COLLEGE ALGEBRA

A Graphics Approach

M. G. Settle

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A Graphics Approach

To Robin Lichtman Settle

PREFACE

College Algebra: A Graphics Approach was developed to help students gain a greater understanding of algebra through graphics and to increase their interest and performance in algebra topics through graphics calculator use. The traditional topics of college algebra are covered, with graphs and functions emphasized throughout. This text is designed for a one-term course in college algebra. A background of either an intermediate algebra course (such as *Intermediate Algebra: A Graphics Approach* by M. G. Settle) or an appropriate secondary school course is assumed. No former knowledge of calculators is assumed.

CONTENT FEATURES ■ ■ ■

The introductory material on the graphics calculator is presented in Chapter 0, *The Graphics Calculator Toolbox*. This material is presented in a guided discovery format, which provides easy access for students (and allows instructors the option of starting the course in Chapter 3 or Chapter 4). The graphics calculator is fully integrated into the course materials—its use is not optional. In Chapter 0, proficiency with the calculator is obtained by reviewing number systems, scientific notation, exponents, expressions, and equation solving. After completing Chapter 0, the student is prepared in both algebra background and graphics calculator skills for equations in two variables (in Chapter 3) or for the introduction to functions (in Chapter 4). Chapters 1 and 2 may be assigned as review material, or the topics may be used as introductory material to the corresponding functions in later chapters. In Chapter 1, the calculator is used to test for errors in work involving operations on algebraic expressions. These exercises not only give the student a feel for the calculator, but also reinforce the fact that algebraic expressions represent number phrases. In Chapter 2, the calculator is used to check the solution to an equation in one variable. Here, the graph screen is introduced as a tool for seeing several evaluations of an expression for various replacements of the variable. From the beginning, the use of a *friendly* graph screen is emphasized.

Throughout the book, detailed instructions are given for the TI-81 calculator. This calculator was chosen as a baseline graphics calculator because of its features, cost, and user base. Footnotes are provided for the TI-82, the upgrade to the TI-81. These footnotes also provide for the easy use of other graphics calculators, such as the Casio 7700G/8700G and the Sharp 9200/9300EL calculators. These calculators, like the TI-82, work from a 95-pixel screen, using a −4.7-to-4.7 graphics window. Additionally, the *Graphics Calculator Supplement,* a manual written by M. G. Settle and available with the book, provides specific instructions for the TI-85, HP-48G, and the Casio and Sharp calculators, keyed to material in the textbook.

The graphics calculator is an integral part of this book—its use is assumed. Although traditional topics are covered, they are greatly enhanced by the use of the graphics calculator. Chapters 1, 2, and 3 provide extensive review of algebraic expressions, equations in one variable, and linear relations. Function concepts, notation, and graphs form the core of this book (Chapters 4, 5, 6, and 7). Chapters 8 and 9 cover systems and matrices with an emphasis on calculator use. Chapter 10 discusses conic sections, and Chapter 11 covers sequences, series, and probability.

This book is designed for student use. From the strategically placed "Give It a Try" problems in the content sections (with answers provided) to the "Using the Graphics Calculator" boxes, students are encouraged to read and think about algebra concepts. In many of the exercises, especially the application problems, and in the "Discovery" topics, students are asked to write. This emphasis follows the recommendations of many professional groups to "incorporate writing in mathematics courses."

PEDAGOGICAL FEATURES ■ ■ ■

Examples Several examples are provided to cover each concept presented. These examples are presented in a form that is useful to students. The graphics calculator is fully integrated into these examples. Instructors will find that this feature greatly increases student involvement in the text materials. For students, reading calculator instructions improves critical reading and thinking skills required for success in mathematics (as well as for other subjects).

Using the Graphics Calculator Specific instructions are provided for students on how to use the graphics calculator. These instructions are highlighted and are often accompanied by calculator screens. This feature greatly reduces the burden on instructors and frees valuable classroom time for instruction, discussion, and questions.

Give It a Try Several short sets of problems are placed strategically within each section to provide students with an understanding check. These problems deal with the currently presented concepts and often expand on recently presented examples. Answers plus explanatory material for these problems are conveniently located at the back of the book to provide students with immediate feedback.

Warning and Remember These boxed materials are placed in the margins at critical positions throughout the book. These boxes show common errors to be avoided and important background material for concepts being developed.

Summary At the end of each chapter, a summary with page references reviews important concepts and skills developed in the chapter.

Exercises At the end of each section, several problems are presented to ensure full development of the concepts and skills presented in the section. Enough problems are presented for review later in the course. Most problems are presented in a matched, odd-even format. Graphics calculator problems are also presented in these exercise sets. At the end of each chapter, a chapter review exercise set is provided, along with a chapter test.

Discovery These sections appear throughout the textbook. Many of the discovery topics are graphics-calculator based, such as finding range settings for friendly graph screens and power regression. Other discovery topics include the Richter scale for measuring earthquake intensity and parametric equations.

Programs An important feature of the graphics calculator is its ability to store a sequence of instructions (a program) in memory. Using this feature, a student can execute programs to do a wide variety of mundane or potentially error-producing procedures. Three such programs are a program for finding the equation of a line, a program for producing the solution to a quadratic equation, and a program for performing synthetic division. All of these programs are given in Appendix A and are optional.

SUPPLEMENTS ■ ■ ■

Instructor's Solutions Manual The *Instructor's Solutions Manual* by Jon D. Weerts contains an answer or solution to every even-numbered exercise and chapter test question in the book. Graphics calculator screens are shown for many of the solutions.

Student's Solutions Manual The *Student's Solutions Manual* by Jon D. Weerts contains complete solutions, including graphics calculator screens, for the odd-numbered exercises and odd-numbered chapter test questions. One sample test per chapter is also provided.

Using Graphics Calculators The *Graphics Calculator Supplement* by M. G. Settle provides instructions matching the introductory materials in Chapter 0 for the TI-85, HP-48G, Casio 7700G/8700G and Sharp 9200/9300EL calculators. (The TI-81 and TI-82 calculators are covered in the textbook.) Also, calculator-specific instructions are provided for other techniques that vary from those presented in the textbook (for example, function evaluation and matrix entry).

Test Bank The *Test Bank* by Charles Heuer contains three versions of a multiple-choice test and two versions of an open-ended test for each chapter in *College Algebra: A Graphics Approach*.

WestTest© 3.0 (Computer-Generated Testing Programs) Versions of this software are available for both the PC and Macintosh computer systems to qualified adopters of the textbok.

Overhead Transparencies The important figures and tables in the textbook are available as transparency masters to schools adopting *College Algebra: A*

Graphics Approach. **Worksheet masters** for each section provide additional problems that are easy to grade and provide quick feedback to students.

Videotapes Two videotapes are available to introduce the TI-81, TI-82, TI-85, Casio 7700G, Hewlett-Packard 48G, and Sharp 9200/9300EL graphics calculators.

Graph$^+$ Software The *Graph$^+$* software by M. G. Settle is a program for PC computers. This program has a user interface similar to a graphics calculator. Students can use the software to produce printed copies of graphs. Introductory materials are provided and the instructions presented in the textbook for the TI-81 calculator can be followed to produce corresponding results on PC computers.

GraphToolZ Software The *GraphToolZ* software by Tom Saxton is a graphing program for the Macintosh family of computers. An introductory package of materials provides students with instructions for getting started with this software.

Computer Tutorials *Natural Language Mathematics Tutorial* software by Mathens, Inc., contains algorithms for generating multiple examples of the basic problem types in *College Algebra: A Graphics Approach*. These tutorials are available for both the PC and Macintosh computer systems.

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I have used a graphics approach to algebra over the past several years—first using the personal computer, and now using hand-held graphics calculators. Such instruction is exciting and enjoyable to give, and is well received by students. I wish both students and instructors all the best in this endeavor.

M. G. Settle
Marquis Bayou, Florida
1995

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GRAPHICS CALCULATOR TOOLBOX

Graphing functions can improve your understanding of concepts in mathematics, and using the graphics calculator can increase your efficiency in producing these graphs. The graphics calculator is also a valuable tool in learning algebra concepts and in checking work produced in solving algebraic problems.

The graphics calculator is a "tool" in the sense that it helps us do work, and skill with this tool can enhance your enjoyment of this course. In many cases, the graphics calculator, along with the knowledge and skill developed in this course, can open the door to additional mathematics courses. As many students have found, a mathematical background often results in increased career opportunities.

A good analogy for learning to use the graphics calculator is that of learning to drive a car. We may start with a mentor demonstrating the basic steps—using the brake, the steering wheel, and so on. Once we have been shown these steps, we must practice the procedure. With the graphics calculator, we will present the basic steps (keystrokes) in this introduction. Then you must practice the procedure. Like learning to drive a car, watching someone (such as an instructor) carry out steps on the calculator can provide ideas, but you cannot learn to use the calculator merely by watching—use the calculator, and practice.

Being able to drive a car may help us get from one point to another more efficiently than walking. However, in some places walking may be better than driving, in order to closely investigate a particular area. In learning algebra using the graphics calculator, some topics will require using simple paper and pencil to gain a full understanding.

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