### Prepare for Class: “Read the Book”

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
<th>Benefit</th>
<th>Page(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Every Chapter begins with . . .</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chapter-Opening Topic &amp; Project</td>
<td>Each chapter begins with a discussion of a topic of current interest and ends with a related project.</td>
<td>In the concluding project, you will apply what you have learned to solve a problem related to the topic.</td>
<td>424, 533</td>
</tr>
<tr>
<td>Internet-Based Projects</td>
<td>These projects allow for the integration of spreadsheet technology that you will need to be a productive member of the workforce.</td>
<td>The projects give you an opportunity to collaborate and use mathematics to deal with issues of current interest.</td>
<td>533</td>
</tr>
<tr>
<td><strong>Every Section begins with . . .</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LEARNING OBJECTIVES</td>
<td>Each section begins with a list of objectives. Individual objectives also appear in the text where they are covered.</td>
<td>These objectives focus your studying by emphasizing what’s most important and where to find it.</td>
<td>446</td>
</tr>
<tr>
<td>Sections contain . . .</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PREPARING FOR THIS SECTION</td>
<td>Most sections begin with a list of key concepts to review, with page numbers.</td>
<td>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.</td>
<td>446</td>
</tr>
<tr>
<td>Now Work the ‘Are You Prepared?’ Problems</td>
<td>These problems assess whether you have the prerequisite knowledge for the upcoming section.</td>
<td>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!</td>
<td>446, 458</td>
</tr>
<tr>
<td>Now Work PROBLEMS</td>
<td>These follow most examples and direct you to a related exercise.</td>
<td>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.</td>
<td>454, 460</td>
</tr>
<tr>
<td>CAUTION</td>
<td>Words of caution are provided in the text.</td>
<td>These point out common mistakes and help you avoid them.</td>
<td>482</td>
</tr>
<tr>
<td>Explorations and Seeing the Concept</td>
<td>These graphing utility activities foreshadow a concept or reinforce a concept just presented.</td>
<td>You will obtain a deeper and more intuitive understanding of theorems and definitions.</td>
<td>441, 453</td>
</tr>
<tr>
<td>In Words</td>
<td>This feature provides alternative descriptions of select definitions and theorems.</td>
<td>Why didn’t you say that in the first place? This feature translates math into plain English.</td>
<td>465</td>
</tr>
<tr>
<td><strong>Calculus</strong></td>
<td>This symbol appears next to information essential for the study of calculus.</td>
<td>Foreshadowing calculus now will make the material easier later.</td>
<td>220, 429, 454</td>
</tr>
<tr>
<td>SHOWCASE EXAMPLES</td>
<td>These examples provide “how to” instruction by offering a guided, step-by-step approach to solving a problem.</td>
<td>With each step presented on the left and the mathematics displayed on the right, you can immediately see how each step is employed.</td>
<td>358–359</td>
</tr>
<tr>
<td>Model It! Examples and Problems</td>
<td>These examples and problems require you to build a mathematical model from either a verbal description or data. The homework Model It! problems are marked by purple problem numbers.</td>
<td>It is rare for a problem to come in the form “Solve the following equation.” Rather, the equation must be developed based on an explanation of the problem. These problems require you to develop models that will enable you to describe the problem mathematically and suggest a solution to the problem.</td>
<td>472, 504</td>
</tr>
<tr>
<td>NEW!</td>
<td>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 is back-referenced to the chapter, section and page where the concept was originally discussed.</td>
<td>Sometimes as you read, you encounter a word or concept you know you’ve seen before, but don’t remember exactly what it means. This feature will point you to where you first learned the word or concept. A quick review now will help you see the connection to what you are learning for the first time and make remembering easier the next time.</td>
<td>453</td>
</tr>
</tbody>
</table>
## Practice: “Work the Problems”

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
<th>Benefit</th>
<th>Page(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>‘Are You Prepared?’ Problems</strong></td>
<td>These problems assess your retention of the prerequisite material. Answers are given at the end of the section exercises. This feature is related to the Preparing for This Section feature.</td>
<td>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!</td>
<td>446, 458</td>
</tr>
<tr>
<td><strong>Concepts and Vocabulary</strong></td>
<td>These short-answer questions, mainly fill-in-the-blank, multiple-choice, and true/false items, assess your understanding of key definitions and concepts in the current section.</td>
<td>It is difficult to learn math without knowing the language of mathematics. These problems test your understanding of the formulas and vocabulary.</td>
<td>458–459</td>
</tr>
<tr>
<td><strong>Skill Building</strong></td>
<td>Correlated with section examples, these problems provide straightforward practice.</td>
<td>These problems give you ample opportunity to dig in and develop your skills.</td>
<td>459–461</td>
</tr>
<tr>
<td><strong>Mixed Practice</strong></td>
<td>These problems offer comprehensive assessment of the skills learned in the section by asking problems related to more than one concept or objective. These problems may also require you to utilize skills learned in previous sections.</td>
<td>Learning mathematics is a building process. Many concepts build on each other and are related. These problems help you see how mathematics builds on itself and how the concepts are linked together.</td>
<td>461</td>
</tr>
<tr>
<td><strong>Applications and Extensions</strong></td>
<td>These problems allow you to apply your skills to real-world problems. They also enable you to extend concepts learned in the section.</td>
<td>You will see that the material learned within the section has many uses in everyday life.</td>
<td>461–464</td>
</tr>
<tr>
<td><strong>NEW! Challenge Problems</strong></td>
<td>These problems have been added in most sections and appear at the end of the Application and Extensions exercises. They are intended to be thought-provoking, requiring some ingenuity to solve.</td>
<td>Challenge problems can be used for group work or to challenge your students. Solutions to Challenge Problems are in the Annotated Instructor’s Edition or in the Instructor’s Solution Manual (online).</td>
<td>464</td>
</tr>
<tr>
<td><strong>Explaining Concepts: Discussion and Writing</strong></td>
<td>“Discussion and Writing” problem numbers are colored red. They support class discussion, verbalization of mathematical ideas, and writing and research projects.</td>
<td>To verbalize an idea, or to describe it clearly in writing, shows real understanding. These problems nurture that understanding. Many are challenging, but you’ll get out what you put in.</td>
<td>464</td>
</tr>
<tr>
<td><strong>Retain Your Knowledge</strong></td>
<td>These problems allow you to practice content learned earlier in the course.</td>
<td>Remembering how to solve all the different kinds of problems that you encounter throughout the course is difficult. This practice helps you remember previously learned skills.</td>
<td>464</td>
</tr>
<tr>
<td><strong>Now Work Problems</strong></td>
<td>Many examples refer you to a related homework problem. These related problems are marked by \ and orange problem numbers.</td>
<td>If you get stuck while working problems, look for the closest Now Work problem, and refer to the related example to see if it helps.</td>
<td>454, 456, 457</td>
</tr>
<tr>
<td><strong>NEW! Interactive Figure Exercises</strong></td>
<td>Exercises that require you to manipulate an interactive figure to solve. These exercises are labeled with the icon [.</td>
<td>These exercises help you visualize important concepts and develop a “feel” for them. The figures are housed at bit.ly/2MibgaO and were developed in GeoGebra by author Michael Sullivan III.</td>
<td>458, 459, 473, 474</td>
</tr>
<tr>
<td><strong>Review Exercises</strong></td>
<td>Every chapter concludes with a comprehensive list of exercises to practice. Use the list of objectives to determine what objective and examples correspond to each problem.</td>
<td>Work these problems to ensure that you understand all the skills and concepts employed in the chapter. Think of it as a comprehensive review of the chapter. All answers to Chapter Review problems appear in the back of the text.</td>
<td>528–531</td>
</tr>
</tbody>
</table>
### Review: “Study for Quizzes and Tests”

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
<th>Benefit</th>
<th>Page(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Most Sections Contain . . .</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retain Your Knowledge</td>
<td>Keeps what you have learned at the forefront and see how topics are connected.</td>
<td>These problems allow content to remain fresh so you are more prepared for the final exam.</td>
<td>478</td>
</tr>
<tr>
<td><strong>The Chapter Review at the end of each chapter contains . . .</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Things to Know</td>
<td>A detailed list of important theorems, formulas, and definitions from the chapter.</td>
<td>Review these and you’ll know the most important material in the chapter!</td>
<td>526–527</td>
</tr>
<tr>
<td>You Should Be Able to . . .</td>
<td>A complete list of objectives by section, examples that illustrate the objective, and practice exercises that test your understanding of the objective.</td>
<td>Do the recommended exercises and you’ll have mastered the key material. If you get something wrong, go back and review the example listed, and try again.</td>
<td>527–528</td>
</tr>
<tr>
<td>Review Exercises</td>
<td>These provide comprehensive review and practice of key skills, matched to the Learning Objectives for each section.</td>
<td>Practice makes perfect. These problems combine exercises from all sections, giving you a comprehensive review in one place.</td>
<td>528–531</td>
</tr>
<tr>
<td>Chapter Test</td>
<td>About 15–20 problems that can be taken as a Chapter Test. Be sure to take the Chapter Test under test conditions—no notes!</td>
<td>Be prepared. Take the sample practice test under test conditions. This will get you ready for your instructor’s test. If you get a problem wrong, you can watch the Chapter Test Prep Video.</td>
<td>531–532</td>
</tr>
<tr>
<td>Cumulative Review</td>
<td>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. When you use them in conjunction with the Retain Your Knowledge problems, you will be ready for the final exam.</td>
<td>These problem sets are really important. Completing them will ensure that you are not forgetting anything as you go. This will go a long way toward keeping you primed for the final exam.</td>
<td>532–533</td>
</tr>
</tbody>
</table>
For the family

Katy (Murphy) and Pat
Mike and Yola
Dan and Sheila
Colleen (O’Hara) and Bill

Shannon, Patrick, Ryan
Michael, Kevin, Marissa
Maeve, Sean, Nolan
Kaleigh, Billy, Timmy
# Contents

Three Distinct Series ........................................... xix
The Enhanced with Graphing Utilities Series ............... xx
Preface to the Instructor ........................................ xx
Resources for Success ........................................... xxviii
Applications Index ............................................... xxix
To the Student ..................................................... xxxiv

<table>
<thead>
<tr>
<th>Review</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>R.1 Real Numbers</strong></td>
<td>2</td>
</tr>
<tr>
<td>Work with Sets • Classify Numbers • Evaluate Numerical Expressions • Work with Properties of Real Numbers</td>
<td></td>
</tr>
<tr>
<td><strong>R.2 Algebra Essentials</strong></td>
<td>18</td>
</tr>
<tr>
<td>Graph Inequalities • Find Distance on the Real Number Line • Evaluate Algebraic Expressions • Determine the Domain of a Variable • Use the Laws of Exponents • Evaluate Square Roots • Use a Calculator to Evaluate Exponents • Use Scientific Notation</td>
<td></td>
</tr>
<tr>
<td><strong>R.3 Geometry Essentials</strong></td>
<td>31</td>
</tr>
<tr>
<td>Use the Pythagorean Theorem and Its Converse • Know Geometry Formulas • Understand Congruent Triangles and Similar Triangles</td>
<td></td>
</tr>
<tr>
<td><strong>R.4 Polynomials</strong></td>
<td>41</td>
</tr>
<tr>
<td>Recognize Monomials • Recognize Polynomials • Add and Subtract Polynomials • Multiply Polynomials • Know Formulas for Special Products • Divide Polynomials Using Long Division • Work with Polynomials in Two Variables</td>
<td></td>
</tr>
<tr>
<td><strong>R.5 Factoring Polynomials</strong></td>
<td>51</td>
</tr>
<tr>
<td>Factor the Difference of Two Squares and the Sum and Difference of Two Cubes • Factor Perfect Squares • Factor a Second-Degree Polynomial: ( x^2 + Bx + C ) • Factor by Grouping • Factor a Second-Degree Polynomial: ( Ax^2 + Bx + C, A \neq 1 ) • Complete the Square</td>
<td></td>
</tr>
<tr>
<td><strong>R.6 Synthetic Division</strong></td>
<td>59</td>
</tr>
<tr>
<td>Divide Polynomials Using Synthetic Division</td>
<td></td>
</tr>
<tr>
<td><strong>R.7 Rational Expressions</strong></td>
<td>63</td>
</tr>
<tr>
<td>Reduce a Rational Expression to Lowest Terms • Multiply and Divide Rational Expressions • Add and Subtract Rational Expressions • Use the Least Common Multiple Method • Simplify Complex Rational Expressions</td>
<td></td>
</tr>
<tr>
<td><strong>R.8 nth Roots; Rational Exponents</strong></td>
<td>74</td>
</tr>
<tr>
<td>Work with ( n )th Roots • Simplify Radicals • Rationalize Denominators and Numerators • Simplify Expressions with Rational Exponents</td>
<td></td>
</tr>
</tbody>
</table>

| 1 Graphs, Equations, and Inequalities | 83 |
| **1.1 Graphing Utilities; Introduction to Graphing Equations** | 84 |
| Graph Equations by Plotting Points • Graph Equations Using a Graphing Utility • Use a Graphing Utility to Create Tables • Find Intercepts from a Graph • Use a Graphing Utility to Approximate Intercepts |
4.4 **Building Quadratic Models from Verbal Descriptions and from Data**  
Build Quadratic Models from Verbal Descriptions • Build Quadratic Models from Data

4.5 **Inequalities Involving Quadratic Functions**  
Solve Inequalities Involving a Quadratic Function

---

**Chapter Review**

**Chapter Test**

**Cumulative Review**

**Chapter Projects**

---

5 **Polynomial and Rational Functions**

5.1 **Polynomial Functions**  
Identify Polynomial Functions and Their Degree • Graph Polynomial Functions Using Transformations • Identify the Real Zeros of a Polynomial Function and Their Multiplicity

5.2 **The Graph of a Polynomial Function; Models**  
Analyze the Graph of a Polynomial Function • Build Cubic Models from Data

5.3 **The Real Zeros of a Polynomial Function**  
Use the Remainder and Factor Theorems • Use Descartes’ Rule of Signs to Determine the Number of Positive and the Number of Negative Real Zeros of a Polynomial Function • Use the Rational Zeros Theorem to List the Potential Rational Zeros of a Polynomial Function • Find the Real Zeros of a Polynomial Function • Solve Polynomial Equations • Use the Theorem for Bounds on Zeros • Use the Intermediate Value Theorem

5.4 **Complex Zeros; Fundamental Theorem of Algebra**  
Use the Conjugate Pairs Theorem • Find a Polynomial Function with Specified Zeros • Find the Complex Zeros of a Polynomial Function

5.5 **Properties of Rational Functions**  
Find the Domain of a Rational Function • Find the Vertical Asymptotes of a Rational Function • Find the Horizontal or Oblique Asymptote of a Rational Function

5.6 **The Graph of a Rational Function**  
Analyze the Graph of a Rational Function • Solve Applied Problems Involving Rational Functions

5.7 **Polynomial and Rational Inequalities**  
Solve Polynomial Inequalities Graphically and Algebraically • Solve Rational Inequalities Graphically and Algebraically

---

**Chapter Review**

**Chapter Test**

**Cumulative Review**

**Chapter Projects**

---

6 **Exponential and Logarithmic Functions**

6.1 **Composite Functions**  
Form a Composite Function • Find the Domain of a Composite Function
6.2 One-to-One Functions; Inverse Functions
Determine Whether a Function Is One-to-One • Determine the Inverse of a Function Defined by a Mapping or a Set of Ordered Pairs • Obtain the Graph of the Inverse Function from the Graph of a One-to-One Function • Verify that a Function Defined by an Equation Is an Inverse Function • Find the Inverse of a Function Defined by an Equation

6.3 Exponential Functions
Evaluate Exponential Functions • Graph Exponential Functions • Define the Number e • Solve Exponential Equations

6.4 Logarithmic Functions
Change Exponential Statements to Logarithmic Statements and Logarithmic Statements to Exponential Statements • Evaluate Logarithmic Expressions • Determine the Domain of a Logarithmic Function • Graph Logarithmic Functions • Solve Logarithmic Equations

6.5 Properties of Logarithms
Work with the Properties of Logarithms • Write a Logarithmic Expression as a Sum or Difference of Logarithms • Write a Logarithmic Expression as a Single Logarithm • Evaluate Logarithms Whose Base Is Neither 10 Nor e • Graph a Logarithmic Function Whose Base is Neither 10 Nor e

6.6 Logarithmic and Exponential Equations
Solve Logarithmic Equations • Solve Exponential Equations • Solve Logarithmic and Exponential Equations Using a Graphing Utility

6.7 Financial Models
Determine the Future Value of a Lump Sum of Money • Calculate Effective Rates of Return • Determine the Present Value of a Lump Sum of Money • Determine the Rate of Interest or the Time Required to Double a Lump Sum of Money

6.8 Exponential Growth and Decay Models; Newton's Law; Logistic Growth and Decay Models
Model Populations That Obey the Law of Uninhibited Growth • Model Populations That Obey the Law of Uninhibited Decay • Use Newton's Law of Cooling • Use Logistic Models

6.9 Building Exponential, Logarithmic, and Logistic Models from Data
Build an Exponential Model from Data • Build a Logarithmic Model from Data • Build a Logistic Model from Data

Chapter Review

Chapter Test

Cumulative Review

Chapter Projects

7 Trigonometric Functions

7.1 Angles, Arc Length, and Circular Motion
Angles and Degree Measure • Convert between Decimal and Degree, Minute, Second Measures for Angles • Find the Length of an Arc of a Circle • Convert from Degrees to Radians and from Radians to Degrees • Find the Area of a Sector of a Circle • Find the Linear Speed of an Object Traveling in Circular Motion

7.2 Right Triangle Trigonometry
Find the Values of Trigonometric Functions of Acute Angles • Use Fundamental Identities • Find the Values of the Remaining Trigonometric Functions, Given the Value of One of Them • Use the Complementary Angle Theorem
7.3 Computing the Values of Trigonometric Functions of Acute Angles

Find the Exact Values of the Trigonometric Functions of \( \frac{\pi}{4} \) = 45° • Find the Exact Values of the Trigonometric Functions of \( \frac{\pi}{6} \) = 30° and \( \frac{\pi}{3} \) = 60° • Use a Calculator to Approximate the Values of the Trigonometric Functions of Acute Angles • Model and Solve Applied Problems Involving Right Triangles

7.4 Trigonometric Functions of Any Angle

Find the Exact Values of the Trigonometric Functions for Any Angle • Use Coterminal Angles to Find the Exact Value of a Trigonometric Function • Determine the Signs of the Trigonometric Functions of an Angle in a Given Quadrant • Find the Reference Angle of an Angle • Use a Reference Angle to Find the Exact Value of a Trigonometric Function • Find the Exact Values of the Trigonometric Functions of an Angle, Given Information about the Functions

7.5 Unit Circle Approach; Properties of the Trigonometric Functions

Find the Exact Values of the Trigonometric Functions Using the Unit Circle • Know the Domain and Range of the Trigonometric Functions • Use Periodic Properties to Find the Exact Values of the Trigonometric Functions • Use Even-Odd Properties to Find the Exact Values of the Trigonometric Functions

7.6 Graphs of the Sine and Cosine Functions

Graph the Sine Function \( y = \sin x \) and Functions of the Form \( y = A \sin (\omega x) \) • Graph the Cosine Function \( y = \cos x \) and Functions of the Form \( y = A \cos (\omega x) \) • Determine the Amplitude and Period of Sinusoidal Functions • Graph Sinusoidal Functions Using Key Points • Find an Equation for a Sinusoidal Graph

7.7 Graphs of the Tangent, Cotangent, Cosecant, and Secant Functions

Graph the Tangent Function \( y = \tan x \) and the Cotangent Function \( y = \cot x \) • Graph Functions of the Form \( y = A \tan (\omega x) + B \) and \( y = A \cot (\omega x) + B \) • Graph the Cosecant Function \( y = \csc x \) and the Secant Function \( y = \sec x \) • Graph Functions of the Form \( y = A \csc (\omega x) + B \) and \( y = A \sec (\omega x) + B \)

7.8 Phase Shift; Sinusoidal Curve Fitting

Graph Sinusoidal Functions of the Form \( y = A \sin (\omega x - \phi) + B \) • Build Sinusoidal Models from Data

Chapter Review
Chapter Test
Cumulative Review
Chapter Projects

8 Analytic Trigonometry

8.1 The Inverse Sine, Cosine, and Tangent Functions

Define the Inverse Sine Function • Find the Value of an Inverse Sine Function • Define the Inverse Cosine Function • Find the Value of an Inverse Cosine Function • Define the Inverse Tangent Function • Find the Value of an Inverse Tangent Function • Use Properties of Inverse Functions to Find Exact Values of Certain Composite Functions • Find the Inverse Function of a Trigonometric Function • Solve Equations Involving Inverse Trigonometric Functions
8.2 The Inverse Trigonometric Functions (Continued) 656
Define the Inverse Secant, Cosecant, and Cotangent Functions • Find the Value of Inverse Secant, Cosecant, and Cotangent Functions • Find the Exact Value of Composite Functions Involving the Inverse Trigonometric Functions • Write a Trigonometric Expression as an Algebraic Expression

8.3 Trigonometric Equations 662
Solve Equations Involving a Single Trigonometric Function • Solve Trigonometric Equations Using a Calculator • Solve Trigonometric Equations Quadratic in Form • Solve Trigonometric Equations Using Fundamental Identities • Solve Trigonometric Equations Using a Graphing Utility

8.4 Trigonometric Identities 672
Use Algebra to Simplify Trigonometric Expressions • Establish Identities

8.5 Sum and Difference Formulas 680
Use Sum and Difference Formulas to Find Exact Values • Use Sum and Difference Formulas to Establish Identities • Use Sum and Difference Formulas Involving Inverse Trigonometric Functions • Solve Trigonometric Equations Linear in Sine and Cosine

8.6 Double-angle and Half-angle Formulas 693
Use Double-angle Formulas to Find Exact Values • Use Double-angle Formulas to Establish Identities • Use Half-angle Formulas to Find Exact Values

8.7 Product-to-Sum and Sum-to-Product Formulas 704
Express Products as Sums • Express Sums as Products

Chapter Review 708
Chapter Test 711
Cumulative Review 712
Chapter Projects 713

9 Applications of Trigonometric Functions 714
9.1 Applications Involving Right Triangles 715
Solve Right Triangles • Solve Applied Problems

9.2 The Law of Sines 721
Solve SAA or ASA Triangles • Solve SSA Triangles • Solve Applied Problems

9.3 The Law of Cosines 732
Solve SAS Triangles • Solve SSS Triangles • Solve Applied Problems

9.4 Area of a Triangle 739
Find the Area of SAS Triangles • Find the Area of SSS Triangles

9.5 Simple Harmonic Motion; Damped Motion; Combining Waves 745
Build a Model for an Object in Simple Harmonic Motion • Analyze Simple Harmonic Motion • Analyze an Object in Damped Motion • Graph the Sum of Two Functions

Chapter Review 755
Chapter Test 757
Cumulative Review 758
Chapter Projects 758
11 Analytic Geometry  825

11.1 Conics  826
Know the Names of the Conics

11.2 The Parabola  827
Analyze Parabolas with Vertex at the Origin • Analyze Parabolas with Vertex at \((h, k)\) • Solve Applied Problems Involving Parabolas

11.3 The Ellipse  837
Analyze Ellipses with Center at the Origin • Analyze Ellipses with Center at \((h, k)\) • Solve Applied Problems Involving Ellipses

11.4 The Hyperbola  850
Analyze Hyperbolas with Center at the Origin • Find the Asymptotes of a Hyperbola • Analyze Hyperbolas with Center at \((h, k)\) • Solve Applied Problems Involving Hyperbolas

11.5 Rotation of Axes; General Form of a Conic  865
Identify a Conic • Use a Rotation of Axes to Transform Equations • Analyze an Equation Using a Rotation of Axes • Identify Conics without Rotating the Axes

11.6 Polar Equations of Conics  873
Analyze and Graph Polar Equations of Conics • Convert the Polar Equation of a Conic to a Rectangular Equation
12 Systems of Equations and Inequalities

12.1 Systems of Linear Equations: Substitution and Elimination
Solve Systems of Equations by Substitution • Solve Systems of Equations by Elimination • Identify Inconsistent Systems of Equations Containing Two Variables • Express the Solution of a System of Dependent Equations Containing Two Variables • Solve Systems of Three Equations Containing Three Variables • Identify Inconsistent Systems of Equations Containing Three Variables • Express the Solution of a System of Dependent Equations Containing Three Variables

12.2 Systems of Linear Equations: Matrices
Write the Augmented Matrix of a System of Linear Equations • Write the System of Equations from the Augmented Matrix • Perform Row Operations on a Matrix • Solve a System of Linear Equations Using Matrices

12.3 Systems of Linear Equations: Determinants
Evaluate 2 by 2 Determinants • Use Cramer’s Rule to Solve a System of Two Equations Containing Two Variables • Evaluate 3 by 3 Determinants • Use Cramer’s Rule to Solve a System of Three Equations Containing Three Variables • Know Properties of Determinants

12.4 Matrix Algebra
Find the Sum and Difference of Two Matrices • Find Scalar Multiples of a Matrix • Find the Product of Two Matrices • Find the Inverse of a Matrix • Solve a System of Linear Equations Using an Inverse Matrix

12.5 Partial Fraction Decomposition
Decompose \( \frac{P}{Q} \) where \( Q \) Has Only Nonrepeated Linear Factors
- Decompose \( \frac{P}{Q} \) where \( Q \) Has Repeated Linear Factors - Decompose \( \frac{P}{Q} \) where \( Q \) Has a Nonrepeated Irreducible Quadratic Factor - Decompose \( \frac{P}{Q} \) where \( Q \) Has a Repeated Irreducible Quadratic Factor

12.6 Systems of Nonlinear Equations
Solve a System of Nonlinear Equations Using Substitution • Solve a System of Nonlinear Equations Using Elimination

12.7 Systems of Inequalities
Graph an Inequality by Hand • Graph an Inequality Using a Graphing Utility • Graph a System of Inequalities

12.8 Linear Programming
Set Up a Linear Programming Problem • Solve a Linear Programming Problem

Chapter Review
Chapter Test
Cumulative Review
Chapter Projects
14 Counting and Probability 1048

14.1 Counting 1049
Find All the Subsets of a Set • Count the Number of Elements in a Set
• Solve Counting Problems Using the Multiplication Principle

14.2 Permutations and Combinations 1054
Solve Counting Problems Using Permutations Involving \( n \) Distinct Objects
• Solve Counting Problems Using Combinations • Solve Counting Problems Using Permutations Involving \( n \) Nondistinct Objects

14.3 Probability 1063
Construct Probability Models • Compute Probabilities of Equally Likely Outcomes • Find Probabilities of the Union of Two Events • Use the Complement Rule to Find Probabilities

Chapter Review 1073
Chapter Test 1075
Cumulative Review 1076
Chapter Projects 1076

Answers AN1
Challenge Problem Solutions CP1
Photo Credits C1
Subject Index I1
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.

**Enhanced with Graphing Utilities Series**

This series provides a thorough integration of graphing utilities into topics, allowing students to explore mathematical concepts and encounter ideas usually studied in later courses. Many examples show solutions using algebra side-by-side with graphing techniques. Using technology, the approach to solving certain problems differs from the Contemporary (Flagship) or Concepts through Functions Series, while the emphasis on understanding concepts and building strong skills is maintained. Texts in this series are *College Algebra, Algebra & Trigonometry,* and *Precalculus.*

**Flagship Series**

The Flagship Series is the most traditional in approach, yet modern in its treatment of precalculus mathematics. In each text, needed review material is included and is referenced when it is used. Graphing utility coverage is optional and can be included or excluded at the discretion of the instructor. Texts in this series are *College Algebra, Algebra & Trigonometry, Trigonometry: A Unit Circle Approach,* and *Precalculus.*

**Concepts through Functions Series**

This series differs from the others, utilizing a functions approach that serves as the organizing principle tying concepts together. Functions are introduced early in various formats. This approach supports the Rule of Four, which states that functions are represented symbolically, numerically, graphically, and verbally. Each chapter introduces a new type of function and 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. Graphing utility coverage is optional and can be included or excluded at the discretion of the instructor. Texts in this series are *College Algebra; Precalculus, with a Unit Circle Approach to Trigonometry; Precalculus, with a Right Triangle Approach to Trigonometry.*
The Enhanced with Graphing Utilities Series

**College Algebra, Eighth Edition**
This text provides an approach to college algebra that completely integrates graphing technology without sacrificing mathematical analysis and conceptualization. The text has three chapters of review material preceding the chapter on functions. Graphing calculator usage is integrated throughout. After completing this text, a student will be prepared for trigonometry, finite mathematics, and business calculus.

**Algebra & Trigonometry, Eighth Edition**
This text contains all the material in *College Algebra*, but it also develops the trigonometric functions using a right triangle approach and shows how that approach is related to the unit circle approach. Graphing techniques are emphasized, including a thorough discussion of polar coordinates, parametric equations, and conics using polar coordinates. Vectors in the plane, including the dot product, sequences, induction, and the binomial theorem are also presented. After completing this text, a student will be prepared for finite mathematics, business calculus, and engineering calculus.

**Precalculus, Eighth Edition**
This text contains a review chapter before covering the traditional precalculus topics of functions and their graphs, polynomial and rational functions, and exponential and logarithmic functions. The trigonometric functions are introduced using a unit circle approach and show how it is related to the right triangle approach. Graphing techniques are emphasized, including a thorough discussion of polar coordinates, parametric equations, and conics using polar coordinates. Vectors in the plane and in space, including the dot and cross products, sequences, induction, and the binomial theorem are also presented. Graphing calculator usage is integrated throughout. The final chapter provides an introduction to calculus, with a discussion of the limit, the derivative, and the integral of a function. After completing this text, a student will be prepared for finite mathematics, business calculus, and engineering calculus.
Preface to the Instructor

As professors at an urban university (Michael Sullivan) and a community college (Michael Sullivan III), we are aware of the varied needs of students in this course. Such students range from those who have little mathematical background and are fearful of mathematics courses to those with 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. We have written this text with both groups in mind.

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. As an instructor and an author of a developmental mathematics series, Michael’s son and co-author, Michael Sullivan III, understands the trepidations and skills that students bring to the Algebra and Trigonometry course. As the father of current college students, Michael III realizes that today’s college students demand a variety of media to support their education. This text addresses that demand by providing technology and video support that enhances understanding without sacrificing math skills. Together, we have taken great pains to ensure that the text offers 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 confident that, building on the success of the first seven editions and incorporating many of these suggestions, we have made Algebra & Trigonometry Enhanced with Graphing Utilities, 8th Edition, an even better tool for learning and teaching. 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. As an instructor and an author of a developmental mathematics series, Michael’s son and co-author, Michael Sullivan III, understands the trepidations and skills that students bring to the Algebra and Trigonometry course. As the father of current college students, Michael III realizes that today’s college students demand a variety of media to support their education. This text addresses that demand by providing technology and video support that enhances understanding without sacrificing math skills. Together, we have taken great pains to ensure that the text offers 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 confident that, building on the success of the first seven editions and incorporating many of these suggestions, we have made Algebra & Trigonometry Enhanced with Graphing Utilities, 8th Edition, an even better tool for learning and teaching. We continue to encourage you to share with us your experiences teaching from this text.

Features in the Eighth Edition

A descriptive list of the many special features of Algebra & Trigonometry can be found 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 this and to discuss it with your students at the beginning of your course. Our experience is that when students utilize these features, they are more successful in the course.

New to the Eighth Edition

New Within the Textbook

Here are the new features of this edition:

- **Challenge Problems** – These problems appear in the Applications and Extensions part of the section exercises and are designed to challenge students. Full solutions are in the back of the Annotated Instructor’s Edition and in the Instructor’s Solution Manual.
- **“Need to Review?” Feature** – We placed reminders in the margin for key review topics. The reminders point students to the location of the review material in the textbook.
- **Chapter Projects** – The projects have been enhanced to give students an up-to-the-minute experience. Many of these projects require the student to research information online in order to solve problems.
- **Interactive Figure Exercises** – We have added this new category of exercises that require students to manipulate an interactive figure to solve. The interactive figures may be found at bit.ly/2Mibga0 or in the Video and Resource Library of MyLab Math, and were created by author Michael Sullivan III in GeoGebra. These exercises are labeled with the icon  
- **Expanded! Retain Your Knowledge Problems** – These problems, which were new to the previous edition, are based on learning research, including a study of precalculus students at University of Louisville entitled “Spaced retrieval practice increases college students’ short- and long-term retention of mathematics knowledge” (Hopkins et al, 2016). The Retain Your Knowledge problems were so well received that we have expanded them 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 ( ). All answers to Retain Your Knowledge problems are given in the back of the text and these problems are available in the prebuilt assignments in the Assignment Manager in MyLab Math.
- **Key to Exercise Types** – To help you navigate the features of the exercise sets, we’ve included a key at the bottom of the first page of each section’s exercises.
• **Graphing Utility Screen Captures** – In several instances we have added Desmos screen captures along with the TI-84 Plus CE screen captures. These updated screen captures provide alternative ways of visualizing concepts and making connections between equations, data, and graphs in full color.

### Content Changes

**Chapter R**
- Section R.8 Objective 3 now includes rationalizing the numerator. Problems 69–76 provide practice.

**Chapter 1**
- Section 1.1 has been reorganized to only include an introduction to graphing and graphing utilities.

**Chapter 2**
- NEW Section 2.1 The Distance and Midpoint Formulas
- NEW Section 2.2 Example 5 Testing an Equation for Symmetry

**Chapter 3**
- NEW Section 3.1 Objective 1 Describe a Relation
  - NEW Example 1 Describing a Relation demonstrates using the Rule of Four to express a relation numerically, as a mapping, and graphically given a verbal description.
- NEW Section 3.2 Example 4 Expending Energy

**Chapter 4**
- Section 4.3 now 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**
- Previous 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**
- NEW Section 6.2 Objective Verify a Function Defined by an Equation is an Inverse Function

**Chapter 7**
- NEW Section 7.1 Example 6 Field Width of a Digital Lens Reflex Camera Lens
- NEW Section 7.5 Example 5 Using Symmetry to Find Exact Values of Trigonometric Functions
- Sections 7.6 and 7.7 were reorganized for increased clarity. Two new objectives were added to Section 7.7.

**Chapter 8**
- Sections 8.1 and 8.2 were reorganized for increased clarity. Four new objectives were added to Section 8.1. The objectives in Section 8.2 were reordered.

**Chapter 10**
- Section 10.3 DeMoivre’s Theorem was rewritten to support the exponential form of a complex number.
  - Euler’s Formula is introduced to express a complex number in exponential form. The exponential form is used to compute products and quotients.
  - DeMoivre’s Theorem is expressed using the exponential form of a complex number. The exponential form is used to find complex roots.

**Chapter 12**
- NEW Section 12.5 Example 1 Identifying Proper and Improper Rational Expressions

**Chapter 13**
- NEW Section 13.3 Objective 5 Solving Annuity Problems Using Formulas

### New Within MyLab Math

- **Setup & Solve Exercises** require students to show how they set up a problem as well as the solution, better mirroring what is required of them on tests. We have included both the “traditional” and Setup & Solve versions of exercise within MyLab to provide you with more options for assessing students.
- **Integrated Review** content and assessments help you provide students with the remediation they need, when they need it. Integrated Review consists of:
  - **Skills Check Quizzes** by chapter assess the prerequisite skills students need for that chapter.
  - **Skills Review Homework**, again by chapter, is personalized (based on the results of the Skills Check Quiz) to provide students with help on the prerequisite skills they are lacking. Students receive just the help they need—no more, no less.
- **Intermediate Algebra eText, Exercises, Videos, and Worksheets**—For students who need more help (or for co-requisite courses), we’ve included the contents of a streamlined Intermediate Algebra course within this MyLab course. There’s no need to go elsewhere for remediation.
- **Interactive Figures** (formerly titled Guided Visualizations) have been expanded to support teaching and learning. The figures (created in GeoGebra by author Michael Sullivan III) illustrate key concepts and allow manipulation. They have been designed to be used in lecture as well as by students independently.
- **Enhanced Sample Assignments** are pre-made section-level assignments that address key concepts within the section and help keep previously learned skills fresh with RetainYour Knowledge questions. They are assignable and editable.
Using the Eighth 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 Algebra and Trigonometry 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 accompanying figure) 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
This is 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 Trigonometric Functions
Section 7.8 may be omitted in a brief course.

Chapter 8 Analytic Trigonometry
Sections 8.2, 8.6, and 8.7 may be omitted in a brief course.

Chapter 9 Applications of Trigonometric Functions
Sections 9.4 and 9.5 may be omitted in a brief course.

Chapter 10 Polar Coordinates; Vectors
Sections 10.1–10.3 and Sections 10.4–10.5 are independent and may be covered separately.

Chapter 11 Analytic Geometry
Sections 11.1–11.4 follow in sequence. Sections 11.5, 11.6, and 11.7 are independent of each other, but each requires Sections 11.1–11.4.

Chapter 12 Systems of Equations and Inequalities
Sections 12.2–12.7 may be covered in any order, but each requires Section 12.1. Section 12.8 requires Section 12.7.

Chapter 13 Sequences; Induction; The Binomial Theorem
There are three independent parts: Sections 13.1–13.3, Section 13.4, and Section 13.5.

Chapter 14 Counting and Probability
The sections follow in sequence.

Acknowledgments
Texts are written by authors, but they evolve from idea to final form through the efforts of many people.

Thanks are due to the following people for their assistance and encouragement during the preparation of this edition:
• From Pearson Education: Dawn Murrin, for her substantial support, dedication, and energy; Jeff Weidenaar for his attention to detail, experience, editorial expertise, and genuine interest in this project; Peggy McMahon for directing the always difficult production process; Rose Kernan for handling liaison between the compositor and author; Stacey Sveum and Jordan Longoria for their creative and enthusiastic marketing this text; Marcia Horton for her continued support and genuine interest; Paul Corey for his leadership and commitment to excellence; and Peggy Lucas and the Pearson sales team for their continued confidence and personal support of our texts.
• Accuracy checkers: Roger Lipsett read the entire manuscript and checked the accuracy of answers. Timothy Britt created the Solutions Manuals and accuracy-checked answers.
• Michael Sullivan III would like to thank his colleagues at Joliet Junior College for their support and feedback.
Finally, we offer our sincere thanks to the dedicated users and reviewers of our texts, whose collective insights form the backbone of each text revision.
The list of those to whom we are indebted continues to grow. If we’ve forgotten anyone, please accept our apology. Thank you to all.
Preface to the Instructor
Preface to the Instructor

Laura Pyzdrowski, West Virginia University
Michael Prophet, University of Northern Iowa
Charlotte Pisors, Baylor University
Philip Pina, Florida Atlantic University
Linda Padilla, Joliet Junior College
Leticia Oropesa, University of Miami
Seth F. Oppenheimer, Mississippi State University
Carrie Oren, University of Miami International
Alec Matheson, Lamar University
Nancy Matthews, University of Oklahoma
James Maxwell, Oklahoma State University
Laura Mathews, University of Oklahoma
Michael McCollum, Joliet Junior College
David Mee, Bowling Green State University
Carolyn Metcalf, Concordia University
Samia Metwally, Eric Community College
Rich Meyers, Joliet Junior College
Eldon Miller, University of Mississippi
James Miller, West Virginia University
Michael Miller, Iowa State University
Kathleen Miranda, SUNY at Old Westbury
Chris Mire, The Community College of Baltimore County
Val Mohanakumar, Hillsborough Community College
Thomas Monaghan, Naperville North High School
Miguel Montanez, Miami Dade College, Wolfson Campus
Maria Montoya, Our Lady of the Lake University
Susan Moosai, Florida Atlantic University
Craig Morse, Naperville North High School
Samad Mortabit, Metropolitan State University
Put Mower, Washburn University
Tammy Mulh, University of Central Florida
A. Muhundan, Manatee Community College
Jane Murphy, Middletown Community College
Richard Nadel, Florida International University
Gabriel Naga, Kansas State University
Bill Naegle, South Suburban College
Karla Neal, Louisiana State University
Lawrence E. Newman, Holyoke Community College
Dwight Newsome, Pasco-Hernando Community College
Denise Nunley, Maricopa Community College
James Nymann, University of Texas-El Paso
Mark Omdot, Anoka-Ramsey Community College
Seth Oppenheimer, Mississippi State University
Leticia Oropesa, University of Miami
Linda Padilla, Joliet Junior College
Sanja Pantic, University of Illinois at Chicago
E. James Peake, Iowa State University
Kelly Pearson, Murray State University
Dashamir Petrela, Florida Atlantic University
Philip Pina, Florida Atlantic University
Charlotte Pisors, Baylor University
Michael Prophet, University of Northern Iowa
Laura Pyzdrowski, West Virginia University
Carrie Quensell, Weber State University
Neal C. Raher, University of Akron
Thomas Radin, San Joaquin Delta College
Aiibg Serene Radulovic, Florida Atlantic University
Ken A. Rager, Metropolitan State College
Traci Reed, St. Johns River State College
Kenneth D. Reeves, San Antonio College
Elsi Reinhart, Truckee Meadows Community College
Jose Remeser, Miami Dade College, Wolfson
Jane Ringwald, Iowa State University
Douglas F. Robertson, University of Minnesota, MPLS
Stephen Rodi, Austin Community College
William Rogge, Lincoln Northeast High School
Howard L. Rolf, Baylor University
Mike Rosenthal, Florida International University
Phoebe Rouse, Louisiana State University
Edward Rozema, University of Tennessee at Chattanooga
Dennis C. Runde, Manatee Community College
Paul Rumon, Missouri University of Science and Technology
Amit Saini, University of Nevada-Reno
Laura Salazar, Northwest Vista College
Alan Saleski, Loyola University of Chicago
Susan Sandmeyer, Jamestown Community College
Brenda Santis, Salt Lake Community College
Linda Schmidt, Greenville Technical College
Ingred Scott, Montgomery College
A.K. Shamma, University of West Florida
Zachary Sharan, University of Texas at San Antonio
Joshua Sheehan, Virginia Western CC
Martin Sherry, Lower Columbia College
Carmen Sherrin, Florida International University
Tatiana Subh, San Jose State University
Anita Sik, Delgado Community College
Timothy Sipka, Alma College
Charlotte Smegal, University of Tampa
Lori Smegalmar, Manatee Community College
Gary Smith, Loyola Blakefield
Cindy Soderstrom, Salt Lake Community College
Leslie Soltis, Mercyhurst College
John Spellman, Southwest Texas State University
Karen Spike, University of North Carolina Raleigh
Shashank Sriram, Okaloosa-Walton Community College
Kratina Staley, North Carolina Agricultural and Technical State University
Becky Stamper, Western Kentucky University
Judy Staver, Florida Community College
Robin Steinberg, Pima Community College
Neil Stephens, Hindsdale South High School
Sonya Stephens, Florida A&M University
Patrick Stevens, Joliet Junior College
John Summer, University of Tampa
Matthew TenHuisen, University of North Carolina, Wilmington
Christopher Terry, Augusta State University
Diane Tesa, South Suburban College
Tommy Thompson, Brookhaven College
Martha K. Tietze, Shawnee Mission Northwest High School
Richard J. Tomlinson, Iowa State University
Florentina Tong, University of West Florida
Suzanne Topp, Salt Lake Community College
Marilyn Toscano, University of Wisconsin, Superior
Marvel Townsend, University of Florida
Jim Trudnowski, Carroll College
David Tseng, Miami Dade College, Kendall Campus
Robert Tuskey, Joliet Junior College
Mihaela Vajiac, Chapman University-Orange
Julia Varbalow, Thomas Nelson Community College
Richard G. Vinson, University of South Alabama
Jorge Viola-Priolo, Florida Atlantic University
Mary Vomack, University of Idaho
Jennifer Walsh, Daytona Beach Community College
Donna Wandke, Naperville North High School
Timothy L. Warkentin, Cloud County Community College
Melissa J. Watts, Virginia State University
Hayal Weiss, Middletown Community College
Kathryn Wetzel, Amarillo College
Darlene Whitkop, Northern Illinois University
Suzanne Williams, Central Piedmont Community College
Harriett Wilson, University of Florida
Christine Wilson, West Virginia University
Brad Wind, Florida International University
Anna Wodarczyk, Florida International University
Mary Wolyniak, Broome Community College
Canton Woods, Auburn University
Tamara S. Worner, Wayne State College
Terri Wright, New Hampshire Community Technical College, Manchester
Rob Wylie, Carl Albert State College
Aletthea Zambesi, University of West Florida
George Zari, Chicago State University
Loris Zucca, Lone Star College-Kingswood
Steve Zuro, Joliet Junior College

Michael Sullivan
Chicago State University
Michael Sullivan III
Joliet Junior College
Get the most out of MyLab Math

MyLab Math for *Algebra & Trigonometry Enhanced with Graphing Utilities 8e* by Michael Sullivan & Michael Sullivan III

*(access code required)*

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

**Preparedness**

Preparedness is one of the biggest challenges in many math courses. Pearson offers a variety of content and course options to support students with just-in-time remediation and key-concept review as needed.

**Integrated Review in MyLab Math**

Integrated Review can be used in corequisite courses or simply to help students who enter a course without a full understanding of prerequisite skills and concepts. Premade, editable Integrated Review assignments are available to assign in the Assignment Manager.

- Students begin each chapter by completing a Skills Check to pinpoint which topics, if any, they need to review.

- Personalized review homework provides extra support for students who need it on just the topics they didn’t master in the preceding Skills Check.

- Additional review materials including videos featuring Michael Sullivan III, worksheets, and Sullivan’s *Algebra Review* text, are available.

pearson.com/mylab/math
Get the most out of MyLab Math

New! Interactive Figures

Interactive Figures, created in GeoGebra by Michael Sullivan III, bring mathematical concepts to life, helping students visualize the concept through guided exploration and purposeful manipulation. Assignable in MyLab Math with assessment questions to check students’ conceptual understanding.

Enhanced Sample Assignments

The Sullivans make course set-up easier by giving instructors a starting point for each section. Enhanced Sample Assignments use a thoughtful mix of Sullivan hallmark practice problems that are geared to maximize students’ performance—including Retain Your Knowledge exercises that improve students’ recall of concepts learned earlier in the course.

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.

pearson.com/mylab/math
Resources for Success

Instructor Resources
Online resources can be downloaded at pearson.com/mylab/math or from www.pearson.com.

Annotated Instructor’s Edition
ISBN - 0135812828 / 9780135812822
Shorter answers are on the page beside the exercises. Longer answers are in the back of the text.

Instructor’s Solution Manual
Includes fully worked solutions to all exercises in the text.

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 correlate to the textbook and include alternate classroom examples for every textbook objective.

Mini Lecture Notes
This guide 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. Videos are 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.

Student’s Solutions Manual
ISBN - 013581328X / 9780135813287
Provides detailed worked-out solutions to odd-numbered exercises. Available within MyLab Math and in print.

Guided Lecture Notes
ISBN - 0135813107 / 9780135813102
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 and 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 are also available in print format.

Algebra Review
ISBN: 0131480065 / 9780131480063
Four chapters of Intermediate Algebra review. Perfect for a corequisite course or for individual review. Available in print form; PDFs are also available within MyLab Math.
## Applications Index

### Acoustics
- amplifying sound, 530
- loudness of sound, 477, 532
- loudspeaker, 753
- tuning fork, 753
- whispering galleries, 845

### Aerodynamics
- modeling aircraft motion, 824

### Agriculture
- farm management, 990–991
- farm workers in U.S., 517
- field enclosure, 974
- field irrigation, 116
- floor design, 1017, 1045
- football stadium seating, 1019
- fruit orchard, 517
- irrigation, 116
- vertical circular building, 201
- window design, 329–330
- wind tunnel, 201

### Air travel
- distance of prehistoric man's death, 530
- parking at O'Hare International Airport, 329
- travel between two planes, 228, 236
- transatlantic, 228, 236

### Archaeology
- age of ancient tools, 510
- age of fossil, 516
- date of prehistoric man's death, 530

### Architecture
- brick staircase, 1019, 1045
- Burj Khalifa building, 33
- caster design, 329
- racetrack design, 845
- special window, 330
- stadium construction, 1019
- window design, 329–330
- window dimensions, 116
- window frame, 116

### Area
- Bermuda Triangle, 743
- building ground, 743
- curve, 654
- dodecagon, 753
- isosceles triangle, 702
- octagon, 701–702
- sector of circle, 545
- segment of circle, 756

### Art
- fine decorative pieces, 570
- framing a painting, 159

### Astronomy
- angle of elevation of Sun, 271
- Halley's comet, 879
- International Space Station (ISS), 894
- light-year, 31
- planetary orbits, 845
- Earth, 848
- elliptical, 848
- Jupiter, 848
- Mars, 848
- Mercury, 879
- Neptune, 898
- Pluto, 848, 898

### Aviation
- fighter jet design, 743
- modeling aircraft motion, 824
- orbital launches, 911
- sonic boom, 864

### Biology
- alcohol and driving, 472, 477–478
- bacterial growth, 508–509
- E. coli, 251, 293, 522
- blood types, 1053
- bone length, 337–338
- cancer, 462, 523
- cricket chirp rate and temperature, 330–331
- healing of wounds, 462, 476
- lung volume, 594
- maternal age versus Down syndrome, 308
- muscle force, 811
- yeast biomass as function of time, 521–522

### Business
- advertising, 193, 309, 338
- automobile production, 431, 927
- blending coffee, 142, 159
- candy bar size, 117
- checkout lines, 1072
- clothing store, 1075
- cookie orders, 995–996
- cost of can, 406–407, 409
- of charter bus, 159
- of commodity, 431
- of manufacturing, 30, 142, 236, 417, 984
- marginal, 322, 337
- minimizing, 991–992
- of printing textbooks, 362–363
- of production, 251, 431, 955, 996

### Calculus
- area under a curve, 278, 654
- area under graph, 251, 865, 880, 957, 1073
- average rate of change, 366, 446, 478, 496, 582, 595, 619, 655, 661, 672, 680, 731, 820, 857, 894, 914, 928, 1013
- carrying a ladder around a corner, 670
- concavity test, 323
- critical numbers, 1013
- difference quotient, 279, 331, 335, 387, 446, 464, 506, 548, 571, 691, 708, 849, 894, 928, 975, 1031
- discontinuities, 410
- exact value calculations, 837
- factoring expressions, 59, 169, 252, 331, 478, 655, 914, 992
- first derivative, 458
- f(x) = e^x, 1012
- increasing/decreasing/constant function, 323, 595, 611, 880, 985
- inequalities, 416, 464
- Intermediate Value Theorem, 380–381, 410, 985
- maximum-minimum problems, 302, 399, 518, 571
- rain gutter construction, 702
- Mean Value Theorem, 252
- Newton's Method, 398
- normal line, 965
- odd-even functions, 366
- partial fraction decomposition, 1020, 1036, 1054, 1063, 1073
- points of intersection, 399, 432
- polynomial functions, 380
- rationalizing numerator, 310, 496, 661, 940
- real zeros, 1020
- rectangular equation of plane curve, 1031
- reduction of expressions to lowest terms, 73
- rewriting expressions, 284, 310, 323, 518, 620, 693, 1063
- secant line equation, 302, 506, 672
- simplifying expressions, 229, 264, 284, 323, 335, 410, 432, 560, 721, 739, 873, 975
- Simpson's rule, 331
- slope of perpendicular line, 229
- tangent line, 559, 788
- turning points, 417, 548

### Carpentry
- See also Geometry

### Chemistry
- alpha particles, 864
- antifreeze solution, 202

### Culinary arts
- see Geometry

### Economics
-See also Geometry

### Finance
- See also Geometry

### Geometry
- See also Applications Index

### Marketing
- See also Geometry

### Probability
- See also Geometry

### Physics
- See also Applications Index

### Psychology
- See also Applications Index

### Statistics
- See also Applications Index

### Technology
- See also Applications Index

### Transportation
- See also Applications Index

### Travel
- See also Applications Index

### Vocational education
- See also Applications Index

### Economics
-See also Geometry
Applications Index

decomposition reactions, 516
drug concentration, 408–409
gas laws, 207
pH, 476
purity of gold, 143
radioactive decay, 515–516, 523, 530, 532, 992
radioactivity from Chernobyl, 516
self-catalytic, 322
solutions, 912
salt, 143, 144, 159
sugar molecules, 143
volume of gas, 155

Combinatorics
airport codes, 1055
binary codes, 1075
birthday permutations, 1057, 1062, 1069, 1073, 1075
blouses and skirts combinations, 1053
book arrangements, 1062
box stacking, 1061
code formation, 1061
combination locks, 1062
committee formation, 1059, 1061–1062, 1075
Senate committees, 1062
flag arrangement, 1060, 1075
letter codes, 1055–1056
license plate possibilities, 1062, 1075
lining up people, 1056, 1061
number formation, 1053, 1061, 1062, 1075
objects selection, 1062
seating arrangements, 1075
shirts and ties combinations, 1053
telephone numbers, 1075
two-symbol codewords, 1052
word formation, 1060, 1062, 1075

Communications
data plan, 212, 237, 289–290
installing cable TV, 283
phone charges, 300
radar detection, 770
satellite dish, 833, 836
satellite receiver, 872
smartphones, 106, 516
social networking, 106, 517, 524
spreading of rumors, 462, 477
texting speed, 410
Touch-tone phones, 707, 754

Computers and computing
Blu-ray drive, 545
graphics, 811, 956
laser printers, 143
tables, 117, 262, 517
website design, 956
website map, 956

Construction
of border around a garden, 117
of border around a pool, 117
of box, 113–114, 116, 974
closed, 288
open, 283

of brick staircase, 1045
of can, 420
of coffee can, 144
of cylindrical tube, 974
of enclosures
around garden, 143
around pond, 143
maximizing area of, 325–326, 329, 337
of fencing, 325–326, 329, 337
minimum cost for, 409
of flashlight, 836
of headlight, 836
of highway, 570, 730, 756
installing cable TV, 283
patio dimensions, 117
pitch of roof, 720
of rain gutter, 329, 364–365, 702
of ramp, 729
access ramp, 193
of rectangular field enclosure, 329
of stadium, 329–330, 1019
of steel drum, 409
of swimming pool, 39, 40
of swing set, 738
of tent, 743
TV dish, 836
vent pipe installation, 848
of walk, 637

Cryptography
matrices in, 956
passwords, 1062

Decorating
Christmas tree, 34

Demographics
birth rate(s), 331, 1047
divorce rate, 1047
diversity index, 476
living at parents’ home, 117
marital status, 1054
mosquito colony growth, 515
nurses, 1054
population,
unmarried women, 322
death rates, 1047
birth rate(s), 331, 1047
Demographics

Economics
Consumer Price Index (CPI), 506
demand equations, 422
inflation, 505
IS-LM model in, 912
marginal propensity to consume, 1030
multiplier, 1030
emissions, 228
per capita federal debt, 505
poverty rates, 364
poverty threshold, 169
relative income of child, 956
supply-side, 252
unemployment, 1075

Education
age distribution of community college, 1076
college costs, 505, 955
college value, 117
crating grades, 156
degrees awarded, 1051
doctorates, 1072
education savings account, 1011
faculty composition, 1073
field trip, 417
funding a college education, 530
grades, 105
learning curve, 463, 477
maximum level achieved, 998
multiple-choice test, 1062
spring break, 991, 1008
student loan interest on, 955
true/false test, 1061
tuition, 530
video games and grade-point average, 308
working students and GPA, 117

Electricity, 105
alternating current (ac), 636
alternating current (ac) circuits, 609, 628, 691
alternating current (ac) generators, 699
classifiers, 753
cost of, 260
current in RC circuit, 463
current in RL circuit, 463, 477
impedance, 127
Kirchhoff’s Rules, 913, 927
parallel circuits, 127
resistance in, 398
rates for, 155, 193
resistance, 71, 74, 207, 210, 398
voltage
foreign, 30
U.S., 30

Electronics
clock signal, 754
cramping tablets, 117
keyboard layout, 410
Mechanics, 105. See also Physics

Media
fake news, 155
YouTube usage, 1072

Medicine. See also Health
AICL recovery, 581
age versus total cholesterol, 525
blood pressure, 610, 670
cancer, 462, 523
drug concentration, 251, 408–409
drug medication, 462, 477
healing of wounds, 462, 476
lithotripsy, 849
spreading of disease, 531

Meteorology
weather balloon height and atmospheric pressure, 520–521

Miscellaneous
banquet seating, 991
bending wire, 974
biohythms, 610
bracing a ladder a corner, 559, 619, 670
citrus ladders, 1019
coffee container, 533
cross-sectional area of beam, 228, 236
curve fitting, 909–910, 912, 916
drafting error, 168
Droste Effect, 1012
Koch's snowflake, 1030
lamp shadow, 864
Mandelbrot sets, 797
mineral deposits in water pipe, 178
motor, 31
paper creases, 1035
pet ownership, 1072
sidewalk area, 560
volume of balloon, 431
windshield wiper, 545
wire enclosure area, 282

Mixtures. See also Chemistry
blending coffees, 138–139, 142, 159, 984, 995
blending teas, 142
cement, 144
mixed nuts, 142, 911, 984, 996
mixing candy, 142
solutions, 912
water and antifreeze, 143

Motion, 753. See also Physics
catching a train, 896
on a circle, 545
of Ferris Wheel rider, 670
goal ball, 236, 670
minute hand of clock, 545, 635

Music
revenues from, 278

Navigation
avoiding a tropical storm, 736
bear, 717, 736, 756
of aircraft, 719
of ship, 719
charting a course, 810
commercial, 729
compass heading, 810
crossing a river, 810
error in correcting, 734–735, 756
time lost due to, 735
rescue, 736
revising a flight plan, 736
sailing, 787

Oceanography
tides, 610, 630

Optics
angle of refraction, 671
bending light, 671
DSLR camera lens field width, 541
index of refraction, 671
light obliterated through glass, 461
mirror, 864
parabolic reflector, 897
reflection, 836

Pediatrics
height vs. head circumference, 445

Pets
dog roaming area, 547

Pharmacy
vitamin intake, 912, 928

Photography
camera distance, 570
field width of lens, 541, 545, 581

Physics, 105
angle of elevation of Sun, 718
bouncing balls, 1045
braking load, 819
damped motion, 756–757
deflection of board, 880
density of a gas, 226
diameter of atom, 31
Doppler effect, 409
effect of elevation on weight, 236
escape velocity, 880
falling objects, 206
force, 142, 809
frictional, 719, 810
to hold a wagon on a hill, 816–818
resultant, 809
of wind on a window, 205, 207
gravity, 398, 417
on Earth, 227, 445
on Jupiter, 229
harmonic motion, 747, 756–757
heat loss, 204, 210
heat transfer, 670
Hooke's Law, 301
horsepower, 207
inclination of mountain trail, 716
inclined ramp, 810–811
intensity of light, 159, 207
kinetic energy, 142, 207
maximum weight supportable by pine, 204
missile trajectory, 340
moment of inertia, 707
motion of object, 747–748
Newton's laws, 206, 511, 516
pendulum motion, 135, 545, 754, 1025
period, 82, 278, 445
simple pendulum, 206
pressure, 142, 207
product of inertia, 702
projectile motion, 116, 279, 322, 335, 568, 581, 670, 697, 702, 707, 885–886, 892, 896
artillery, 335, 661, 893
distance, 582
thrown object, 892
rotational inertia, 229
safe load for a beam, 207
simulating motion, 887
sound to measure distance, 134–135
sonic boom, 864
speed of, 155
static equilibrium, 807, 810, 811, 823
strain, 365

Law and enforcement
motor vehicle thefts, 1072
violent crimes, 228

Leisure and recreation
amusement park ride, 545
cable TV, 283
community skating rink, 289
Ferris wheel, 201, 545, 610, 670, 731, 753
field trip, 417
roller coaster, 630
video games and grade-point average, 308

Measurement
optical methods of 679
of rainfall, 819
objects approaching intersection, 892–893
of pendulum, 754, 757
revolutions of circular disk, 39
simulating, 887
tortoise and the hare race, 974
uniform, 139–140, 142, 892–893

Mechanics, 105.

Property

Housing. See also Real estate
apartment rental, 330
price appreciation of homes, 504
prices for, 420

Investment(s), 105, 142, 159, 532
allocation, 102, 264
in bonds, 991
Treasures, 927, 928, 982, 984, 985–986
zero-coupon, 502, 505
in CDs, 501, 991
comparing, 505
compound interest on, 497–498, 499, 501
diversified, 913
of, 502, 505
education savings account, 1011
finance charges, 504
in fixed-income securities, 991
401(k), 1029, 1045
growth of, 519–520
IRA, 505, 1011, 1029
Roth, 1011
return on, 504, 991
in stock
analyzing, 540
appreciation, 504
NASDAQ stocks, 1061
NYSE stocks, 1061
portfolios of, 1054
price of, 1030
time to reach goal, 504, 506
tripling of, 503, 505

Kinesiology
muscle force, 811

Landscaping, 144. See also Gardens and gardening
boulder movement, 812
cable, 337
elevation, 279
height of tree, 559, 619, 670
removing stump, 811
tree planting, 929
watering lawn, 545

Law and law enforcement
motor vehicle thefts, 1072
violent crimes, 228

Leisure and recreation
amusement park ride, 545
cable TV, 283
community skating rink, 289
Ferris wheel, 201, 545, 610, 670, 731, 753
field trip, 417
roller coaster, 630
video games and grade-point average, 308

Measurement
optical methods of, 679
of rainfall, 819
Applications Index  xxxiii

stress of materials, 207
stretching a spring, 206, 756
tension, 807, 810–811, 823, 1036
thrown object, 159
ball, 330, 335, 805
truck pulls, 811
uniform motion, 139–140, 142, 144,
159, 282, 892–893, 896
velocity down inclined planes, 82
vertically propelled object, 335
vibrating string, 206
wavelength of visible light, 31
weight, 207, 210
wheels
of a car, 810
of a boat, 810
of a pool, 805
work, 142

Play
swinging, 758
wagon pulling, 809, 819

Population. See also
Demographics
bacterial, 515
deme, 515
E. coli growth, 251, 293
decline in, 515
diversity of endangered species, 517
of fruit fly, 513–514
as function of age, 228
growth in, 515, 517
insect, 398, 515, 517
of predators, 595
doof, 510
of United States, 495, 524, 1047
of world, 495, 524, 530, 999

Probability
checkout lines, 1072
coin toss, 1065
colored candy, 1064
exponential, 457, 624, 476–477
household annual income, 1072
Poisson, 462–463
Price is Right games, 1072
of same birthday in roomful of
people, 517
standard normal density function, 278
of winning lottery, 1048, 1073

Publishing
textbook printing cost, 362–363

Pyrotechnics
fireworks display, 863

Rate. See also Speed
catch a bus, 892
catching a train, 892
current of stream, 912
doing emptying of oil tankers, 144
a pool, 144
of filling, 144, 159
to keep up with the Sun, 546
revolutions per minute of bicycle wheels, 545
of water consumption during
shower, 279

Real estate
commission, 155
cost of triangular lot, 743
land cost, 756
mortgage fees, 263
property area, 743
saving for a home, 1029
selling price of, 211
value of, 162

Recreation
bungee jumping, 417
Demon Roller Coaster customer rate, 462–463

Security
security cameras, 719

Seismology
calibrating instruments, 896

Sequences. See also
Combinatorics
ceramic tile floor design, 1017
Drury Lane Theater, 1018
football stadium seating, 1019
seats in amphitheater, 1018

Society
ideal mate, 478

Speed. See also Rate
car, 545
catch a bus, 892
catching a train, 892
current of stream, 912
doing emptying of oil tankers, 144
a pool, 144
doing filling, 144, 159
to keep up with the Sun, 546
revolutions per minute of bicycle wheels, 545
of water consumption during
shower, 279

Sports
baseball, 893, 1062, 1075
diamond, 168
dimensions of home plate, 743
field, 737, 738
homeruns, 309
Little League, 168, 547
on-base percentage, 302–303
World Series, 1062
basketball, 1062
ing-read, 235–236, 720
granny shots, 235
biathlon, 144
bungee jumping, 417
calculating pool shots, 570
cycling, 94–95, 144, 547
discus throw, 94
electa betting, 1075
football, 143, 848, 1062
angle of pursuit, 559
field design, 117
golf, 236, 525, 670, 885–886, 892
distance to the green, 736
sand bunkers, 661
hammer throw, 637
kayaking, 680
marathon runners, 279, 729
Olympic heroes, 144
races, 143, 159, 971–972, 974
relay runners, 1075
shot-put throw, 94
soccer, 737
swimming, 757, 823
tennis, 143, 365, 409

Surveying
land dimensions, 729

Surveys
of appliance purchases, 1053
data analysis, 1050, 1053
stock portfolios, 1054
of summer session attendance, 1053
of TV sets in a house, 1072

Temperature
of air parcel, 1019
body, 31, 155
conversion of, 432, 445
cooling time of pizza, 516
rate of change of, 330–331
measuring, 193
after midnight, 364–365
monthly, 610, 629–630, 636
relationship between scales, 278

Time
for beer stein to warm, 516
for block to slide down inclined
plane, 568–569
Ferris Wheel rider height as
function of, 670
to go from an island to a town, 283
hours of daylight, 423, 534, 610,
626–627, 630, 638–639, 653–654
for pizza to cool, 516
for rescue at sea, 159
of sunrise, 546, 654
of trip, 558–559, 570
waiting, for fast food, 408

Transportation
de-icing salt, 661
high-speed walkways, 143
Niagara Falls Incline Railway, 719
sailing, 787

Travel. See also Air travel;
Navigation
drivers stopped by the police,
532–533
driving to school, 207
parking at O’Hare International
Airport, 262

Volume
gasoline in tank, 82
of ice in skating rink, 289
of water in cone, 283

Weapons
artillery, 335, 661, 893
cannons, 340

Weather
atmospheric pressure, 462, 476
avoiding a tropical storm, 736
cooling air, 1019
forecasting, 1068
hurricanes, 308, 364, 629
lightning and thunder, 159
lightning strikes, 860–861, 863
rainfall measurement, 819
relative humidity, 463
tornadoes, 307
wind chill, 263–264, 531

Work, 819
calculating, 816–818, 823
cost rate jobs, 996
pulling a wagon, 819
ram angle, 819
wheelbarrow push, 809
working together, 141, 143,
144, 159
To the Student

As you begin, you may feel anxious about the number of theorems, definitions, procedures, and equations you encounter. You may wonder if you can learn it all in time. Don’t worry, your concerns are normal. This text was written with you in mind. If you attend class, work hard, and read and study effectively, you will build the knowledge and skills you need to be successful. Here’s how you can use the text to your benefit.

Read Carefully

When you get busy, it’s easy to skip reading and go right to the problems. Don’t! The text provides a large number of examples and clear explanations to help you break down the mathematics into easy-to-understand steps. Reading will provide you with a clearer understanding, beyond simple memorization. Read before class (not after) so you can ask questions about anything you didn’t understand. You’ll be amazed at how much more you’ll get out of class when you do this.

Use the Features

We use many different methods in the classroom to communicate. Those methods, when incorporated into the text, are called “features.” The features serve many purposes, from supplying a timely review of material you learned before (just when you need it), to providing organized review sessions to help you prepare for quizzes and tests. Take advantage of the features and you will master the material.

To make this easier, we’ve provided a brief guide to getting the most from this book. Refer to the “Prepare for Class,” “Practice,” and “Review” guidelines on the first three pages of this book. Spend fifteen minutes reviewing the guide and familiarizing yourself with the features by flipping to the page numbers provided. Then, as you read, use them. This is the best way to make the most of your text. In this edition, we’ve also added a handy key to the labeling of the homework exercises so that you know what the colors and icons mean:

Please do not hesitate to contact us via Math@Pearson.com with any questions, comments, or suggestions about ways to improve this text. We look forward to hearing from you, and good luck with all of your studies.

Best Wishes!
Michael Sullivan
Michael Sullivan III