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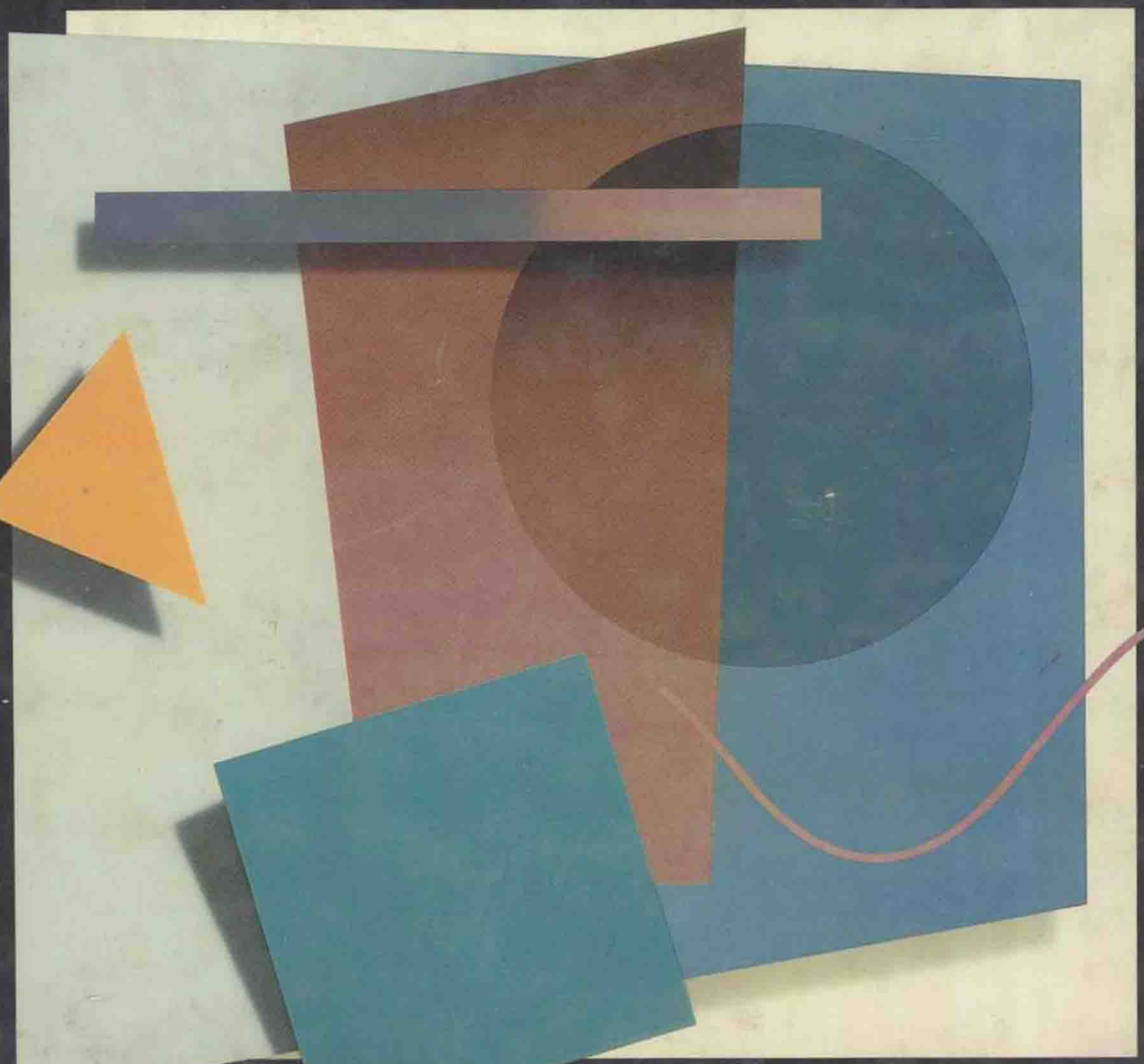
COLLEGE Algebra and Trigonometry



2ND EDITION

College Algebra and Trigonometry

Second Edition

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Preface

The teaching of mathematics is changing in important ways. First, there is greater emphasis on doing mathematics rather than duplicating mathematics through extensive sets of drill exercises. Students are being urged to research topics and write their findings. Second, technological progress is permitting us to explore concepts in ways that would have been impractical just a few years ago.

To respond to these changes, we have written several new features for the second edition. These features include

- Essays and Projects
- Exploring Concepts with Technology
- Graphing Calculator Exercises (optional)

The *Essays and Projects* encourage students to research and write about mathematics and its applications. The essays frequently ask students to explain mathematics in their own words. Our *Exploring Concepts with Technology* extends ideas from the text using computers and calculators. In addition, we have written optional Graphing Calculator Exercises in sections where appropriate. These exercises are supplemented by our new Graphing Workbook which offers 600 additional problems that may be worked using graphing calculators or the Math Assistant graphing software.

Despite these changes, we have retained our basic philosophy which is to deliver a comprehensive and mathematically sound treatment of the topics considered essential for a college algebra and trigonometry course. To help students master these concepts, we have tried to maintain a balance among theory, application, and drill. Each definition is precisely stated and many theorems are proved. Carefully developed mathematics is complemented by abundant, creative applications that are both contemporary and representative of a wide range of disciplines. Many applications problems are accompanied by art that helps the student visualize the mathematics of the problem.

FEATURES

Interactive Presentation *College Algebra and Trigonometry* is written in a style that encourages the student to interact with the textbook. At various places throughout the text, a question in the form of (Why?) is asked of the

reader. This question encourages the reader to pause and think about the current discussion and to answer the question. To make sure the student does not miss important information, the answer to the question is provided as a footnote on the same page.

Each section contains a variety of worked examples. Each example is given a name so that the student can see at a glance the type of problem being illustrated. Each example is accompanied by annotations that assist the student in moving from step to step. Following the worked example is a suggested exercise from that section's exercise set for the student to work. The exercises are color coded by number in the exercise set and the complete solution of that exercise can be found in an appendix to the text.

Extensive Exercise Sets The exercise sets of *College Algebra and Trigonometry* were carefully developed to provide the student with a variety of exercises. The exercises range from drill and practice to interesting challenges and were chosen to illustrate the many facets of topics discussed in the text. Besides the regular exercise sets, there is a set of supplemental problems that includes material from previous chapters, presents extensions of topics, or are of the form "prove or disprove."

Applications One way to motivate a student to an interest in mathematics is through applications. The applications in *College Algebra and Trigonometry* have been taken from agriculture, architecture, biology, business, chemistry, earth science, economics, engineering, medicine, and physics. Besides providing motivation to study mathematics, the applications provide an avenue to problem solving. The applications problems require the student to organize and implement a problem solving scheme. To help students improve their problem-solving skills, we have created many new pieces of art that effectively depict the mathematics of the problem. This art will help students to better conceptualize word problems, as well as encouraging students to become successful problem solvers.

Essays and Projects One of our goals in writing this text has been to involve the student with the text. As mentioned earlier, we do this through various pedagogical features such as pausing at a point in the development of a concept to ask the student to answer a question. *Essays and Projects* is another feature designed to engage the student in mathematics, this time through writing. At the end of each chapter, we have provided guidelines for further investigations. Some of the guidelines ask the student to provide a historical perspective of a topic. Others ask the student to write a proof of some statement. Still others ask the student to chronicle the procedure the student used to solve a problem and to suggest extensions to that problem.

Exploring Concepts with Technology Calculators and computers have expanded the limits of the types of problems that realistically can be solved. To take advantage of the new technologies, we have incorporated in each chapter some optional extensions of ideas presented in that chapter. These problems are not so much conceptually difficult as they are computationally messy. For each of these problems we encourage the student to use

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calculators or computers to investigate solutions. As the student progresses through a solution, we challenge the student to think about the pitfalls of computational solutions.

CHANGES FOR THE SECOND EDITION

We carefully reviewed each chapter and made revisions suggested by some of our colleagues who used the first edition. The changes we made were to the following chapters.

Chapter 3 The organization of this chapter was changed to allow for an earlier introduction to functions and to consolidate the graphing techniques into a single section. The graphing techniques that involve symmetry and translations are now included after the introduction of linear and quadratic functions. Symmetry and the related concepts of even and odd functions are now presented in the same section. Graphing techniques have been expanded to include the concepts of horizontal shrinking and stretching.

Chapter 6 The organization and focus of this chapter was changed completely. We included an earlier introduction to right triangle trigonometry and some of its applications. The concepts of right triangle trigonometry are then naturally extended to general trigonometric functions and then to the circular functions. The particular change in focus or emphasis occurs in the sections on graphing circular functions. The concepts of translation, reflection, stretching, and shrinking of graphs presented in Chapter 3 are used extensively to graph circular functions.

Chapter 8 Because right triangle trigonometry was moved to Chapter 6, the concepts in Chapter 8 now deal exclusively with solving oblique triangles. This allows us to concentrate on the techniques for solving these triangles and their related applications. We also rewrote the material on vectors.

Chapter 11 The algorithm for matrix multiplication has always been difficult to understand. In Chapter 11, matrix multiplication is introduced through an application. This application naturally demonstrates why matrix multiplication should be defined as it is.

In addition to refinements in our presentation of mathematical concepts, we have reviewed the exercise sets and adjusted some of these so that there is a more consistent development of skill level. Application problems were updated and contemporary applications were added. A List of Applications follows the preface.

SUPPLEMENTS FOR THE INSTRUCTOR

College Algebra and Trigonometry has an unusually complete set of teaching aids for the instructor.

Instructor's Annotated Edition This is an exact replica of the student text with the exception that annotations for the instructor are liberally distributed throughout the text. These annotations are identified as "Instructor Notes", and they occur in red in the margin. They include teaching tips, warnings about common errors, graphing calculator suggestions and historical notes.

Solutions Manual The Solutions Manual contains worked-out solutions for all end-of-section, supplemental, challenge and review exercises.

Instructor's Resource Manual with Chapter Tests The Instructor's Manual contains the printed testing program, which is the first of three sources of testing material available to the user. Six printed tests (in two formats—free response and multiple choice) are provided for each chapter. In addition, there are suggestions for course sequencing, suggestions for incorporating graphing calculators and outlines of the Essays and Projects questions.

Computerized Test Generator The Computerized Test Generator is the second source of testing material. The data base has been doubled and now contains more than 3600 test items. These questions are unique to the test generator and do not repeat items provided in the Instructor's Manual testing program. The Test Generator is designed to produce an unlimited number of tests for each chapter of the text, including cumulative tests and final exams. It is available for the IBM PC and compatible computers and the Macintosh.

Printed Test Bank The Printed Test Bank, the third component of the testing material, is a printout of all items in the Computerized Test Generator. Instructors using the Test Generator can use the test bank to select specific items from the data base. Instructors who do not have access to a computer can use the test bank to select items to be included on a test being prepared by hand.

Texas Instruments PC-81 Graphing Calculator Software This powerful, compact software completely emulates the look, feel and functionality of the popular TI-81 graphing software. This software is free to adopters of this texts. Users may obtain a site license free of charge so that they may install the software in computer labs. Offered in cooperation with Texas Instruments.

Houghton Mifflin Video Library The review videos contain 32 segments that cover the essential topics in this text. These videos, professionally produced specifically for the text, offer a valuable resource for further instruction and review.

SUPPLEMENTS FOR THE STUDENT

In addition to the Student Solutions Manual, two computerized study aids, the Computer Tutor and the Math Assistant, accompany this text.

Student Solutions Manual The Student Solutions Manual contains complete solutions to all odd-numbered problems in the text.

Computer Tutor The Computer Tutor is an interactive instructional microcomputer program for student use. Each section in the text is supported by a lesson on the Computer Tutor. Lessons provide additional instruction and practice and can be used in several ways: (1) to cover material the student missed because of absence from class; (2) to reinforce instruction on a concept that the student has not yet mastered; (3) to review material in preparation for examinations. This tutorial is available for the IBM PC and compatible microcomputers.

Math Assistant The Math Assistant is a collection of programs that can be used by both the instructor and the student. Some programs are instructional and allow the student to practice a skill like finding the inverse of a matrix. Other programs are computational routines that perform numerical calculations. In addition, there is a function grapher that graphs elementary functions and polar equations. The Math Assistant is available for the IBM PC, compatible microcomputers, and the Macintosh.

Graphing Workbook The Graphing Workbook contains over 600 exercises that may be solved using a graphing calculator or the Math Assistant graphing software. These problems are designed to extend and explore such concepts as approximating roots of equations, translating graphs, and solving inequalities. Students may complete the exercises individually or in small groups.

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The Graphing Calculator Option

Throughout the text, we have included, where appropriate, optional graphing calculator exercises. For those who wish to explore more extensively with graphing calculators and graphing software, The Graphing Workbook that accompanies this text contains approximately 600 problems that use graphing utilities to explore mathematical concepts and applications. These may be solved with graphing calculators or the Math Assistant graphing software that is available free of charge to users of the text. The chart below lists the topics covered in The Graphing Workbook and the respective sections in each text that correspond to the topic.

The Graphing Workbook also contains some supplemental investigations that extend topics in the text. Below the correlation chart, we have listed the titles of these activities and the respective chapters where the concepts are covered.

The Graphing Workbook also provides directions for how to use the most popular graphing calculators including the Texas Instruments TI-81, the TI-85, and the Casio fx-7700G models and an introduction to the Math Assistant software.

Topic in Graphing Workbook	College Algebra and Trigonometry	College Algebra	College Trigonometry	Precalculus
Absolute Value Graphs	3.1	3.1	1.2	2.1
Slope-Intercept Form	3.3	3.3	—	2.3
Quadratic Functions	3.4	3.4	—	2.4
Maximum and Minimum of Functions	3.4	3.4	—	2.4
Graphing Functions	3.5	3.5	1.4	2.5
Reflections and Translations	3.5	3.5	1.4	2.5
Stretching and Shrinking	3.5	3.5	1.4	2.5
Functions and Their Inverses	3.7	3.7	1.6	2.7
Zeros of Functions	4.3	4.3	—	3.3

continued

Topic in Graphing Workbook	College Algebra and Trigonometry	College Algebra	College Trigonometry	Precalculus
Rational Functions	4.5	4.5	—	3.5
Approximating Zeros of Functions	4.6	4.6	—	3.6
Solving Inequalities	2.5	2.5	—	1.5
Exponential Functions	5.1	5.1	7.1	4.1
Logarithmic Functions	5.3	5.3	7.3	4.3
Sine and Cosine Graphs	6.5	—	2.5	5.4
Exploring Sinusoids	6.5	—	2.5	5.4
Tangent, Cotangent, Secant, and Cosecant Graphs	6.6	—	2.6	5.5
Phase Shift of Trigonometric Functions	6.7	—	2.7	5.6
Trigonometric Identities by Graphing	7.1–7.4	—	3.1–3.4	6.1–6.4
Sums of Sines with Different Periods	7.4	—	3.4	6.4
Products of Sines and Cosines	7.4	—	3.4	6.4
Solving Trigonometric Equations by Graphing	7.6	—	3.6	6.6
Law of Cosines	8.2	—	4.2	7.2
Conics	9.1–9.3	6.1–6.3	6.1–6.3	8.1–8.3
General Polar Graphs	9.4	—	6.5	8.5
Polar Graphs of Conics and Lines	—	—	6.6	8.6
Parametric Equations	—	—	6.7	8.7
Estimating Solutions of Linear Systems of Equations	10.1	7.1	—	9.1
Breakeven Points	10.1	7.1	—	9.1
Linear Programming	10.6	7.6	—	9.6
Estimating Solutions of Quadratic Systems of Equations	10.3	7.3	—	9.3
Matrix Calculations	11.2	8.2	—	10.2
Matrix Application: Markov Chains	11.2	8.2	—	10.2
Matrix Application: Encoding and Decoding	11.2	8.2	—	10.2
Exploring Determinants	11.4	8.4	—	10.4
Arithmetic Sequences and Series	12.2	9.2	—	11.2

Topic in Graphing Workbook	College Algebra and Trigonometry	College Algebra	College Trigonometry	Precalculus
Geometric Sequences and Series	12.3	9.3	—	11.3
Geometric Series Application: Compound Interest	12.3	9.3	—	11.3
Sums of Infinite Series	12.3	9.3	—	11.3

SUPPLEMENTAL INVESTIGATIONS

These exercises can be assigned after completing the indicated chapter.

Topic in Graphing Workbook	College Algebra and Trigonometry	College Algebra	College Trigonometry	Precalculus
Correlation and Line of Best Fit	Chapter 3	Chapter 3	Chapter 1	Chapter 2
Fitting Power Functions to Data	Chapter 4	Chapter 4	—	Chapter 3
Fitting Exponential Functions to Data	Chapter 5	Chapter 5	Chapter 7	Chapter 4
Graphing Squares	Chapter 5	Chapter 5	—	Chapter 4
Polar Sun Flowers	Chapter 9	—	Chapter 6	Chapter 8
Spirals	Chapter 9	—	Chapter 6	Chapter 8
Matrix Transformations of Plane Vectors	Chapter 11	Chapter 8	—	Chapter 10

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