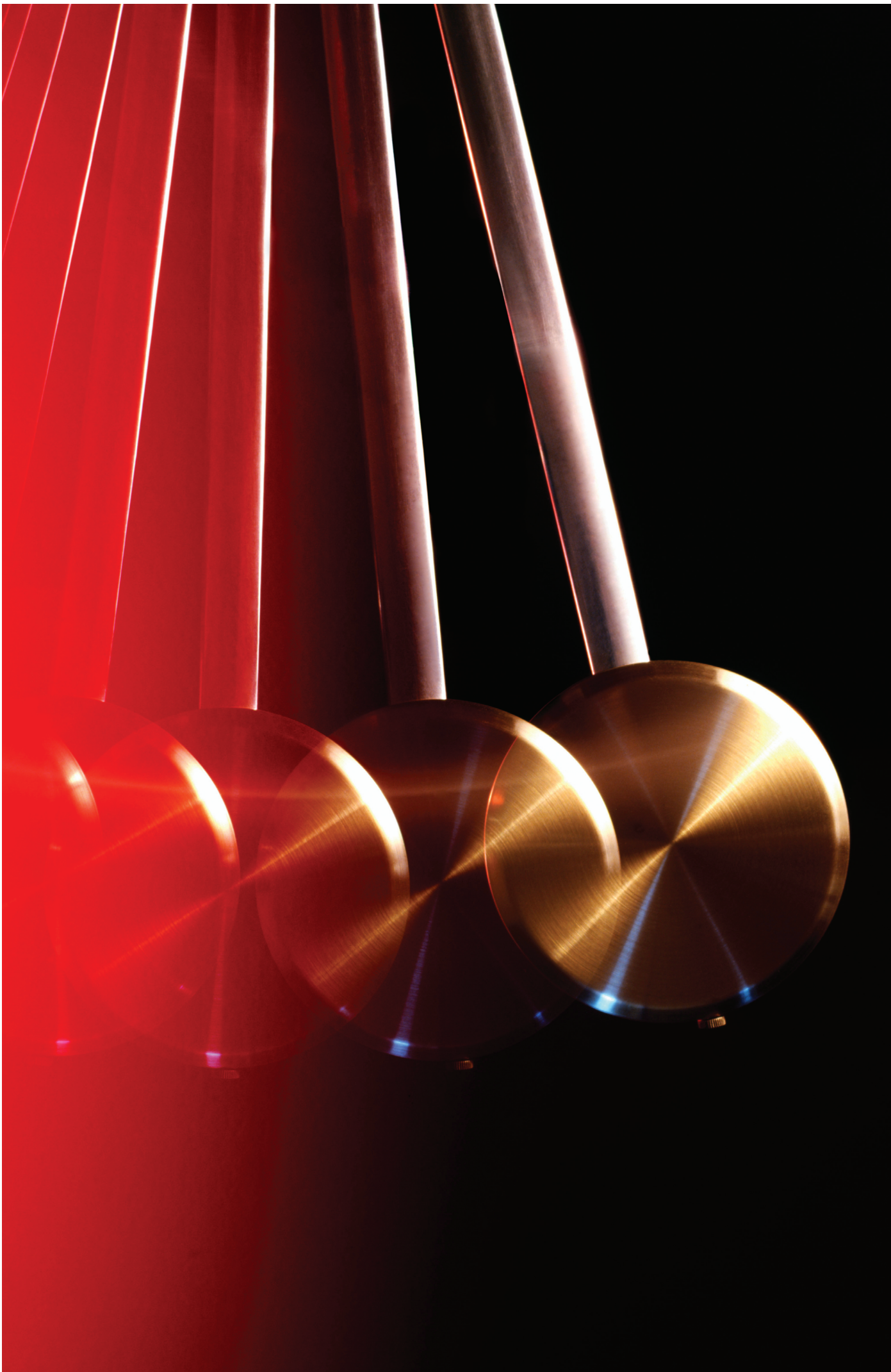
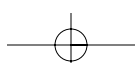
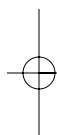
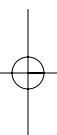
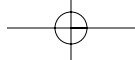


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# Algebra and Trigonometry

*Third Edition*

Dennis G. Zill

Loyola Marymount University

Jacqueline M. Dewar

Loyola Marymount University



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# Contents

Preface xiii



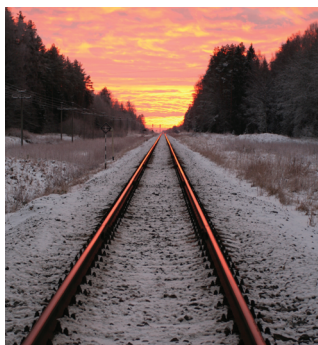
## R Review of Basic Algebra 1

- R.1 The Real Number System 2
- R.2 The Real Number Line 11
- R.3 Integer Exponents 17
- R.4 Radicals 24
- R.5 Rational Exponents 31
- R.6 Polynomials and Special Products 36
- R.7 Factoring Polynomials 45
- R.8 Rational Expressions 51
- Chapter R Review Exercises 60



## 1 Equations and Inequalities 65

- 1.1 Equations 66
- 1.2 Building an Equation from Words 72
- 1.3 Quadratic Equations 81
- 1.4 Complex Numbers 93
- 1.5 Linear Inequalities 99
- 1.6 Absolute-Value Equations and Inequalities 105
- 1.7 Polynomial and Rational Inequalities 110
- Chapter 1 Review Exercises 117



## 2 Rectangular Coordinate System and Graphs 123

- 2.1 The Rectangular Coordinate System 124
- 2.2 Circles and Graphs 130
- 2.3 Equations of Lines 139
- 2.4 Variation 146
- Chapter 2 Review Exercises 151



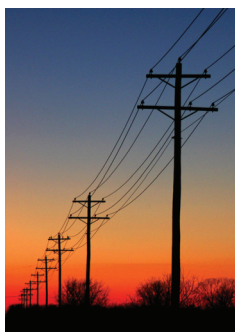
## 3 Functions and Graphs 155

- 3.1 Functions and Graphs 156
- 3.2 Symmetry and Transformations 165
- 3.3 Linear and Quadratic Functions 175
- 3.4 Piecewise-Defined Functions 185
- 3.5 Combining Functions 192
- 3.6 Inverse Functions 201
- 3.7 Building a Function From Words 209
- 3.8 Least Squares Line 216
- Chapter 3 Review Exercises 220



## 4 Polynomial and Rational Functions 225

- 4.1 Polynomial Functions 226
- 4.2 Division of Polynomial Functions 235
- 4.3 Zeros and Factors of Polynomial Functions 242
- 4.4 Real Zeros of Polynomial Functions 249
- 4.5 Approximating Real Zeros 257
- 4.6 Rational Functions 261
- Chapter 4 Review Exercises 274



## 5 Exponential and Logarithmic Functions 279

- 5.1 Exponential Functions 280
- 5.2 Logarithmic Functions 287
- 5.3 Exponential and Logarithmic Equations 294



**5.4** Exponential and Logarithmic Models 300

**5.5** Hyperbolic Functions 312

Chapter 5 Review Exercises 315



## **6** Right Triangle Trigonometry 319

**6.1** Angles and Their Measure 320

**6.2** Right Triangle Trigonometry 328

**6.3** Trigonometric Functions of Special Angles 335

**6.4** Trigonometric Functions of General Angles 339

Chapter 6 Review Exercises 350

## **7** Unit Circle Trigonometry 353

**7.1** The Circular Functions 354

**7.2** Graphs of Sine and Cosine Functions 361

**7.3** Graphs of Other Trigonometric Functions 372

**7.4** Special Identities 379

**7.5** Inverse Trigonometric Functions 389

**7.6** Trigonometric Equations 398

Chapter 7 Review Exercises 405

## **8** Applications of Trigonometry 409

**8.1** Solving Right Triangles 410

**8.2** Applications of Right Triangles 412

**8.3** Law of Sines 418

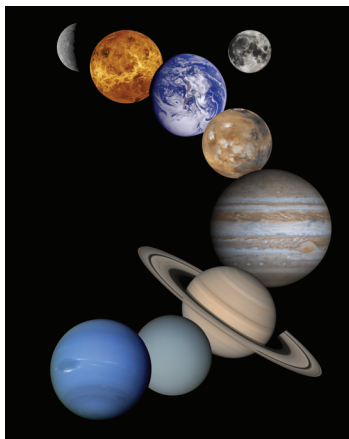
**8.4** Law of Cosines 422

**8.5** Simple Harmonic Motion 427

**8.6** Trigonometric Form of Complex Numbers 431

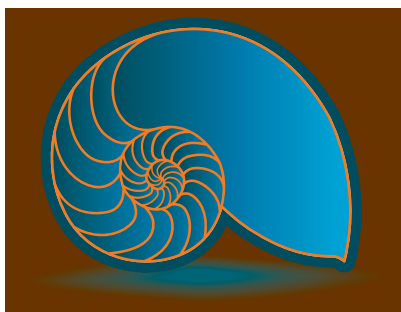
**8.7** Powers and Roots of Complex Numbers 436

Chapter 8 Review Exercises 442



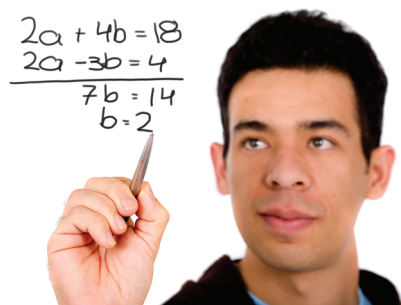
## 9 Topics in Analytic Geometry 447

- 9.1 The Parabola 448
- 9.2 The Ellipse 454
- 9.3 The Hyperbola 461
- 9.4 Rotation of Axes 470
- 9.5 Parametric Equations 476
- Chapter 9 Review Exercises 484



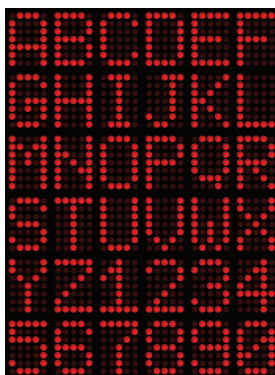
## 10 Polar Coordinates 487

- 10.1 Polar Coordinates 488
- 10.2 Graphs of Polar Equations 492
- 10.3 Conic Sections in Polar Coordinates 502
- 10.4 Vectors in the Plane 508
- 10.5 Dot Product 516
- Chapter 10 Review Exercises 523



## 11 Systems of Equations and Inequalities 527

- 11.1 Systems of Linear Equations 528
- 11.2 Systems of Nonlinear Equations 537
- 11.3 Partial Fractions 543
- 11.4 Systems of Inequalities 548
- 11.5 Linear Programming 554
- Chapter 11 Review Exercises 561



## 12 Matrices and Determinants 565

- 12.1 Introduction to Matrices 566
- 12.2 Algebra of Matrices 570
- 12.3 Determinants 581
- 12.4 Inverse of a Matrix 590
- 12.5 Linear Systems: Augmented Matrices 599

**12.6** Linear Systems: Matrix Inverses 608

**12.7** Linear Systems: Determinants 614

**12.8** Cryptography 618

Chapter 12 Review Exercises 622



## **13** Sequences, Series, and Probability 627

**13.1** Sequences 628

**13.2** Series 635

**13.3** Convergence of Sequences and Series 642

**13.4** Mathematical Induction 651

**13.5** The Binomial Theorem 655

**13.6** Principles of Counting 661

**13.7** Introduction to Probability 669

Chapter 13 Review Exercises 677

**Final Examination 682**

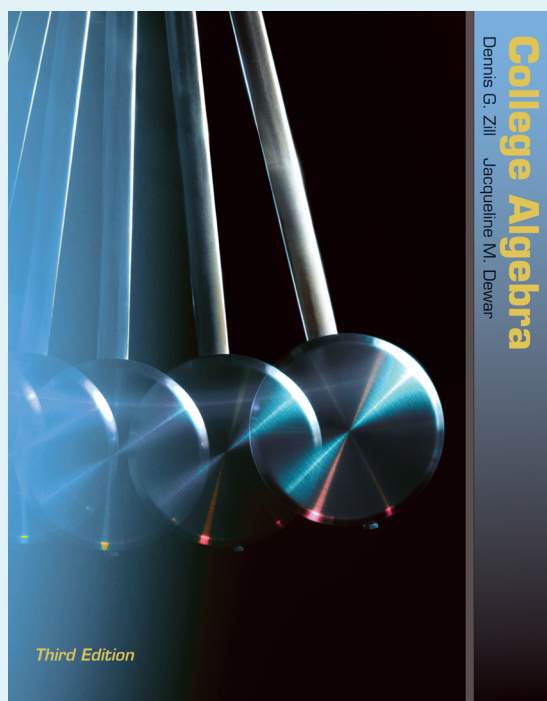
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**Index I-1**

**Credits C-1**



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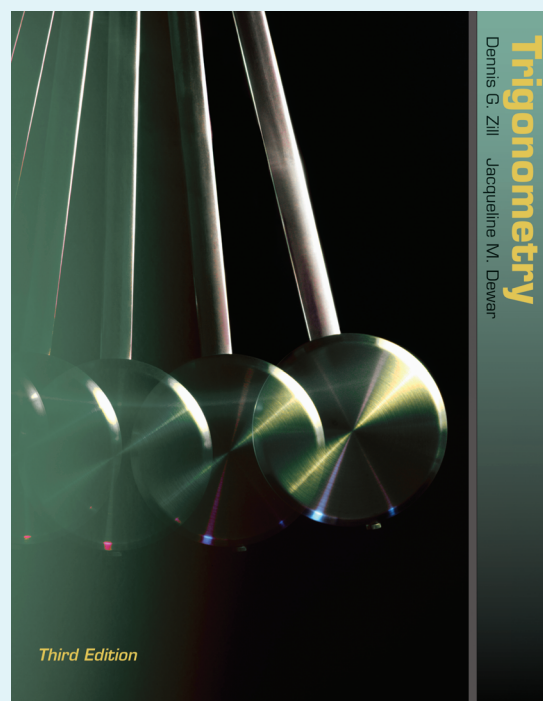
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#### **Brief Table of Contents**

- Chapter 1 Review of Basic Algebra
- Chapter 2 Equations and Inequalities
- Chapter 3 Rectangular Coordinate System and Graphs
- Chapter 4 Functions and Graphs
- Chapter 5 Polynomial and Rational Functions
- Chapter 6 Exponential and Logarithmic Functions
- Chapter 7 Topics in Analytic Geometry
- Chapter 8 Systems of Equations and Inequalities
- Chapter 9 Matrices and Determinants
- Chapter 10 Sequences, Series, and Probability



### **Trigonometry**

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#### **Brief Table of Contents**

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- Chapter 4 Applications of Trigonometry
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- Chapter 6 Exponential and Logarithmic Functions
- Chapter 7 Topics in Analytic Geometry
- Chapter 8 Polar Coordinates

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# Preface

## To the Instructor

□ **Philosophy** This text reflects our philosophy that a mathematics text at the beginning college level should be readable, straightforward, and loaded with motivation. But ultimately, students can learn mathematics only by doing mathematics. Therefore, throughout this text we have placed a strong emphasis on problem solving as a means of understanding. The examples are designed to motivate, instruct, and guide students. The exercises then give the students an opportunity to test their comprehension, challenge their understanding, and apply their knowledge to real-world situations.

□ **Audience and Flexibility** We intend this text to provide a treatment of algebra, graphs, functions, logarithms, trigonometry, systems of equations and inequalities, matrices, analytic geometry, polar coordinates, sequences, and probability that is accessible to a college student with two years of high-school mathematics. We have provided sufficient material here for a standard one-semester or two-quarter or even a slower-paced full-year course. This wealth of topics allows the instructor to choose those best suited to the objectives of his/her courses and the backgrounds and abilities of the students. The text can serve as a prerequisite for finite mathematics, statistics, or discrete mathematics. It can also be an introductory course in college mathematics for the liberal arts or business student who plans no further study of mathematics or as a beginning course in a sequence that provides the prerequisites for calculus.

## Features in the Text

□ **Examples** It has been our experience that examples and exercises are the primary learning sources in a mathematics text. We have found that students rely on examples, not theorems and proofs. Therefore we have included numerous examples to illustrate both the theoretical concepts and the computational techniques covered in the text.

□ **Exercises** As mentioned, we feel that students can learn only by doing. Therefore, in order to promote active participation in problem solving, the exercises are extensive

and varied. The exercise sets include an abundance of drill problems, true-false questions, fill-in-the-blank questions, applications, challenging problems, graphing problems, problems that require interpretation of graphs, and discussion problems. This variety of examples gives students the opportunity to solidify their understanding of basic concepts, see practical uses for abstract mathematical ideas, and test their ingenuity. For this third edition we have reorganized and expanded almost all the exercise sets.

□ **Motivation** While a number of proofs are included, we have typically motivated concepts in an intuitive or geometric manner. In addition, wherever possible we have used figures to illustrate an idea or aid in a solution.

□ **Emphasis on Functions** Since functions are an essential concept in this course and in mathematics as a whole, we have increased the emphasis on functions and function notation in this edition.

□ **Emphasis on Graphing** There is a great emphasis on graphing equations and functions. We have stressed symmetry, use of shifted graphs, reflections, intercepts, and interpretation of graphs throughout the text.

## New to the Third Edition

□ **Applications** In this revision we continue to provide applications culled from journals, newspapers, and scientific texts. These “real-life” problems show students the power and usefulness of the mathematics they learn in this course. The applications in this revision span a wide variety of disciplines including astronomy, biology, business, chemistry, ecology, engineering, geology, medicine, meteorology, optics, and physics.

□ **Annotation Arrows** In the examples we have added many blue-colored annotation arrows within the examples and in the margin to guide the students through the various steps of the solution and to show them how concepts and properties given in theorems and definitions are used in solving a problem. Red-colored annotation arrows in the margin indicate a *Note of Caution*. These cautionary annotations indicate places in the exposition where the student should proceed slowly or even reread the text to avoid common pitfalls and misinterpretations of the material.

□ **Chapter Openers** Each chapter now opens with its own table of contents. In addition we have provided a motivational discussion of the material and a brief historical account of one or more individuals who had influence on the development of the mathematics in the chapter.

□ **Chapter R** The first chapter of the text has been renamed *Review of Basic Algebra* and relabeled as Chapter R because we feel that this material is fundamentally topics covered in a high-school algebra course. As such we feel that the instructor can cover this chapter at a review pace, use it as an informal review assignment to the students, or skip it entirely.



□ **Notes from the Classroom** Selected sections in the text conclude with informal remarks called *Notes from the Classroom*. These remarks are aimed directly at the student and address a wide variety of student/textbook/classroom issues such as alternative terminology, common errors, reinforcement of important concepts, what material is or is not recommended for memorization, solution procedures, use and misuse of calculators, advice on the importance of neatness and organization, misinterpretations, and an occasional word of encouragement.

□ **Key Concepts** Each chapter concludes with a list of the topics that we feel were most important in the chapter. The students can use this as a checklist in reviewing the material for quizzes and examinations.

□ **Chapter Review Exercises** To aid the instructor in choosing topics for review or emphasis, we have reorganized each *Chapter Review Exercises* into three distinct parts: Part A are true/false questions, Part B are fill in the blank questions, and Part C consists of traditional problems that review the important topics and concepts covered in the chapter.

□ **Figures** A word about the numbering of figures, definitions, theorems, and tables is in order. Because of the great number of figures in this text we were motivated to change to a double-decimal numeration system. For example, the interpretation of “Figure 1.2.3” is

Chapter ↓ ↓ Section  
1 · 2 · 3 ← *Third figure in the section*

We feel that this type of numeration will make it easier to find figures, definitions, and theorems when they are referred to in later sections or chapters. In addition, to better link a figure with the text, the first textual reference to each figure is done in the same font style and color as the figure number; for example, **FIGURE 1.2.3**. Also, in this revision all the figures now have brief explanatory captions.

□ **New Topics** In the bulleted list that follows we indicate some of the changes made in the subject matter.

- Almost all exercise sets now contain problems called *For Discussion*. We hope that instructors will utilize these problems, which are primarily conceptual in nature, and their expertise to engage in a classroom exchange of ideas with the students on how these problems can be solved. These problems could also be the basis for assigned writing projects. To encourage original thought we purposely have not included answers to these problems.
- We have improved the discussion of the inverse functions (Section 3.6) by providing more motivation and clarity with several additional figures.
- Section 3.7, *Building a Function from Words*, is new to Chapter 3.
- Section 3.8, *Least Squares Line*, is also new to Chapter 3. In Section 3.8 we compute the least squares line in the usual algebraic manner. The least squares line concept is covered again from the viewpoint of using an inverse matrix in Section 12.6.
- The chapter on exponential and logarithmic functions has been completely rewritten. Many new mathematical models involving these functions are considered in Section 5.4. The hyperbolic functions are now introduced in the new Section 5.5.

- The section on verification of useless trigonometric identities covered in Section 7.4 of the previous edition has been deleted. We feel that the learning value of such a section is questionable, especially when there are far more important topics that could be covered in greater depth. In this edition, Section 7.4 is devoted to the important Pythagorean identities, the sum and difference formulas, double-angle formulas, and half-angle formulas.
- A new section (Section 8.5), *Simple Harmonic Motion*, has been added to Chapter 8.
- Polar coordinates are now covered in a separate chapter (Chapter 10). The discussion of vectors in the plane have been moved to this chapter.
- Because of its simplicity we have added discussions on rotation of polar graphs to Chapter 10 (Sections 10.3 and 10.4).
- A new section (Section 10.5), *The Dot Product*, has been added to Chapter 10.
- In Section 12.5, *Linear Systems: Augmented Matrices*, we show how to use elementary row operations on an augmented matrix to balance chemical equations.
- In Section 12.6, *Linear Systems: Matrix Inverses*, we revisit the notion of the least squares line  $y = mx + b$ . In this section we compute the coefficients  $m$  and  $b$  using matrix methods.
- A new section (Section 12.8), *Cryptography*, has been added to Chapter 12. This brief section introduces the notions of encoding and decoding messages using matrices. We feel that the students will find this material interesting and perhaps will motivate them to seek further information about this important application of matrices.
- A new section (Section 13.3), *Convergence of Sequences and Series*, has been added to Chapter 13. The discussion of the notion of convergence of a sequence or an infinite series is kept at an intuitive level.
- The section on permutations and combinations in the last edition has been rewritten and is now entitled *Principles of Counting* (Section 13.6).

## Supplements

### ***For the Instructor***

The following materials are available online, at

<http://www.jblearning.com/catalog/9780763754617/>

- *Complete Solutions Manual (CSM)* prepared by Warren S. Wright and Carol D. Wright.
- *Computerized Testing System* for both Windows® and MacIntosh® Operating Systems. This system allows instructors to create customized tests and quizzes. The questions and answers are sorted by chapter and can be easily installed on a computer. Publisher-supplied .rtf files can also be uploaded to the instructor's Learning Management System.
- *PowerPoint® Slides* that feature all labeled figures as they appear in the text. This useful tool allows instructors to easily display and discuss figures and problems found within the textbook.

- *WebAssign™*, developed by instructors for instructors, is a premier independent online teaching and learning environment, guiding several million students through their academic careers since 1997. With WebAssign, instructors can create and distribute algorithmic assignments using questions specific to this textbook. Instructors can also grade, record, and analyze student responses and performance instantly; offer more practice exercises, quizzes, and homework; and upload additional resources to share and communicate with your students seamlessly such as the PowerPoint® Slides and the test items supplied by Jones & Bartlett Learning.
- *eBook format*. As an added convenience this complete textbook is now available in eBook format for purchase by the student through WebAssign.
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### ***For the Student***

- *Student Resource Manual (SRM)* prepared by Warren S. Wright and Carol D. Wright. This manual continues to be popular with students using any one of the Zill series of mathematics textbooks. A complete description of the content specific to this text can be found in the preface. Available in both print and online formats, this student manual can be purchased separately or ordered bundled with the textbook at substantial savings.
- *Student Companion Website* is available at [www.jblearning.com/catalog/9780763754617/](http://www.jblearning.com/catalog/9780763754617/). This online tutorial learning center can be accessed at any time during the term. The resources are tied directly to the text and include: Practice Quizzes, an Online Glossary of Key terms, and Animated Flashcards.
- *Graphing Calculator Manual* by Jeffery M. Gervasi, EdD of Porterville College, may be ordered through the bookstore or online at <http://www.jblearning.com/mathematics/precalculus/>.
- *WebAssign™ Access card* can be bundled with this text or purchased separately by the student online at <http://www.webassign.net>.
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