Preface to the Instructor

As a professor of mathematics at an urban public university for 35 years, I understand the varied needs of college algebra students. Students range from being underprepared with little mathematical background and a fear of mathematics, to being highly prepared and motivated. For some, this is their final course in mathematics. For others, it is preparation for future mathematics courses. I have written this text with both groups in mind.

A tremendous benefit of authoring a successful series is the broad-based feedback I receive from instructors and students who have used previous editions. I am sincerely grateful for their support. Virtually every change to this edition is the result of their thoughtful comments and suggestions. I hope that I have been able to take their ideas and, building upon a successful foundation of the tenth edition, make this series an even better learning and teaching tool for students and instructors.

Features in the Eleventh Edition

A descriptive list of the many special features of College Algebra can be found on the endpapers in the front of this text. This list places the 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 it and to discuss it with your students at the beginning of your course. My experience has been that when students use these features, they are more successful in the course.

• Updated! Retain Your Knowledge Problems These problems, which were new to the previous edition, are based on the article “To Retain New Learning, Do the Math,” published in the Educati Review. In this article, Kevin Washburn suggests that “the more students are required to recall new content or skills, the better their memory will be.” The Retain Your Knowledge problems were so well received that they have been expanded in this edition. Moreover, while the focus remains to help students maintain their skills, in most sections, problems were chosen that preview skills required to succeed in subsequent sections or in calculus. These are easily identified by the calculus icon (\( \text{calc} \)). All answers to Retain Your Knowledge problems are given in the back of the text and all are assignable in MyLab Math.

• Guided Lecture Notes Ideal for online, emporium/ redesign courses, inverted classrooms, or traditional lecture classrooms. These lecture notes help students take thorough, organized, and understandable notes as they watch the Author in Action videos. They ask students to complete definitions, procedures, and examples based on the content of the videos and text. In addition, experience suggests that students learn by doing and understanding the why/how of the concept or property. Therefore, many sections will have an exploration activity to motivate student learning. These explorations introduce the topic and/or connect it to either a real-world application or a previous section. For example, when the vertical-line test is discussed in Section 3.2, after the theorem statement, the notes ask the students to explain why the vertical-line test works by using the definition of a function. This challenge helps students process the information at a higher level of understanding.

• Illustrations Many of the figures have captions to help connect the illustrations to the explanations in the body of the text.

• Graphing Utility Screen Captures In several instances we have added Desmos screen captures along with the TI-84 Plus C screen captures. These updated screen captures provide alternate ways of visualizing concepts and making connections between equations, data and graphs in full color.

• Chapter Projects, which apply the concepts of each chapter to a real-world situation, have been enhanced to give students an up-to-the-minute experience. Many of these projects are new requiring the student to research information online in order to solve problems.

• Exercise Sets The exercises in the text have been reviewed and analyzed some have been removed, and new ones have been added. All time-sensitive problems have been updated to the most recent information available. The problem sets remain classified according to purpose.

The ‘Are You Prepared?’ problems have been improved to better serve their purpose as a just-in-time review of concepts that the student will need to apply in the upcoming section.

The Concepts and Vocabulary problems have been expanded to cover each objective of the section. These multiple-choice, fill-in-the-blank, and True/False exercises have been written to also serve as reading quizzes.

Skill Building problems develop the student’s computational skills with a large selection of exercises that are directly related to the objectives of the section.

Mixed Practice problems offer a comprehensive assessment of skills that relate to more than one objective. Often these require skills learned earlier in the course.

Applications and Extensions problems have been updated. Further, many new application-type exercises have been added, especially ones involving information and data drawn from sources the student will recognize, to improve relevance and timelines.

At the end of Applications and Extensions, we have a collection of one or more Challenge Problems. These problems, as the title suggests, are intended to be thought-provoking, requiring some ingenuity to solve. They can be used for group work or to challenge students. At the end of the Annotated Instructor’s
Edition and in the online Instructor’s Solutions Manual, we have provided solutions to all these problems.

The Explaining Concepts: Discussion and Writing exercises provide opportunity for classroom discussion and group projects.

Updated! Retain Your Knowledge has been improved and expanded. The problems are based on material learned earlier in the course. They serve to keep information that has already been learned “fresh” in the mind of the student. Answers to all these problems appear in the Student Edition.

Need to Review? These margin notes provide a just-in-time reminder of a concept needed now, but covered in an earlier section of the book. Each note includes a reference to the chapter, section and page where the concept was originally discussed.

Content Changes to the 11th edition

- **Challenge Problems** have been added in most sections at the end of the Application and Extensions exercises. Challenge Problems are intended to be thought-provoking problems that require some ingenuity to solve. They can be used to challenge students or for group work. Solutions to Challenge Problems are available in the Annotated Instructor’s Edition and the online Instructors Solutions Manual.

- Need to Review? These margin notes provide a just-in-time review for a concept needed now, but covered in an earlier section of the book. Each note is back-referenced to the chapter, section and page where the concept was originally discussed.

- Additional Retain Your Knowledge exercises, whose purpose is to keep learned material fresh in a student’s mind, have been added to each section. Many of these new problems preview skills required for calculus or for concepts needed in subsequent sections.

- **Desmos** screen captures have been added throughout the text. This is done to recognize that graphing technology expands beyond graphing calculators.

- Examples and exercises throughout the text have been augmented to reflect a broader selection of STEM applications.

- Concepts and Vocabulary exercises have been expanded to cover each objective of a section.

- Skill building exercises have been expanded to assess a wider range of difficulty.

- Applied problems and those based on real data have been updated where appropriate.

- **Chapter R**
  - Section R.8 Objective 3 now includes rationalizing the numerator
  - NEW Example 6 Rationalizing Numerators
  - Problems 69-76 provide practice.

- **Chapter 1**
  - NEW Section 1.2 Objective 2 Solve a Quadratic Equation Using the Square Root Method.

- **Chapter 2**
  - NEW Section 2.2 Example 9 Testing an Equation for Symmetry

- **Chapter 3**
  - NEW Section 3.1 Objective 1 Describe a Relation

- **Chapter 4**
  - Section 4.3 introduces the concept of concavity for a quadratic function
  - NEW Section 4.3 Example 3 Graphing a Quadratic Function Using Its Vertex, Axis, and Intercepts
  - Section 4.3 Example 8 Analyzing the Motion of a Projectile (formerly in Section 4.4)
  - NEW Section 4.4 Example 4 Fitting a Quadratic Function to Data

- **Chapter 5**
  - Section 5.1 has been revised and split into two sections:
    - 5.1 Polynomial Functions
    - 5.2 Graphing Polynomial Functions; Models
  - NEW Section 5.2 Example 2 Graphing a Polynomial Function (a 4th degree polynomial function)

- **Chapter 6**
  - Section 6.2 now finds and verifies inverse functions analytically and graphically

- **Chapter 8**
  - NEW Section 8.5 Example 1 Identifying Proper and Improper Rational Expressions
Using the Eleventh Edition Effectively with Your Syllabus

To meet the varied needs of diverse syllabi, this text contains more content than is likely to be covered in an *College Algebra* course. As the chart illustrates, this text has been organized with flexibility of use in mind. Within a given chapter, certain sections are optional (see the details that follow the figure below) 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 text to assist in the review process.

Chapter 1  Equations and Inequalities
Primarily a review of Intermediate Algebra topics, this material is a prerequisite for later topics. 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  Graphs
This chapter lays the foundation for functions. Section 2.5 is optional.

Chapter 3  Functions and Their Graphs
Perhaps the most important chapter. Section 3.6 is optional.

Chapter 4  Linear and Quadratic Functions
Topic selection depends on your syllabus. Sections 4.2 and 4.4 may be omitted without loss of continuity.

Chapter 5  Polynomial and Rational Functions
Topic selection depends on your syllabus.

Chapter 6  Exponential and Logarithmic Functions
Sections 6.1–6.6 follow in sequence. Sections 6.7, 6.8, and 6.9 are optional.

Chapter 7  Analytic Geometry
Sections 7.1–7.4 follow in sequence.

Chapter 8  Systems of Equations and Inequalities
Sections 8.2–8.7 may be covered in any order, but each requires Section 8.1. Section 8.8 requires Section 8.7.

Chapter 9  Sequences; Induction; The Binomial Theorem
There are three independent parts: Sections 9.1–9.3; Section 9.4; and Section 9.5.

Chapter 10  Counting and Probability
The sections follow in sequence.

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 text and series to me. Don is remembered for his extensive contributions to publishing and mathematics.

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Finally, I offer my grateful thanks to the dedicated users and reviewers of my texts, whose collective insights form the backbone of each textbook revision.

Michael Sullivan
Get the Most Out of MyLab Math

Math courses are continuously evolving to help today’s students succeed. It’s more challenging than ever to support students with a wide range of backgrounds, learner styles, and math anxieties. The flexibility to build a course that fits instructors’ individual course formats—with a variety of content options and multimedia resources all in one place—has made MyLab Math the market-leading solution for teaching and learning mathematics since its inception.

Preparedness
One of the biggest challenges in College Algebra, Trigonometry, and Precalculus is making sure students are adequately prepared with prerequisite knowledge. For a student, having the essential algebra skills upfront in this course can dramatically increase success.

- MyLab Math with Integrated Review can be used in corequisite courses, or simply to help students who enter without a full understanding of prerequisite skills and concepts. Integrated Review provides videos on review topics with a corresponding worksheet, along with premade, assignable skills-check quizzes and personalized review homework assignments. Integrated Review is now available within all Sullivan 11th Edition MyLab Math courses.
Resources for Success
MyLab Math Online Course for College Algebra, 11th Edition by Michael Sullivan (access code required)

MyLab™ Math is tightly integrated with each author's style, offering a range of author-created multimedia resources, so your students have a consistent experience.

Video Program and Resources
Author in Action Videos are actual classroom lectures by Michael Sullivan III with fully worked-out examples.

- **Video assessment** questions are available to assign in MyLab Math for key videos.
- **Updated!** The corresponding Guided Lecture Notes assist students in taking thorough, organized, and understandable notes while watching Author in Action videos.

Guided Visualizations
New! Guided Visualizations, created in GeoGebra by Michael Sullivan III, bring mathematical concepts to life, helping students visualize the concept through directed exploration and purposeful manipulation. Assignable in MyLab Math with assessment questions to check students' conceptual understanding.

Retain Your Knowledge Exercises
Updated! Retain Your Knowledge Exercises, assignable in MyLab Math, improve students' recall of concepts learned earlier in the course. New for the 11th Edition, additional exercises will be included that will have an emphasis on content that students will build upon in the immediate upcoming section.
Resources for Success

**Instructor Resources**
Online resources can be downloaded from www.pearson.com, or hardcopy resources can be ordered from your sales representative.

- **Annotated Instructor's Edition College Algebra, 11th Edition**
  ISBN – 013516320X / 9780135163207
  Shorter answers are on the page beside the exercises. Longer answers are in the back of the text.

- **Instructor’s Solutions Manual**
  ISBN – 0135163722 / 9780135163726
  Includes fully worked solutions to all exercises in the text.

- **Learning Catalytics Question Library**
  Questions written by Michael Sullivan III are available within MyLab Math to deliver through Learning Catalytics to engage students in your course.

- **Powerpoint® Lecture Slides**
  Fully editable slides correlate to the textbook.

- **Mini Lecture Notes**
  Includes additional examples and helpful teaching tips, by section.

- **Testgen®**
  TestGen (www.pearsoned.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.

- **Online Chapter Projects**
  Additional projects that give students an opportunity to apply what they learned in the chapter.

**Student Resources**
Additional resources to enhance student success.

- **Lecture Video**
  Author in Action videos are actual classroom lectures with fully worked out examples presented by Michael Sullivan, III. All video is assignable within MyLab Math.

- **Chapter Test Prep Videos**
  Students can watch instructors work through step-by-step solutions to all chapter test exercises from the text. These are available in MyLab Math and on YouTube.

- **Student’s Solutions Manual**
  ISBN - 013516317X / 9780135163177
  Provides detailed worked-out solutions to odd-numbered exercises.

- **Guided Lecture Notes**
  ISBN – 0135163188 / 9780135163184
  These lecture notes assist students in taking thorough, organized, and understandable notes while watching Author in Action videos. Students actively participate in learning the how/why of important concepts through explorations and activities. The Guided Lecture Notes are available as PDF's and customizable Word files in MyLab Math. They can also be packaged with the text and the MyLab Math access code.

- **Algebra Review**
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