaced with the general instruction "Find the derivative of the following functions." With Product Rule and Quotient Rule exercises mixed together, students must first choose the correct method for evaluating derivatives before solving the problems.

3. **Explorations and Challenges** consist of more challenging problems and those that extend the content of the section.

We no longer have a section of the exercises called "Applications," but (somewhat ironically) in eliminating this section, we feel we are providing better coverage of applications because these exercises have been placed strategically *throughout the exercise sets.* Some are in Getting Started, most are in Practice Exercises, and some are in Explorations and Challenges. The applications nearly always have a boldface heading so that the topic of the application is readily apparent.

Regarding the boldface heads that precede exercises: These heads provide instructors with a quick way to discern the topic of a problem when creating assignments. We heard from users of earlier editions, however, that some of these heads provided too much guidance in how to solve a given problem. In this edition, therefore, we eliminated or reworded run-in heads that provided too much information about the solution method for a problem.

Finally, the **Chapter Review exercises** received a major revamp to provide more exercises (particularly intermediate-level problems) and more opportunities for students to choose a strategy of solution. More than 26% of the Chapter Review exercises are new.

Content Changes

Below are noteworthy changes from the previous edition of the text. Many other detailed changes, not noted here, were made to improve the quality of the narrative and exercises. Bullet points with a icon represent major content changes from the previous edition.

Chapter 1 Functions

- Example 2 in Section 1.1 was modified with more emphasis on using algebraic techniques to determine the domain and range of a function. To better illustrate a common feature of limits, we replaced part (c) with a rational function that has a common factor in the numerator and denominator.
- Examples 7 and 8 in Section 1.1 from the second edition (2e) were moved forward in the narrative so that students get an intuitive feel for the composition of two functions using graphs and tables; compositions of functions using algebraic techniques follow.
- Example 10 in Section 1.1, illustrating the importance of secant lines, was made more relevant to students by using real data from a GPS watch during a hike. Corresponding exercises were also added.
- Exercises were added to Section 1.3 to give students practice at finding inverses of functions using the properties of exponential and logarithmic functions.
- New application exercises (investment problems and a biology problem) were added to Section 1.3 to further illustrate the usefulness of logarithmic and exponential functions.

Chapter 2 Limits

- Example 4 in Section 2.2 was revised, emphasizing an algebraic approach to a function with a jump discontinuity, rather than a graphical approach.
- Theorems 2.3 and 2.13 were modified, simplifying the notation to better connect with upcoming material.
- Example 7 in Section 2.3 was added to solidify the notions of left-, right-, and two-sided limits.
- The material explaining the end behavior of exponential and logarithmic functions was reworked, and Example 6 in Section 2.5 was added to show how substitution is used in evaluating limits.
- Exercises were added to Section 2.5 to illustrate the similarities and differences between limits at infinity and infinite limits. We also included some easier exercises in Section 2.5 involving limits at infinity of functions containing square roots.
- Example 5 in Section 2.7 was added to demonstrate an epsilon-delta proof of a limit of a quadratic function.
- We added 17 epsilon-delta exercises to Section 2.7 to provide a greater variety of problems involving limits of quadratic, cubic, trigonometric, and absolute value functions.

Chapter 3 Derivatives

- Chapter 3 now begins with a look back at average and instantaneous velocity, first encountered in Section 2.1, with a corresponding revised example in Section 3.1.
- The derivative at a point and the derivative as a function are now treated separately in Sections 3.1 and 3.2.
- After defining the derivative at a point in Section 3.1 with a supporting example, we added a new subsection: Interpreting the Derivative (with two supporting examples).
- Several exercises were added to Section 3.3 that require students to use the Sum and Constant Rules, together with geometry, to evaluate derivatives.
- The Power Rule for derivatives in Section 3.4 is stated for all real powers (later proved in Section 3.9). Example 4

in Section 3.4 includes two additional parts to highlight this change, and subsequent examples in upcoming sections rely on the more robust version of the Power Rule. The Power Rule for Rational Exponents in Section 3.8 was deleted because of this change.

- We combined the intermediate-level exercises in Section 3.4 involving the Product Rule and Quotient Rule together under one unified set of directions.
- The derivative of e^x still appears early in the chapter, but the derivative of e^{kx} is delayed; it appears only after the Chain Rule is introduced in Section 3.7.
- In Section 3.7, we deleted references to Version 1 and Version 2 of the Chain Rule. Additionally, Chain Rule exercises involving repeated use of the rule were merged with the standard exercises.
- In Section 3.8, we added emphasis on simplifying derivative formulas for implicitly defined functions; see Examples 4 and 5.
- Example 3 in Section 3.11 was replaced; the new version shows how similar triangles are used in solving a related-rates problem.

Chapter 4 Applications of the Derivative

- The Mean Value Theorem (MVT) was moved from Section 4.6 to 4.2 so that the proof of Theorem 4.7 is not delayed. We added exercises to Section 4.2 that help students better understand the MVT geometrically, and we included exercises where the MVT is used to prove some well-known identities and inequalities.
- Example 5 in Section 4.5 was added to give guidance on a certain class of optimization problems.
- Example 3b in Section 4.7 was replaced to better drive home the need to simplify after applying l'Hôpital's Rule.
- Most of the intermediate exercises in Section 4.7 are no longer separated out by the type of indeterminate form, and we added some problems in which l'Hôpital's Rule does not apply.
- Indefinite integrals of trigonometric functions with argument ax (Table 4.9) were relocated to Section 5.5, where they are derived with the Substitution Rule. A similar change was made to Table 4.10.
- Example 7b in Section 4.9 was added to foreshadow a more complete treatment of the domain of an initial value problem found in Chapter 9.
- We added to Section 4.9 a significant number of intermediate antiderivative exercises that require some preliminary work (e.g., factoring, cancellation, expansion) before the antiderivatives can be determined.

Chapter 5 Integration

- Examples 2 and 3 in Section 5.1 on approximating areas were replaced with a friendlier function where the grid points are more transparent; we return to these approximations in Section 5.3, where an exact result is given (Example 3b).
- Three properties of integrals (bounds on definite integrals) were added in Section 5.2 (Table 5.5); the last of these properties is used in the proof of the Fundamental Theorem (Section 5.3).
- Exercises were added to Sections 5.1 and 5.2 where students are required to evaluate Riemann sums using graphs or tables instead of formulas. These exercises will help students better understand the geometric meaning of Riemann sums.
- We added to Section 5.3 more exercises in which the integrand must be simplified before the integrals can be evaluated.
- A proof of Theorem 5.7 is now offered in Section 5.5.
- Table 5.6 lists the general integration formulas that were relocated from Section 4.9 to Section 5.5; Example 4 in Section 5.5 derives these formulas.

Chapter 6 Applications of Integration
Chapter 7 Logarithmic, Exponential, and Hyperbolic Functions

- Chapter 6 from the 2e was split into two chapters in order to match the number of chapters in *Calculus* (Late Transcendentals). The result is a compact Chapter 7.
- Exercises requiring students to evaluate net change using graphs were added to Section 6.1.
- Exercises in Section 6.2 involving area calculations with respect to x and y are now combined under one unified set of directions (so that students must first determine the appropriate variable of integration).
- We increased the number of exercises in Sections 6.3 and 6.4 in which curves are revolved about lines other than the x- and y-axes. We also added introductory exercises that guide students, step by step, through the processes used to find volumes.
- A more gentle introduction to lifting problems (specifically, lifting a chain) was added in Section 6.7 and illustrated in Example 3, accompanied by additional exercises.
- The introduction to exponential growth (Section 7.2) was rewritten to make a clear distinction between the relative growth rate (or percent change) of a quantity and the rate constant k. We revised the narrative so that the equation $y = y_0e^{kt}$ applies to both growth and decay models. This revision resulted in a small change to the half-life formula.
- The variety of applied exercises in Section 7.2 was increased to further illustrate the utility of calculus in the study of exponential growth and decay.

Chapter 8 Integration Techniques

- Table 8.1 now includes four standard trigonometric integrals that previously appeared in the section Trigonometric Integrals (8.3); these integrals are derived in Examples 1 and 2 in Section 8.1.
- A new section (8.6) was added so that students can master integration techniques (that is, choose a strategy) apart from the context given in the previous five sections.
- In Section 8.5 we increased the number and variety of exercises where students must set up the appropriate form of the partial fraction decomposition of a rational function, including more with irreducible quadratic factors.
- A full derivation of Simpson's Rule was added to Section 8.8, accompanied by Example 7, additional figures, and an expanded exercise set.

- The Comparison Test for improper integrals was added to Section 8.9, accompanied by Example 7, a two-part example. New exercises in Section 8.9 include some covering doubly infinite improper integrals over infinite intervals.

Chapter 9 Differential Equations

- The chapter on differential equations that was available only online in the 2e was converted to a chapter of the text, replacing the single-section coverage found in the 2e.
- More attention was given to the domain of an initial value problem, resulting in the addition and revision of several examples and exercises throughout the chapter.

Chapter 10 Sequences and Infinite Series

- The second half of Chapter 10 was reordered: Comparison Tests (Section 10.5), Alternating Series (Section 10.6, which includes the topic of absolute convergence), The Ratio and Root Tests (Section 10.7), and Choosing a Convergence Test (Section 10.8; new section). We split the 2e section that covered the comparison, ratio, and root tests to avoid overwhelming students with too many tests at one time. Section 10.5 focuses entirely on the comparison tests; 39% of the exercises are new. The topic of alternating series now appears before the Ratio and Root Tests so that the latter tests may be stated in their more general form (they now apply to any series rather than only to series with positive terms). The final section (10.8) gives students an opportunity to master convergence tests after encountering each of them separately.
- The terminology associated with sequences (10.2) now includes *bounded above, bounded below,* and *bounded* (rather than only *bounded,* as found in earlier editions).
- Theorem 10.3 (Geometric Sequences) is now developed in the narrative rather than within an example, and an additional example (10.2.3) was added to reinforce the theorem and limit laws from Theorem 10.2.
- Example 5c in Section 10.2 uses mathematical induction to find the limit of a sequence defined recursively; this technique is reinforced in the exercise set.
- Example 3 in Section 10.3 was replaced with telescoping series that are not geometric and that require re-indexing.
- We increased the number and variety of exercises where the student must determine the appropriate series test necessary to determine convergence of a given series.
- We added some easier intermediate-level exercises to Section 10.6, where series are estimated using nth partial sums for a given value of n.
- Properties of Convergent Series (Theorem 10.8) was expanded (two more properties) and moved to Section 10.3 to better balance the material presented in Sections 10.3 and 10.4. Example 4 in Section 10.3 now has two parts to give students more exposure to the theorem.

Chapter 11 Power Series

- Chapter 11 was revised to mesh with the changes made in Chapter 10.
- We included in Section 11.2 more exercises where the student must find the radius and interval of convergence.
- Example 2 in Section 11.3 was added to illustrate how to choose a different center for a series representation of a function when the original series for the function converges to the function on only part of its domain.
- We addressed an issue with the exercises in Section 11.2 of the previous edition by adding more exercises where the intervals of convergence either are closed or contain one, but not both, endpoints.
- We addressed an issue with exercises in the previous edition by adding many exercises that involve power series centered at locations other than 0.

Chapter 12 Parametric and Polar Curves

- The arc length of a two-dimensional curve described by parametric equations was added to Section 12.1, supported by two examples and additional exercises. Area and surfaces of revolution associated with parametric curves were also added to the exercises.
- In Example 3 in Section 12.2, we derive more general polar coordinate equations for circles.
- The arc length of a curve described in polar coordinates is given in Section 12.3.

Chapter 13 Vectors and the Geometry of Space

- The material from the 2e chapter Vectors and Vector-Valued Functions is now covered in this chapter and the following chapter.
- Example 5c in Section 13.1 was added to illustrate how to express a vector as a product of its magnitude and its direction.
- We increased the number of applied vector exercises in Section 13.1, starting with some easier exercises, resulting in a wider gradation of exercises.
- We adopted a more traditional approach to lines and planes; these topics are now covered together in Section 13.5, followed by cylinders and quadric surfaces in Section 13.6. This arrangement gives students early exposure to all the basic three-dimensional objects that they will encounter throughout the remainder of the text.
- A discussion of the distance from a point to a line was moved from the exercises into the narrative, supported with Example 3 in Section 13.5. Example 4 finds the point of intersection of two lines. Several related exercises were added to this section.
- In Section 13.6 there is a larger selection of exercises where the student must identify the quadric surface associated with a given equation. Exercises are also included where students design shapes using quadric surfaces.

Chapter 14 Vector-Valued Functions

- More emphasis was placed on the surface(s) on which a space curve lies in Sections 14.1 and 14.3.

- We added exercises in Section 14.1 where students are asked to find the curve of intersection of two surfaces and where students must verify that a curve lies on a given surface.
- Example 3c in Section 14.3 was added to illustrate how a space curve can be mapped onto a sphere.
- Because the arc length of plane curves (described parametrically in Section 12.1 and with polar coordinates in Section 12.3) was moved to an earlier location in the text, Section 14.4 is now a shorter section.

Chapter 15 Functions of Several Variables

- Equations of planes and quadric surfaces were removed from this chapter and now appear in Chapter 13.
- The notation in Theorem 15.2 was simplified to match changes made to Theorem 2.3.
- Example 7 in Section 15.4 was added to illustrate how the Chain Rule is used to compute second partial derivatives.
- We added more challenging partial derivative exercises to Section 15.3 and more challenging Chain Rule exercises to Section 15.4.
- Example 7 in Section 15.5 was expanded to give students more practice finding equations of curves that lie on surfaces.
- Theorem 15.13 was added in Section 15.5; it's a three-dimensional version of Theorem 15.11.
- Example 7 in Section 15.7 was replaced with a more interesting example; the accompanying figure helps tell the story of maximum/minimum problems and can be used to preview Lagrange multipliers.
- We added to Section 15.7 some basic exercises that help students better understand the second derivative test for functions of two variables.
- Example 1 in Section 15.8 was modified so that using Lagrange multipliers is the clear path to a solution, rather than eliminating one of the variables and using standard techniques. We also make it clear that care must be taken when using the method of Lagrange multipliers on sets that are not closed and bounded (absolute maximum and minimum values may not exist).

Chapter 16 Multiple Integration

- Example 2 in Section 16.3 was modified because it was too similar to Example 1.
- More care was given to the notation used with polar, cylindrical, and spherical coordinates (see, for example, Theorem 16.3 and the development of integration in different coordinate systems).
- Example 3 in Section 16.4 was modified to make the integration a little more transparent and to show that changing variables to polar coordinates is permissible in more than just the xy-plane.
- More multiple integral exercises were added to Sections 16.1, 16.2, and 16.4, where integration by substitution or integration by parts is needed to evaluate the integrals.
- In Section 16.4 we added more exercises in which the integrals must first be evaluated with respect to x or y instead of z. We also included more exercises that require triple integrals to be expressed in several orderings.

Chapter 17 Vector Calculus

- Our approach to scalar line integrals was streamlined; Example 1 in Section 17.2 was modified to reflect this fact.
- We added basic exercises in Section 17.2 emphasizing the geometric meaning of line integrals in a vector field. A subset of exercises was added where line integrals are grouped so that the student must determine the type of line integral before evaluating the integral.
- Theorem 17.5 was added to Section 17.3; it addresses the converse of Theorem 17.4. We also promoted the area of a plane region by a line integral to theorem status (Theorem 17.8 in Section 17.4).
- Example 3 in Section 17.7 was replaced to give an example of a surface whose bounding curve is not a plane curve and to provide an example that buttresses the claims made at the end of the section (that is, Two Final Notes on Stokes' Theorem).
- More line integral exercises were added to Section 17.3 where the student must first find the potential function before evaluating the line integral over a conservative vector field using the Fundamental Theorem of Line Integrals.
- We added to Section 17.7 more challenging surface integrals that are evaluated using Stokes' Theorem.

New to MyLab Math

- **Assignable Exercises** To better support students and instructors, we made the following changes to the assignable exercises:
  - Updated the solution processes in Help Me Solve This and View an Example to better match the techniques used in the text.
  - Added more Setup & Solve exercises to better mirror the types of responses that students are expected to provide on tests. We also added a parallel "standard" version of each Setup & Solve exercise, to allow the instructor to determine which version to assign.
  - Added exercises corresponding to new exercises in the text.

- Added exercises where MyLab Math users had identified gaps in coverage in the 2e.
- Added extra practice exercises to each section (clearly labeled EXTRA). These "beyond the text" exercises are perfect for chapter reviews, quizzes, and tests.
- Analyzed aggregated student usage and performance data from MyLab Math for the previous edition of this text. The results of this analysis helped improve the quality and quantity of exercises that matter the most to instructors and students.

- **Instructional Videos** For each section of the text, there is now a new full-lecture video. Many of these videos make use of Interactive Figures to enhance student understanding of concepts. To make it easier for students to navigate to the specific content they need, each lecture video is segmented into shorter clips (labeled Introduction, Example, or Summary). Both the full lectures and the video segments are assignable within MyLab Math. The videos were created by the following team: Matt Hudelson (Washington State University), Deb Carney and Rebecca Swanson (Colorado School of Mines), Greg Wisloski and Dan Radelet (Indiana University of Pennsylvania), and Nick Ormes (University of Denver).
- **Enhanced Interactive Figures** Incorporating functionality from several standard Interactive Figures makes Enhanced Interactive Figures mathematically richer and ideal for in-class demonstrations. Using a single figure, instructors can illustrate concepts that are difficult for students to visualize and can make important connections to key themes of calculus.
- **Enhanced Sample Assignments** These section-level assignments address gaps in pre-calculus skills with a personalized review of prerequisites, help keep skills fresh with spaced practice using key calculus concepts, and provide opportunities to work exercises without learning aids so students can check their understanding. They are assignable and editable.
- **Quick Quizzes** have been added to Learning Catalytics™ (an in-class assessment system) for every section of the text.
- **Maple™, Mathematica®, and Texas Instruments® Manuals and Projects** have all been updated to align with the latest software and hardware.

Noteworthy Features

Figures

Given the power of graphics software and the ease with which many students assimilate visual images, we devoted considerable time and deliberation to the figures in this text. Whenever possible, we let the figures communicate essential ideas using annotations reminiscent of an instructor's voice at the board. Readers will quickly find that the figures facilitate learning in new ways.

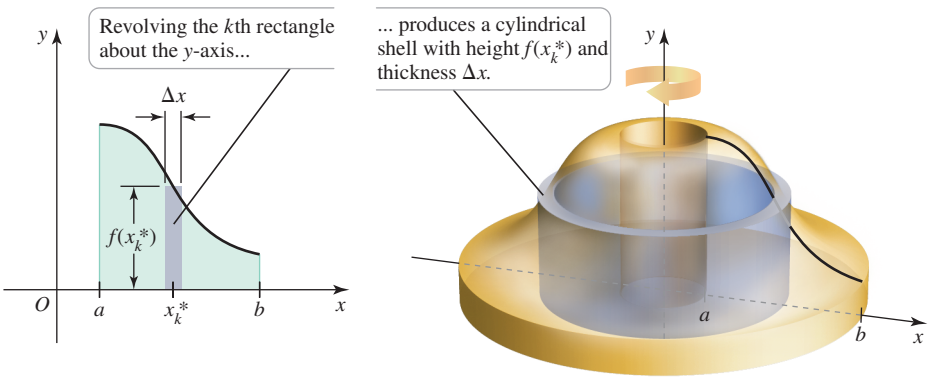


Figure 6.40

Annotated Examples

Worked-out examples feature annotations in blue to guide students through the process of solving the example and to emphasize that each step in a mathematical argument must be rigorously justified. These annotations are designed to echo how instructors "talk through" examples in lecture. They also provide help for students who may struggle with the algebra and trigonometry steps within the solution process.

Quick Checks

The narrative is interspersed with Quick Check questions that encourage students to do the calculus as they are reading about it. These questions resemble the kinds of questions instructors pose in class. Answers to the Quick Check questions are found at the end of the section in which they occur.

Guided Projects

MyLab Math contains 78 Guided Projects that allow students to work in a directed, step-by-step fashion, with various objectives: to carry out extended calculations, to derive physical models, to explore related theoretical topics, or to investigate new applications of calculus. The Guided Projects vividly demonstrate the breadth of calculus and provide a wealth of mathematical excursions that go beyond the typical classroom experience. A list of related Guided Projects is included at the end of each chapter.

Incorporating Technology

We believe that a calculus text should help students strengthen their analytical skills and demonstrate how technology can extend (not replace) those skills. Calculators and graphing utilities are additional tools in the kit, and students must learn when and when not to use them. Our goal is to accommodate the different policies regarding technology adopted by various instructors.

Throughout the text, exercises marked with T indicate that the use of technology—ranging from plotting a function with a graphing calculator to carrying out a calculation using a computer algebra system—may be needed. See page xx for information regarding our technology resource manuals covering Maple, Mathematica, and Texas Instruments graphing calculators.

Text Versions

- **eBook with Interactive Figures** The text is supported by a groundbreaking and award-winning electronic book created by Eric Schulz of Walla Walla Community College. This "live book" runs in Wolfram CDF Player (the free version of Mathematica) and contains the complete text of the print book plus interactive versions of approximately 700 figures. Instructors can use these interactive figures in the classroom to illustrate the important ideas of calculus, and students can explore them while they are reading the text. Our experience confirms that the interactive figures help build students' geometric intuition of calculus. The authors have written Interactive Figure Exercises that can be assigned via MyLab Math so that students can engage with the figures outside of class in a directed way. Available only within MyLab Math, the eBook provides instructors with powerful new teaching tools that expand and enrich the learning experience for students.
- **Other eBook Formats** The text is also available in various stand-alone eBook formats. These are listed in the Pearson online catalog: **www.pearson.com**. MyLab Math also contains an HTML eBook that is screen-reader accessible.
- **Other Print Formats** The text is also available in split editions (Single Variable [Chapters 1–12] and Multivariable [Chapters 10–17]) and in unbound (3-hole punched) formats. Again, see the Pearson online catalog for details: **www.pearson.com.**

Acknowledgments

We would like to express our thanks to the following people, who made valuable contributions to this edition as it evolved through its many stages.

Accuracy Checkers

Jennifer Blue

Lisa Collette

Nathan Moyer

Tom Wegleitner

Reviewers

Siham Alfred, *Germanna Community College*

Darry Andrews, *Ohio State University*

Pichmony Anhaouy, *Langara College*

Raul Aparicio, *Blinn College*

Anthony Barcellos, *American River College*

Rajesh K. Barnwal, *Middle Tennessee State University*

Susan Barton, *Brigham Young University, Hawaii*

Aditya Baskota, *Kauai Community College*

Al Batten, *University of Colorado, Colorado Springs*

Jeffrey V. Berg, *Arapahoe Community College*

Martina Bode, *University of Illinois, Chicago*

Kaddour Boukaabar, *California University of Pennsylvania*

Paul W. Britt, *Our Lady of the Lake College*

Steve Brosnan, *Belmont Abbey College*

Brendan Burns Healy, *Tufts University*

MK Choy, *CUNY Hunter College*

Nathan P. Clements, *University of Wyoming*

Gregory M. Coldren, *Frederick Community College*

Brian Crimmel, *U.S. Coast Guard Academy*

Robert D. Crise, Jr, *Crafton Hills College*

Dibyajyoti Deb, *Oregon Institute of Technology*

Elena Dilai, *Monroe Community College*

Johnny I. Duke, *Georgia Highlands College*

Fedor Duzhin, *Nanyang Technological University*

Houssein El Turkey, *University of New Haven*

J. Robson Eby, *Blinn College*

Amy H. Erickson, *Georgia Gwinnett College*

Robert A. Farinelli, *College of Southern Maryland*

Rosemary Farley, *Manhattan College*

Lester A. French, Jr, *University of Maine, Augusta*

Pamela Frost, *Middlesex Community College*

Scott Gentile, *CUNY Hunter College*

Stephen V. Gilmore, *Johnson C. Smith University*

Joseph Hamelman, *Virginia Commonwealth University*

Jayne Ann Harderq, *Oral Roberts University*

Miriam Harris-Botzum, *Lehigh Carbon Community College*

Mako Haruta, *University of Hartford*

Ryan A. Hass, *Oregon State University*

Christy Hediger, *Lehigh Carbon Community College*

Joshua Hertz, *Northeastern University*

Peter Hocking, *Brunswick Community College*

Farhad Jafari, *University of Wyoming*

Yvette Janecek, *Blinn College*

Tom Jerardi, *Howard Community College*

Karen Jones, *Ivy Tech Community College*

Bir Kafle, *Purdue University Northwest*

Mike Kawai, *University of Colorado, Denver*

Mahmoud Khalili, *Oakton Community College*

Lynne E. Kowski, *Raritan Valley Community College*

Tatyana Kravchuk, *Northern Virginia Community College*

Lorraine Krusinski, *Brunswick High School*

Frederic L. Lang, *Howard Community College*

Robert Latta, *University of North Carolina, Charlotte*

Angelica Lyubenko, *University of Colorado, Denver*

Darren E. Mason, *Albion College*

John C. Medcalf, *American River College*

Elaine Merrill, *Brigham Young University, Hawaii*

Robert Miller, *Langara College*

Mishko Mitkovski, *Clemson University*

Carla A. Monticelli, *Camden County College*

Charles Moore, *Washington State University*

Humberto Munoz Barona, *Southern University*

Clark Musselman, *University of Washington, Bothell*

Glenn Newman, *Newbury College*

Daniela Nikolova-Popova, *Florida Atlantic University*

Janis M. Oldham, *North Carolina A&T State University*

Byungdo Park, *CUNY Hunter College*

Denise Race, *Eastfield College*

Hilary Risser, *Montana Tech*

Sylvester Roebuck, *Jr, Olive Harvey College*

John P. Roop, *North Carolina A&T State University*

Paul N. Runnion, *Missouri University of Science and Technology*

Kegan Samuel, *Middlesex Community College*

Steve Scarborough, *Oregon State University*

Vickey Sealy, *West Virginia University*

Ruth Seidel, *Blinn College*

Derek Smith, *Nashville State Community College*

James Talamo, *Ohio State University*

Yan Tang, *Embry-Riddle Aeronautical University*

Kye Taylor, *Tufts University*

Daniel Triolo, *Lake Sumter State College*

Cal Van Niewaal, *Coe College*

Robin Wilson, *California Polytechnic State University, Pomona*

Kurt Withey, *Northampton Community College*

Amy Yielding, *Eastern Oregon University*

Prudence York-Hammons, *Temple College*

Bradley R. Young, *Oakton Community College*

Pablo Zafra, *Kean University*

The following faculty members provided direction on the development of the MyLab Math course for this edition:

Heather Albrecht, *Blinn College*

Terry Barron, *Georgia Gwinnett College*

Jeffrey V. Berg, *Arapahoe Community College*

Joseph Bilello, *University of Colorado, Denver*

Mark Bollman, *Albion College*

Mike Bostick, *Central Wyoming College*

Laurie L. Boudreaux, *Nicholls State University*

Steve Brosnan, *Belmont Abbey College*

Debra S. Carney, *Colorado School of Mines*

Robert D. Crise, Jr, *Crafton Hills College*

Shannon Dingman, *University of Arkansas*

Deland Doscol, *North Georgia Technical College*

J. Robson Eby, *Blinn College*

Stephanie L. Fitch, *Missouri University of Science and Technology*

Dennis Garity, *Oregon State University*

Monica Geist, *Front Range Community College*

Brandie Gilchrist, *Central High School*

Roger M. Goldwyn, *Florida Atlantic University*

Maggie E. Habeeb, *California University of Pennsylvania*

Ryan A. Hass, *Oregon State University*

Danrun Huang, *St. Cloud State University*

Zhongming Huang, *Midland University*

Christa Johnson, *Guilford Technical Community College*

Bir Kafle, *Purdue University Northwest*

Semra Kilic-Bahi, *Colby-Sawyer College*

Kimberly Kinder, *Missouri University of Science and Technology*

Joseph Kotowski, *Oakton Community College*

Lynne E. Kowski, *Raritan Valley Community College*

Paula H. Krone, *Georgia Gwinnett College*

Daniel Lukac, *Miami University*

Jeffrey W. Lyons, *Nova Southeastern University*

James Magee, *Diablo Valley College*

Erum Marfani, *Frederick Community College*

Humberto Munoz Barona, *Southern University*

James A. Mendoza Alvarez, *University of Texas, Arlington*

Glenn Newman, *Newbury College*

Peter Nguyen, *Coker College*

Mike Nicholas, *Colorado School of Mines*

Seungly Oh, *Western New England University*

Denise Race, *Eastfield College*

Paul N. Runnion, *Missouri University of Science and Technology*

Polly Schulle, *Richland College*

Rebecca Swanson, *Colorado School of Mines*

William Sweet, *Blinn College*

M. Velentina Vega-Veglio, *William Paterson University*

Nick Wahle, *Cincinnati State Technical and Community College*

Patrick Wenkanaab, *Morgan State University*

Amanda Wheeler, *Amarillo College*

Diana White, *University of Colorado, Denver*

Gregory A. White, *Linn Benton Community College*

Joseph White, *Olympic College*

Robin T. Wilson, *California Polytechnic State University, Pomona*

Deborah A. Zankofski, *Prince George's Community College*

The following faculty were members of the Engineering Review Panel. This panel made recommendations to improve the text for engineering students.

Al Batten, *University of Colorado, Colorado Springs*

Josh Hertz, *Northeastern University*

Daniel Latta, *University of North Carolina, Charlotte*

Yan Tang, *Embry-Riddle Aeronautical University*

Pearson MyLab

MyLab Math Online Course
for *Calculus: Early Transcendentals, 3e*

(access code required)

MyLab™ Math is available to accompany Pearson's market-leading text offerings. To give students a consistent tone, voice, and teaching method, each text's flavor and approach are tightly integrated throughout the accompanying MyLab Math course, making learning the material as seamless as possible.

PREPAREDNESS

One of the biggest challenges in calculus courses is making sure students are adequately prepared with the prerequisite skills needed to successfully complete their course work. MyLab Math supports students with just-in-time remediation and review of key concepts.

Integrated Review Course

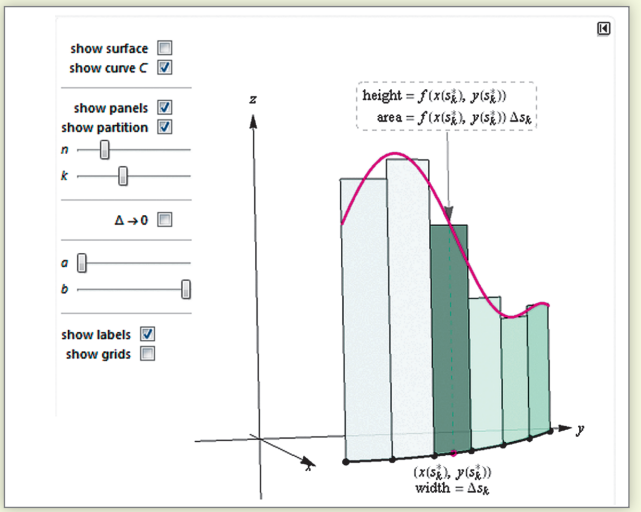
These special MyLab courses contain pre-made, assignable quizzes to assess the prerequisite skills needed for each chapter, plus personalized remediation for any gaps in skills that are identified. Each student, therefore, receives the appropriate level of help—no more, no less.

DEVELOPING DEEPER UNDERSTANDING

MyLab Math provides content and tools that help students build a deeper understanding of course content than would otherwise be possible.

eBook with Interactive Figures

The eBook includes approximately 700 figures that can be manipulated by students to provide a deeper geometric understanding of key concepts and examples as they read and learn new material. Students get unlimited access to the eBook within any MyLab Math course using that edition of the text. The authors have written Interactive Figure Exercises that can be assigned for homework so that students can engage with the figures outside of the classroom.



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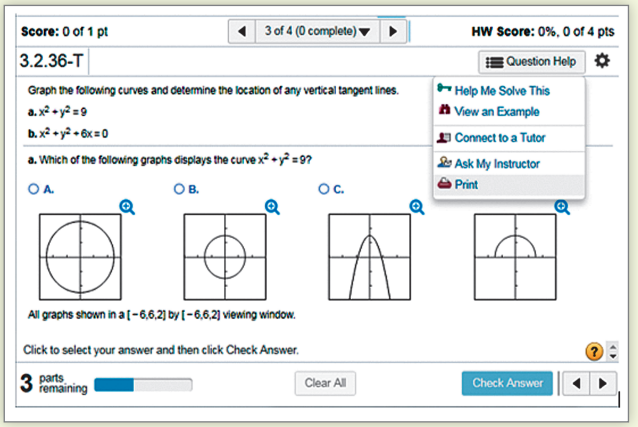


Exercises with Immediate Feedback

The over 8000 homework and practice exercises for this text regenerate algorithmically to give students unlimited opportunity for practice and mastery. MyLab Math provides helpful feedback when students enter incorrect answers and includes the optional learning aids Help Me Solve This, View an Example, videos, and/or the eBook.

NEW! Enhanced Sample Assignments

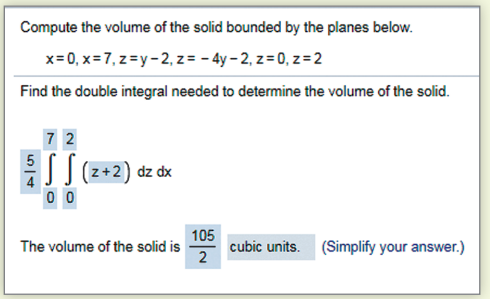
These section-level assignments include just-in-time review of prerequisites, help keep skills fresh with spaced practice of key concepts, and provide opportunities to work exercises without learning aids so students can check their understanding. They are assignable and editable within MyLab Math.

Additional Conceptual Questions

Additional Conceptual Questions focus on deeper, theoretical understanding of the key concepts in calculus. These questions were written by faculty at Cornell University under an NSF grant and are also assignable through Learning Catalytics™.

Setup & Solve Exercises

These exercises require students to show how they set up a problem, as well as the solution, thus better mirroring what is required on tests. This new type of exercise was widely praised by users of the second edition, so more were added to the third edition.



ALL NEW! Instructional Videos

For each section of the text, there is now a new full-lecture video. Many of these videos make use of Interactive Figures to enhance student understanding of concepts. To make it easier for students to navigate to the content they need, each lecture video is segmented into shorter clips (labeled Introduction, Example, or Summary). Both the video lectures and the video segments are assignable within MyLab Math. The Guide to Video-Based Assignments makes it easy to assign videos for homework by showing which MyLab Math exercises correspond to each video.

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UPDATED! Technology Manuals (downloadable)

- Maple™ Manual and Projects by Kevin Reeves, East Texas Baptist University
- Mathematica® Manual and Projects by Todd Lee, Elon University
- TI-Graphing Calculator Manual by Elaine McDonald-Newman, Sonoma State University

These manuals cover *Maple* 2017, *Mathematica 11,* and the TI-84 Plus and TI-89, respectively. Each manual provides detailed guidance for integrating the software package or graphing calculator throughout the course, including syntax and commands. The projects include instructions and ready-made application files for Maple and Mathematica. The files can be downloaded from within MyLab Math.

Student's Solutions Manuals (softcover and downloadable)

Single Variable Calculus: Early Transcendentals (Chapters 1–12)
ISBN: 0-13-477048-X | 978-0-13-477048-2
Multivariable Calculus (Chapters 10–17)
ISBN: 0-13-476682-2 | 978-0-13-476682-9
Written by Mark Woodard (Furman University), the Student's Solutions Manual contains worked-out solutions to all the odd-numbered exercises. This manual is available in print and can be downloaded from within MyLab Math.

SUPPORTING INSTRUCTION

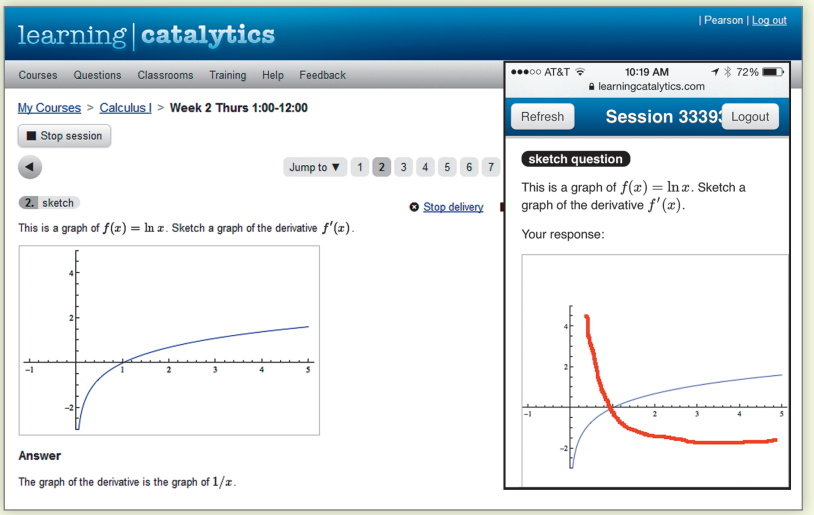
MyLab Math comes from an experienced partner with educational expertise and an eye on the future. It provides resources to help you assess and improve student results at every turn and unparalleled flexibility to create a course tailored to you and your students.

NEW! Enhanced Interactive Figures

Incorporating functionality from several standard Interactive Figures makes Enhanced Interactive Figures mathematically richer and ideal for in-class demonstrations. Using a single enhanced figure, instructors can illustrate concepts that are difficult for students to visualize and can make important connections to key themes of calculus.

Learning Catalytics

Now included in all MyLab Math courses, this student response tool uses students' smartphones, tablets, or laptops to engage them in more interactive tasks and thinking during lecture. Learning Catalytics™ fosters student engagement and peer-to-peer learning with real-time analytics. Access pre-built exercises created specifically for calculus, including Quick Quiz exercises for each section of the text.



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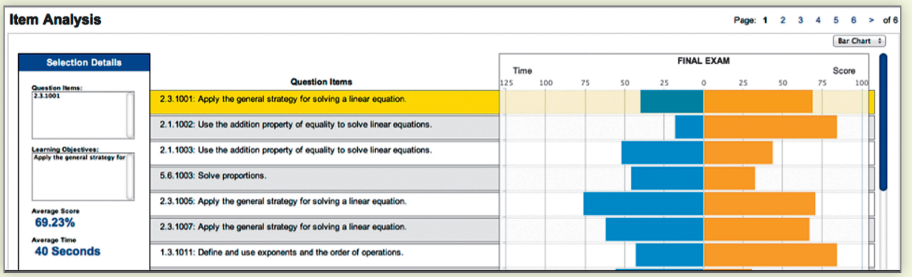
PowerPoint Lecture Resources (downloadable)

Slides contain presentation resources such as key concepts, examples, definitions, figures, and tables from this text. They can be downloaded from within MyLab Math or from Pearson's online catalog at **www.pearson.com**.

Comprehensive Gradebook

The gradebook includes enhanced reporting functionality, such as item analysis and a reporting dashboard to enable you to efficiently manage your course. Student performance data are presented at the class, section, and program levels in an accessible, visual manner so you'll have the information you need to keep your students on track.



TestGen

TestGen® (**www.pearson.com/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 and/or add new questions. The software and test bank are available for download from Pearson's online catalog, **www.pearson.com**. The questions are also assignable in MyLab Math.

Instructor's Solutions Manual (downloadable)

Written by Mark Woodard (Furman University), the Instructor's Solutions Manual contains complete solutions to all the exercises in the text. It can be downloaded from within MyLab Math or from Pearson's online catalog, **www.pearson.com**.

Instructor's Resource Guide (downloadable)

This resource includes Guided Projects that require students to make connections between concepts and applications from different parts of the calculus course. They are correlated to specific chapters of the text and can be assigned as individual or group work. The files can be downloaded from within MyLab Math or from Pearson's online catalog, **www.pearson.com**.

Accessibility

Pearson works continuously to ensure that our products are as accessible as possible to all students. We are working toward achieving WCAG 2.0 Level AA and Section 508 standards, as expressed in the Pearson Guidelines for Accessible Educational Web Media, **www.pearson.com/mylab/math/accessibility**.

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