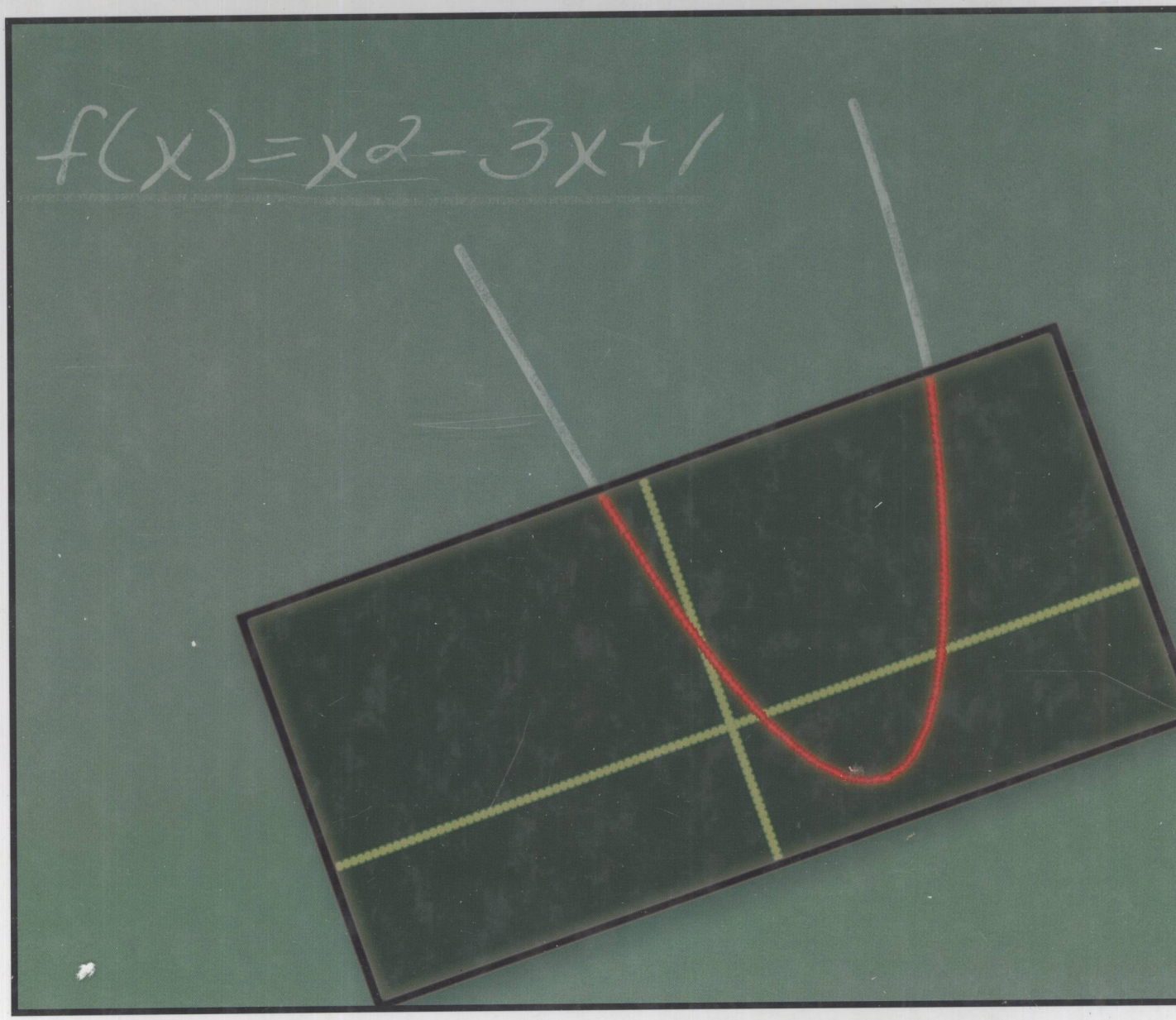
College Algebra Essentials

Enhanced with Graphing Utilities

Fourth Edition



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FOURTH EDITION

COLLEGE ALGEBRA ESSENTIALS

Enhanced with Graphing Utilities

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Prentice Hall

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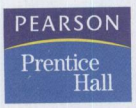

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Prepare for Class
"Read the Book"

	Feature	Description	Benefit	Page
		Every chapter begins with....		
	Chapter Opening Article & Project	Each chapter begins with a current article and ends with a related project.	The Article describes a real situation. The Project lets you apply what you learned to solve a related problem.	395 & 501
		Every section begins with...		
	Learning Objectives	Each section begins with a list of objectives. Objective numbers appear in the margin where the objective is covered.	These focus your studying by emphasizing what's most important and where to find it.	396
		Most sections contain...		
	Preparing for This Section	Sections begin with a list of key concepts to review, with page numbers.	Ever forget what you've learned? This feature highlights previously learned material to be used in this section. Review it, and you'll always be prepared to move forward.	396
NEW	**Now Work the 'Are You Prepared?' Problems**	Special problems that support the Preparing for This Section feature.	Not sure you need the Preparing for This Section review? Work the 'Are You Prepared?' problems. If you get one wrong, you'll know exactly what you need to review and where to review it!	396 & 401
	Calculus Icon	These appear next to information essential for the study of calculus.	Pay attention– if you spend extra time now, you'll do better later!	401
	"Now Work" Problems	These follow most examples, and direct you to a related exercise.	We learn best by doing. You'll solidify your understanding of examples if you try a similar problem right away, to be sure you understand what you've just read.	398
	WARNING	Warnings are provided in the text.	These point out common mistakes and help you to avoid them.	451
	Seeing the Concept & Explorations	These features suggest graphing utility activities.	You will obtain a deeper and more intuitive understanding of theorems and definitions.	400
NEW	**In Words**	These provide alternative descriptions of select definitions and theorems.	Does math ever look foreign to you? This feature translates math into plain English.	405
	Step-by-Step, Annotated Examples	Examples contain detailed, intermediate steps. Many include additional annotations	Work the examples on your own, uncovering the solution line-by-line as you go. Each line will verify your work. For additional help, consult the blue annotations, which provide the reason why the statement. to the left is valid.	413
NEW	**Side-by-Side Algebraic and Graphing Solutions**	Examples that can be solved both algebraically and graphically are shown side-by-side	Seeing the solution side-by-side will help you to decide the more efficient way to solve a problem.	118

Practice
"Work the Problems"

Feature	Description	Benefit	Page
	"Assess Your Understanding" contains a variety of problems at the end of each section.		
NEW **'Are You Prepared?' Problems**	These assess your retention of the prerequisite material you'll need. Answers are given at the end of the section exercises. This feature is related to the Preparing for This Section feature.	Do you always remember what you've learned? Working these problems is the best way to find out. If you get one wrong, you'll know exactly what you need to review, and where to review it!	401
Concepts and Vocabulary	These Fill-in-the-Blank and True/False items assess your understanding of key definitions and concepts in the current section.	Learning math is more than memorization – it's about discovering connections. These problems help you understand the 'big ideas' before diving into skill building.	401
Skill Building	Correlated to section examples, these problems provide straightforward practice, organized by difficulty.	It's important to dig in and develop your skills. These problems provide you with ample practice to do so.	402-403
Applications and Extensions	These problems allow you to apply your skills to real-world problems. These problems also allow you to extend concepts leamed in the section.	You will see that the material learned within the section has many uses in everyday life.	403-404
Discussion and Writing	"Discussion and Writing" problems are colored red. These support class discussion, verbalization of mathematical ideas, and writing and research projects.	To verbalize an idea, or to describe it clearly in writing, shows real understanding. These problems nurture that understanding. They're challenging , but you'll get out what you put in.	418
Now Work Problems	Many examples refer you to a related homework problem. These related problems are marked by a pencil and yellow numbers.	If you get stuck while working problems, look for the closest Now Work problem and refer back to the related example to see if it helps.	402

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Review
"Study for Quizzes and Tests"

Feature	Description	Benefit	Page
Chapter Reviews at the end of each chapter contain...			
"Things to Know"	A detailed list of important theorems, formulas, and definitions, from the chapter.	Review these and you'll know the most important material in the chapter!	493-494
"You Should be Able To..."	Contains a complete list of objectives by section, with corresponding practice exercises.	Do the recommended exercises and you'll have mastery over the key material. If you get something wrong, review the suggested page numbers and try again.	495
Review Exercises	These provide comprehensive review and practice of key skills, matched to the Learning Objectives for each section.	Practice makes perfect. These problems combine exercises from all sections, giving you a comprehensive review in one place.	496-500
Chapter Test	About 15–20 problems that can be taken as a Chapter Test. Be sure to take the Chapter Test under test conditions—no notes!	Be prepared. Take the sample practice test. This will get you ready for your instructor's test.	500
Chapter Projects	The Chapter Project applies what you've learned in the chapter. Additional projects are available on the Instructor's Resource Center (IRC)	The Project gives you an opportunity to apply what you've learned in the chapter to solve a problem related to the opening article. If your instructor allows, these make excellent opportunities to work in a group, which is often the best way of learning math.	501
Cumulative Review	These problem sets appear at the end of each chapter, beginning with Chapter 2. They combine problems from previous chapters, providing an ongoing cumulative review.	These are really important. They will ensure that you are not forgetting anything as you go. These will go a long way toward keeping you constantly primed for quizzes and tests.	501-502

NEW

COLLEGE ALGEBRA ESSENTIALS

In memory of Mary . . .
Wife and Mother

Three Distinct Series

Students have different goals, learning styles, and levels of preparation. Instructors have different teaching philosophies, styles, and techniques. Rather than write one series to fit all, the Sullivans have written three distinct series. All share the same goal—to develop a high level of mathematical understanding and an appreciation for the way mathematics can describe the world around us. The manner of reaching that goal, however, differs from series to series.

Contemporary Series, Seventh Edition

The Contemporary Series is the most traditional in approach, yet modern in its treatment of precalculus mathematics. Graphing utility coverage is optional and can be included or excluded based on instructor preference.
College Algebra, College Algebra Essentials, Algebra & Trigonometry, Trigonometry, Precalculus, Precalculus Essentials

Enhanced with Graphing Utilities Series, Fourth Edition

This series provides a more thorough integration of graphing utilities into topics, allowing students to explore mathematical concepts and foreshadow ideas usually studied in later courses. Using technology, the approach to solving certain problems differs from the Contemporary series, while the emphasis on understanding concepts and building strong skills does not.
College Algebra, College Algebra Essentials, Algebra & Trigonometry, Trigonometry, Precalculus, Precalculus Essentials

Graphing, Data, and Analysis Series, Third Edition

This series differs from the others, utilizing a functions approach which serves as the organizing principle tying concepts together. Each chapter introduces a new type of function, then develops all concepts pertaining to that particular function. The solutions of equations and inequalities, instead of being developed as stand-alone topics, are developed in the context of the underlying functions. Technology is integrated at the same level as the Enhanced with Graphing Utilities series (described above).
College Algebra, Algebra & Trigonometry, Precalculus

The Essentials Edition

What Is the Goal of the Essentials Edition?

Our goal in publishing this *Essentials* version of Sullivan and Sullivan's ***College Algebra Enhanced with Graphing Utilities, 4th Edition***, is to provide a lighter, more tailored, less expensive alternative to the parent textbook.

What's "Essential" About It?

Many one semester courses do not cover the full scope of the parent textbook. So, we selected topics from the parent version that are often not used and removed them, leaving a "core" set of chapters and sections. This "core" is the *Essentials* version.

Is Anything Else Different from the Parent Textbook?

No. The only difference is that some topics have been removed from the parent textbook to create the *Essentials* edition. The chapters and sections that remain which comprise the *Essentials* edition are *identical*, *word-for-word* to those in the parent textbook. Depth of coverage within topics has not been sacrificed in the *Essentials* edition.

What's In and What's Out?

The Table of Contents indicates what is included in this *Essentials* edition ("highlighted"), and what is excluded from this *Essentials* edition (subdued). Why have we left topics in the table of contents that are not included in this *Essentials* edition? Two reasons: (1) we wanted you to be able to determine quickly and easily which book is more appropriate for your course. This is easily done via this format. (2) the parent textbook and the *Essentials* edition share the same supplements. This is made possible by maintaining consistent chapter and section numbering in both books.

What If I Cover Something in My Course That Is Not in the Essentials Edition?

There are two options for you. You can simply ask your Prentice Hall sales representative to send you the parent textbook for review. Or, if you only need two or three additional sections, ask your Prentice Hall representative about custom publishing opportunities, the best way to reach an exact fit.

Preface to the Instructor

As professors at both an urban university and a community college, Michael Sullivan and Michael Sullivan, III are aware of the varied needs of College Algebra students, ranging from those who have little mathematical background and a fear of mathematics courses, to those having a strong mathematical education and a high level of motivation. For some of your students, this will be their last course in mathematics, whereas others will further their mathematical education. This text is written for both groups.

As a teacher, and as an author of precalculus, engineering calculus, finite mathematics, and business calculus texts, Michael Sullivan understands what students must know if they are to be focused and successful in upper level math courses. However, as a father of four, he also understands the realities of college life. His co-author and son, Michael Sullivan, III, believes in the value of technology as a tool for learning that enhances understanding without sacrificing math skills. Together, both authors have taken great pains to ensure that the text contains solid, student-friendly examples and problems, as well as a clear and seamless writing style.

A tremendous benefit of authoring a successful series is the broad-based feedback we receive from teachers and students. Virtually every change in this edition is the result of their thoughtful comments and suggestions. We are sincerely grateful for this support and hope that we have been able to take these ideas and, building upon a successful third edition, make this series an even better tool for learning and teaching. We continue to encourage you to share with us your experiences teaching from this text.

New Features in the Fourth Edition

Rather than provide a list of new features here, we have placed that information in the end sheet on the front cover of this book. The new features are easy to spot by the "New" in the left column.

This places the new features in their proper context, as building blocks of an overall learning system that has been carefully crafted over the years to help students get the most out of the time they put into studying. Please take the time to review this, and to discuss it with your students at the beginning of your course. Our experience has been that when students utilize these features, they are more successful in the course.

Organizational Changes in the Fourth Edition

- "Integer Exponents" and "Square Roots" now appear earlier in Chapter R in Section R.2. "Radicals" is now combined with "Rational Exponents" in Chapter R.
- "Setting Up Equations: Applications" has been renamed to "Problem Solving: Interest, Mixture, Uniform Motion, Constant Rate Jobs" and now appears in Section 1.6. The easier applications from "Setting Up Equations: Applications" are now in Section 1.2.
- "Synthetic Division" has been moved from the former Chapter 5: "The Zeros of a Polynomial Function" to Chapter R.
- "Quadratic Equations in the Complex Number System" has been moved from former Chapter 5: "The Zeros of a Polynomial Function" to Chapter 1, Section 1.4. This section remains optional and also allows for either early or late coverage of complex numbers and quadratic equations with a negative discriminant.
- Portions of Chapter 2: "Linear and Quadratic Functions" and Chapter 3: "Functions and Their Graphs" have been combined into one chapter, Chapter 2: "Functions and Their Graphs."
- Former Section 2.3: "Quadratic Functions" and former Section 2.4: "Quadratic Models" have been combined into one section, Section 3.1: "Quadratic Functions and Models."
- "Composite Functions," formerly in Chapter 3: "Functions and Their Graphs," now appears as Section 4.1 in Chapter 4: "Exponential and Logarithmic Functions."
- Former Chapter 4: "Polynomial and Rational Functions" and Chapter 5: "The Zeros of a Polynomial Function" have been combined into one chapter, Chapter 3: "Polynomial and Rational Functions."

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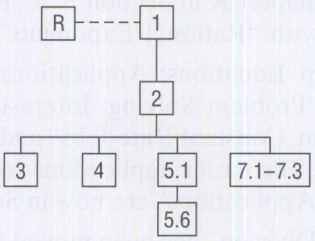
- Former Section 4.3: "Rational Functions I" has been renamed as Section 3.3: "Properties of Rational Functions." Former Section 4.4: "Rational Functions II: Analyzing Graphs" has been renamed Section 3.4: "The Graph of a Rational Function; Inverse and Joint Variation."
- "Systems of Linear Equations: Two Equations Containing Two Variables" and "Systems of Linear Equations Containing Three Variables" have been combined in one section as "Systems of Linear Equations: Substitution and Elimination."

Using the Fourth Edition Effectively with Your Syllabus

As the chart illustrates, this book has been organized with flexibility of use in mind. Within a given chapter, certain sections are optional (see the detail following the flow chart) and can be omitted without loss of continuity.



Chapter R Review

This chapter consists of review material. It may be used as the first part of the course or later as a just-in time review when the content is required. Specific references to this chapter occur throughout the book to assist in the review process.

Chapter 1 Graphs, Equations, and Inequalities

This chapter presents an introduction to graphing and the graphing utility. Equations and inequalities are solved algebraically and graphically. The coverage of complex numbers and quadratic equations with a negative discriminant is optional and may be postponed or skipped entirely without loss of continuity.

Chapter 2 Functions and Their Graphs

Perhaps the most important chapter. Section 2.8 is optional.

Chapter 3 Polynomial and Rational Functions

Topic selection depends on your syllabus.

Chapter 4 Exponential and Logarithmic Functions

Sections 4.1–4.6 follow in sequence. Sections 4.7–4.9 are optional.

Chapter 5 Systems of Equations and Inequalities

Sections 5.2–5.5 and Section 5.7 are not included in the Essentials version of College Algebra.

Chapter 6 Analytic Geometry

This chapter is not included in the Essentials version of College Algebra.

Chapter 7 Sequences; Induction; The Binomial Theorem

Sections 7.4 and Section 7.5 are not included in the Essentials version of College Algebra.

Chapter 8 Counting and Probability

This chapter is not included in the Essentials version of College Algebra.

Acknowledgments

Textbooks are written by authors, but evolve from an idea to final form through the efforts of many people. It was Don Dellen who first suggested this series. Don is remembered for his extensive contributions to publishing and mathematics.

We would also like to extend thanks to the following individuals for their important assistance and encouragement in the preparation of this edition: From Prentice Hall: Halee Dinsey for her innovative marketing skills; Adam Jaworski for his substantial contributions, ideas, and enthusiasm; Patrice Jones, who remains a huge fan and supporter; Dawn Murrin for her talent and skill in getting supplements out; Bob Walters, who continues to amaze us with his organizational skill as Production Editor; Sally Yagan for her continued support and genuine interest; and the Prentice Hall Sales Team, for their continued confidence in our books. We also extend out thanks to Teri Lovelace and the entire Laurel Technical Services staff, for their dedication to accuracy in checking manuscript and answers. Special thanks to Celeste Hernandez for her help in preparing chapter projects, and to Kevin Bodden for his work in preparing the chapter tests.

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STUDENT RESOURCES

Student Study-Pak

Everything a student needs to succeed in one place. Free, packaged with the book, or available for purchase standalone. Study-Pak contains:

- ***Student Solutions Manual***
  Fully worked solutions to odd-numbered exercises.
- ***Pearson Tutor Center***
  Tutors provide one-on-one tutoring for any problem with an answer at the back of the book. Students access the Tutor Center via toll-free phone, fax, or email.
- ***CD Lecture Series***
  A comprehensive set of CD-ROMs, tied to the textbook, containing short video clips of an instructor working key book examples.
- ***Algebra Review***
  Four chapters of Intermediate Algebra review. Perfect for a slower-paced course or for individual review.
- ***Chapter Test Prep Video CD***
  Gives student **step-by-step video solutions to every problem in each Chapter Test.** An instructor works through each chapter test problem providing valuable review to enhance mastery of key chapter content. Easy video navigation allows students to instantly access the solution to any problem.

MathXL®

MathXL® is a powerful online homework, tutorial, and assessment system that accompanies your textbook. Instructors can create, edit, and assign online homework and tests using algorithmically generated exercises correlated at the objective level to the textbook. Student work is tracked in an online gradebook. Students can take chapter tests and receive personalized study plans based on their results. The study plan diagnoses weaknesses and links students to tutorial exercises for objectives they need to study. Students can also access video clips from selected exercises. MathXL® is available to qualified adopters. For more information, visit our website at **www.mathxl.com**, or contact your Prentice Hall sales representative for a demonstration.

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