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. As an author of a developmental mathematics series, Michael's co-author and son, Michael Sullivan, III, understands the trepidations and skills students bring to the College Algebra course. Michael, III also 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. We are sincerely grateful for their support. 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 first 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.

About This Book

This book utilizes a functions approach to College Algebra. Functions are introduced early (Chapter 1) in various formats: maps, tables, sets of ordered pairs, equations, and graphs. Our approach to functions illustrates the symbolic, numeric, graphic, and verbal representations of functions. This allows students to make connections between the visual representation of a function and its algebraic representation.

It is our belief that students need to "hit the ground running" so that they do not become complacent in their studies. After all, it is highly likely that students have been exposed to solving equations and inequalities prior to entering this class. By spending precious time reviewing these concepts, students are likely to think of the course as a rehash of material learned in other courses and say to themselves, "I know this material, so I don't have to study." This may result in the students developing poor study habits for this course. By introducing functions early in the course, students are less likely to develop bad habits.

Another advantage of the early introduction of functions is that the discussion of equations and inequalities can focus around the concept of a function. For example, rather than asking students to solve an equation such as $2x^2 + 5x + 2 = 0$, we ask students to find the zeros of $f(x) = 2x^2 + 5x + 2$ or solve $f(x) = 0$ when $f(x) = 2x^2 + 5x + 2$. While the technique used to solve this type of problem is the same, the fact that the problem looks different to the student means the student is less apt to say, "Oh, I already have seen this problem before, and I know how to solve it." In addition, in Calculus students are going to be asked to solve equations such as $f'(x) = 0$, so solving $f(x) = 0$ is a logical prerequisite skill to practice in Precalculus. Another advantage to solving equations through the eyes of a function is that the properties of functions can be included in the solution. For example, the linear function $f(x) = 2x - 3$ has one real zero because the function f is increasing on its domain.

Features in the Fourth Edition

Rather than provide a list of new features here, that information can be found on pages i–iii.

This 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 the features listed on pages i–iii and to discuss them 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.

Changes in the Fourth Edition

Content

- Desmos screen captures have been added throughout the text. This is done to recognize that graphing technology expands beyond graphing calculators.
- Definitions have been reviewed, and in a few cases, revised to be consistent with those presented in Calculus. For example, in the definitions for increasing/decreasing functions, we deleted the word "open", allowing for functions to increase/decrease on any type of interval.

Organization

- **Chapter F, Section 3** We moved the objective "Find the Equation of a Line Given Two Points" after the objective "Identify the Slope and y-Intercept of a Line from Its Equation". This allows us to express lines in slope-intercept form.

Using this Book Effectively and Efficiently with Your Syllabus

To meet the varied needs of diverse syllabi, this book contains more content than is likely to be covered in a typical College Algebra course. As the chart illustrates, this book has been organized with flexibility of use in mind. Even within a given chapter, certain sections are optional and can be omitted without loss of continuity. See the detail following the flow chart.
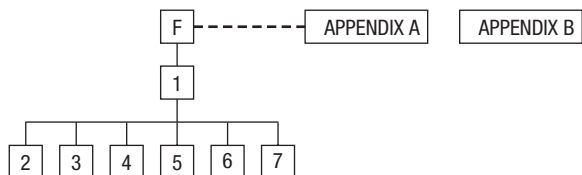
Foundations   A Prelude to Functions

Quick coverage of this chapter, which is mainly review material, will enable you to get to Chapter 1, *Functions and Their Graphs*, earlier.

Chapter 1   Functions and Their Graphs

Perhaps the most important chapter. Sections 1.6 and 1.7 are optional.

Chapter 2   Linear and Quadratic Functions

Topic selection depends on your syllabus. Sections 2.2, 2.6, and 2.7 may be omitted without a loss of continuity.

Chapter 3   Polynomial and Rational Functions

Topic selection depends on your syllabus. Section 3.6 is optional.

Chapter 4   Exponential and Logarithmic Functions

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

Chapter 5   Analytic Geometry

Sections 5.1–5.4 follow in sequence.

Chapter 6   Systems of Equations and Inequalities

Sections 6.2–6.7 may be covered in any order. Section 6.8 requires Section 6.7.

Chapter 7   Sequences; Induction; the Binomial Theorem

There are three independent parts: Sections 7.1–7.3, Section 7.4, and Section 7.5.

Chapter 8   Counting and Probability

The sections follow in sequence.

Appendix A   Review

This review material may be covered at the start of a course or used as a just-in-time review. Specific references to this material occur throughout the text to assist in the review process.

Appendix B   Graphing Utilities

Reference is made to these sections at the appropriate place in the text.

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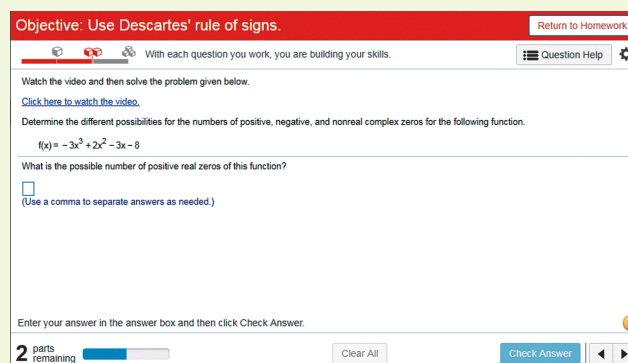*Michael Sullivan, III*
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Get the Most Out of
MyLab Math

Used by over 3 million students a year, MyLab™ Math is the world's leading online program for teaching and learning mathematics. MyLab Math delivers assessment, tutorials, and multimedia resources that provide engaging and personalized experiences for each student, so learning can happen in any environment. Each course is developed to accompany Pearson's best-selling content, authored by thought leaders across the math curriculum, and can be easily customized to fit any course format.

Preparedness

One of the biggest challenges in many mathematics courses is making sure students are adequately prepared with the prerequisite skills needed to successfully complete their course work. MyLab Math offers a variety of content and course options to support students with just-in-time remediation and key-concept review.

- **Skill Builder** offers adaptive practice that is designed to increase students' ability to complete their assignments. By monitoring student performance on their homework, Skill Builder adapts to each student's needs and provides just-in-time, in-assignment practice to help them improve their proficiency of key learning objectives.

- **Getting Ready** material provides just-in-time review, integrated throughout the course as needed to prepare students with prerequisite material to succeed. From a quick quiz, a personalized, just-in-time review assignment is generated for each student, allowing them to refresh forgotten concepts.

Objective: Use Descartes' rule of signs.   Return to Homework

With each question you work, you are building your skills.   Question Help

Watch the video and then solve the problem given below.

Click here to watch the video.

Determine the different possibilities for the numbers of positive, negative, and nonreal complex zeros for the following function.

$f(x) = -3x^3 + 2x^2 - 3x - 8$

What is the possible number of positive real zeros of this function?

(Use a comma to separate answers as needed.)

Enter your answer in the answer box and then click Check Answer.

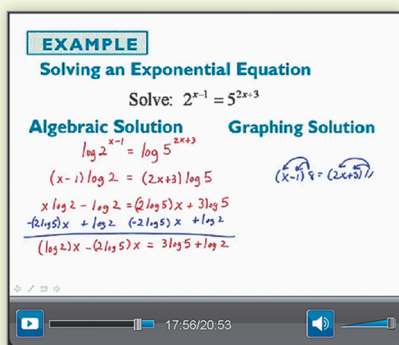**2** parts remaining   Clear All   Check Answer

⏱ Due	Assignment
	Q Getting Ready for Chapter 1 Quiz
	H Getting Ready for Chapter 1 Homework
	Q Getting Ready for Chapter 2 Quiz
	H Getting Ready for Chapter 2 Homework
	Q Getting Ready for Chapter 3 Quiz
	H Getting Ready for Chapter 3 Homework
	Q Getting Ready for Chapter 4 Quiz
	H Getting Ready for Chapter 4 Homework

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Resources for Success

MyLab Math Online Course College Algebra:
Concepts Through Functions
by Sullivan and Sullivan (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 is tightly integrated throughout the accompanying **MyLab Math** course, making learning the material as seamless as possible.

Video Program and Resources

Author in Action Videos are actual classroom lectures with fully worked out examples presented by Michael Sullivan III.

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

Retain Your Knowledge

Updated! Retain Your Knowledge Exercises support ongoing review at the course level and help students maintain essential skills. These are excellent cumulative review problems and are perfect for studying for final exams. Retain Your Knowledge Exercises are available to assign in **MyLab Math** and in the text.


Problems 103–116 are based on material learned earlier in the course. The purpose of these problems is to keep the material fresh in your mind so that you are better prepared for the final exam.

113. Use the techniques of shifting, compressing or stretching, and reflections to graph $f(x) = -|x + 2| + 3$.

114. Find the zeros of the quadratic function $f(x) = 3x^2 + 5x + 1$. What are the x-intercepts, if any, of the graph of the function?

115. Find the domain of $R(x) = \dfrac{6x^2 - 11x - 2}{2x^2 - x - 6}$. Find any horizontal, vertical, or oblique asymptotes.

116. If $f(x) = 3x^2 - 7x$, find $f(x + h) - f(x)$.
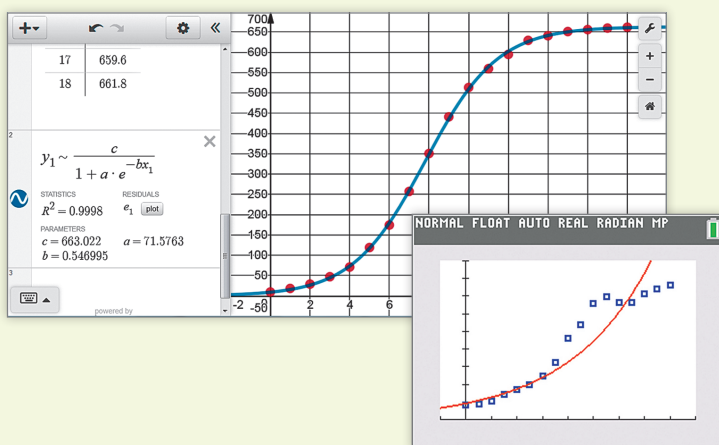
Graphing Images

Updated! Throughout each chapter TI-84 Plus C and Desmos© screenshots appear. These images help students visualize concepts clearly and make stronger connections among equations, data and graphs in full color; using the graphing technology they are most familiar with.

Sample Assignments

Enhanced Sample Assignments make course set-up easier by giving instructors a starting point for each chapter. Each assignment, handpicked by the author to align with this text, includes a thoughtful mix of question types (e.g., conceptual, skills, etc.) specific to that topic.

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Resources for Success

Pearson MyLab

Instructor Resources

Annotated Instructor's Edition

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The Annotated Instructor's Edition includes answers to the exercises sets. Shorter answers are on the page beside the exercises, and longer answers are in the back of the text.

The following resources can be downloaded from www.pearson.com or at www.pearson.com/mylab/math

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

PowerPoint® Lecture Slides
Fully editable slides that correlate to the textbook.

Instructor Solutions Manual
Includes fully worked solutions to all textbook exercises.

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.

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

Online Chapter Projects
Additional projects that let students apply what was learned in the chapter.

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Additional resources to help student success:

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

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

Student Solutions Manual
Provides detailed worked-out solutions to odd-numbered exercises.

Guided Lecture Notes
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 textbook and MyLab Math access code.

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Skills for Success
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