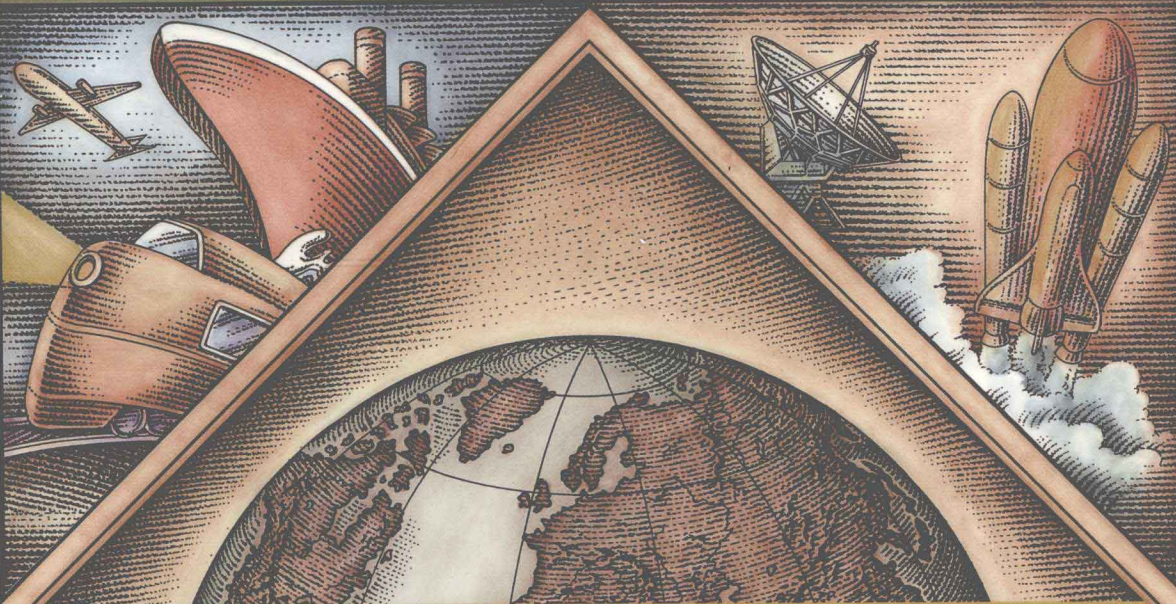
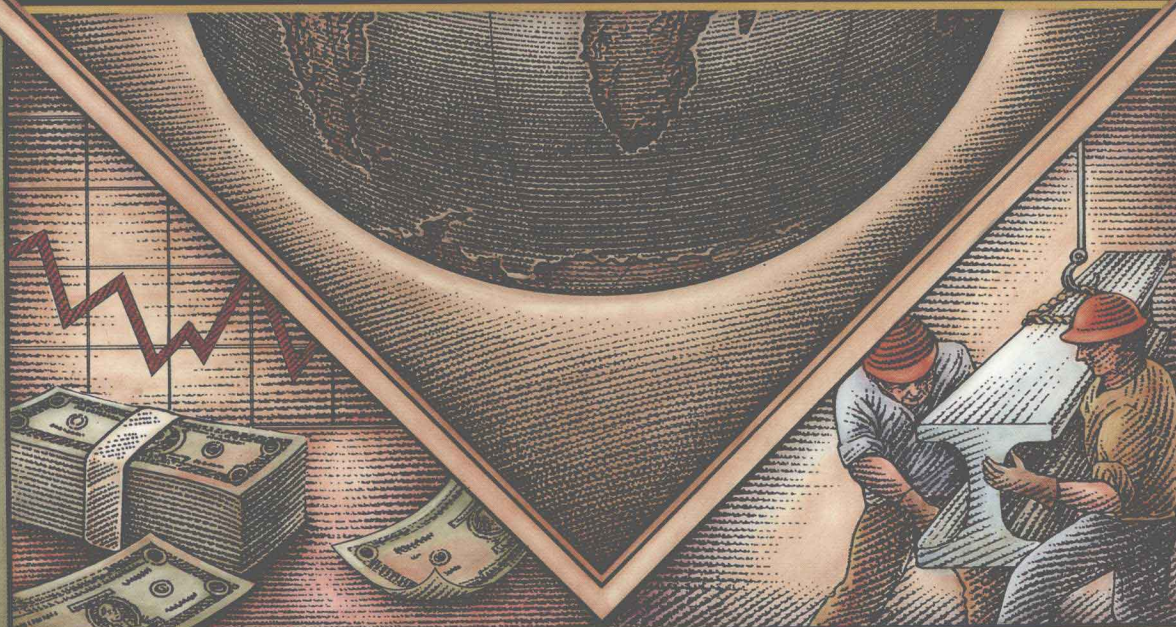


ANNOTATED INSTRUCTOR'S EDITION



BEGINNING AND INTERMEDIATE ALGEBRA

SECOND EDITION



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SECOND EDITION

ANNOTATED INSTRUCTOR'S EDITION

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Preface



The second edition of *Beginning and Intermediate Algebra* is designed to accommodate instructors and students who wish to eliminate the topic overlap between typical beginning and intermediate algebra texts. This text integrates the appropriate topics from the successful Lial/Hornsby parent texts, *Beginning Algebra*, Eighth Edition, and *Intermediate Algebra*, Eighth Edition, in one book and features a flexible Table of Contents that can be easily adapted for a variety of course structures.

This revision of *Beginning and Intermediate Algebra* reflects our ongoing commitment to creating the best possible text and supplements package using the most up-to-date strategies for helping students succeed. One of these strategies, evident in our new Table of Contents and consistent with current teaching practices, involves the early introduction of functions and graphing lines in a rectangular coordinate system. We believe that this pedagogy has a great deal of merit as it provides students with the important “input-output” concept that will be an integral part of later mathematics courses. This organization also allows an early treatment of interesting interpretations of data in the form of line and bar graphs—two pictorial representations that students already see on a daily basis in magazines and newspapers. Chapter 4 introduces three sections on linear equations in two variables, ordered pairs, graphing, and slope, with a gentle introduction to the function concept in the form of input-output relationships. This allows students to read graphs in the chapters that immediately follow and to slowly develop an understanding of the basic idea of a function. Chapter 8 reviews lines and graphing presented in Chapter 4, then introduces the more involved concepts of forms of equations of lines and inequalities in two variables. The function concept is addressed again here, this time with a thorough discussion of domain, range, function notation, and other function-related topics. Also consistent with this approach, graphs of quadratic equations are included earlier in the text when quadratic equations are solved (Chapter 11) rather than with the material on conic sections as in the previous edition.

If you choose not to cover graphing linear equations and functions earlier as the new edition suggests, you can defer Chapter 4 and combine it with Chapter 8 as in the previous edition. Material on graphing in Section 5.1 can easily be omitted. Applied problems in Chapters 5–7 that refer to the function concept can be used without actually working through Chapter 4. Alternatively, the material in Chapter 8 can be covered immediately after Chapter 4, if desired.

Other up-to-date pedagogical strategies to foster student success include a strong emphasis on vocabulary and problem solving, an increased number of real world applications in both examples and exercises, and a focus on relevant industry themes throughout the text.

Another strategy for student success, an exciting new CD-ROM called “Pass the Test,” debuts with this edition of *Beginning and Intermediate Algebra*. Directly correlated to the text’s content, “Pass the Test” helps students master concepts by providing interactive pretests, chapter tests, section reviews, and InterAct Math tutorial exercises.

- For additional flexibility, three new appendixes have been included. Because of the many requests for “transitional” material, Appendix E, in conjunction with the Summary exercise group in Chapter 2, form an excellent package of review topics between beginning and intermediate algebra.

NEW FEATURES

We believe students and instructors will welcome the following new features:

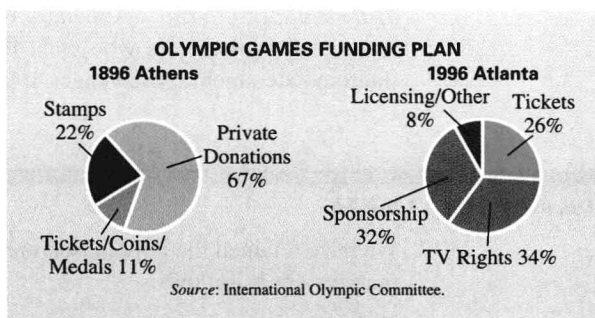


Industry Themes To help motivate the material, each chapter features a particular industry that is presented in the chapter opener and revisited in examples and exercises in the chapter. Identified by special icons, these examples and exercises incorporate sourced data, often in the form of graphs and tables. Featured industries include business, health care, entertainment, sports, transportation, and others. (See pages 1, 88, and 199.)

New Examples and Exercises We have added 25% more real application problems with data sources. These examples and exercises often relate to the industry themes. They are designed to show students how algebra is used to describe and interpret data in everyday life. (See pages 9, 178, and 235.)



The Olympic Committee has come to rely more and more on television rights and major corporate sponsors to finance the games. The pie charts show the funding plans for the first Olympics in Athens and the 1996 Olympics in Atlanta. Use proportions and the figures to answer the questions in Exercises 35 and 36.




35. In the 1996 Olympics, total revenue of \$350 million was raised. There were 10 major sponsors.
 - (a) Write a proportion to find the amount of revenue provided by tickets. Solve it.
 - (b) What amount was provided by sponsors? Assuming the sponsors contributed equally, how much was provided per sponsor?
 - (c) What amount was raised by TV rights?
36. Suppose the amount of revenue raised in the 1896 Olympics was equivalent to the \$350 million in 1996.
 - (a) Write a proportion for the amount of revenue provided by stamps and solve it.
 - (b) What amount (in dollars) would have been provided by private donations?
 - (c) In the 1888 Olympics, there were 9 major sponsors, and the total revenue was \$95 million. What is the ratio of major sponsors in 1888 to those in 1996? What is the ratio of revenue in 1888 to revenue in 1996?



Cautions and Notes We often give students warnings of common errors and emphasize important ideas in Cautions and Notes that appear throughout the exposition.

Connections Retained from the previous edition, Connections boxes have been streamlined and now often appear at the beginning or the end of the exposition in selected sections. They continue to provide connections to the real world or to other mathematical concepts, historical background, and thought-provoking questions for writing or class discussion. (See pages 105, 225, and 250.)

Problem Solving Increased emphasis has been given to our six-step problem-solving method to aid students in solving application problems. This method is continually reinforced in examples and exercises throughout the text. (See pages 105, 107, and 354.)

Ample and Varied Exercise Sets Algebra students require a large number and variety of practice exercises to master the material. This text contains approximately 7700 exercises, including over 2100 review exercises, plus numerous conceptual and writing exercises, journal exercises, and challenging exercises that go beyond the examples. More illustrations, diagrams, graphs, and tables now accompany exercises. Multiple-choice, matching, true/false, and completion exercises help to provide variety. Exercises suitable for calculator use are marked with a calculator icon  in both the Student Edition and the Annotated Instructor's Edition. (See pages 34, 143, and 170.)

Relating Concepts Previously titled Mathematical Connections, these sets of exercises often appear near the end of selected sections. They tie together topics and highlight the relationships among various concepts and skills. For example, they may show how algebra and geometry are related, or how a graph of a linear equation in two variables is related to the solution of the corresponding linear equation in one variable. Instructors have told us that these sets of exercises make great collaborative activities for small groups of students. (See pages 69, 234, and 256.)

Ample Opportunity for Review Each chapter concludes with a Chapter Summary that features Key Terms and Symbols, Test Your Word Power, and a Quick Review of each section's content. Chapter Review Exercises keyed to individual sections are included as well as mixed review exercises and a Chapter Test. Following every chapter after Chapter 1, there is a set of Cumulative Review Exercises that covers material going back to the first chapter. Students always have an opportunity to review material that appears earlier in the text, and this provides an excellent way to prepare for the final examination in the course. (See pages 192–198 and 238–246.)

SUPPLEMENTS

Our extensive supplements package includes the Annotated Instructor's Edition, testing materials, study guides, solutions manuals, CD-ROM software, videotapes, and a Web site. For more information on these and other helpful supplements, contact your Addison Wesley Longman sales representative.

FOR THE STUDENT


Student's Study Guide and Journal (ISBN 0-321-06220-5)

The *Student's Study Guide and Journal* contains a "Chart Your Progress" feature for students to track their scores on homework assignments, quizzes, and tests, additional practice for each learning objective, section summary outlines that give students additional writing opportunities and help with test preparation, and self-tests with answers at the end of each chapter. A manual icon at the beginning of each section in the Student Edition identifies section coverage.


Student's Solutions Manual (ISBN 0-321-06219-1)

The *Student's Solutions Manual* provides solutions to all odd-numbered exercises (journal and writing exercises excepted). A manual icon at the beginning of each section in the Student Edition identifies section coverage.


InterAct Math Tutorial Software (ISBN 0-321-06218-3 (Student Version))

This tutorial software correlates with every odd-numbered exercise in the text. The program is highly interactive with sample problems and interactive guided solutions accompanying every exercise. The program recognizes common student errors and provides customized feedback with sophisticated answer recognition capabilities. The management system (InterAct Math Plus) allows instructors to create, administer, and track tests, and to monitor student performance during practice sessions.


"Real to Reel" Videotapes (0-321-05662-0)

This videotape series provides separate lessons for each section in the book. A videotape icon at the beginning of each section identifies section coverage. All objectives, topics, and problem-solving techniques are covered and content is specific to *Beginning and Intermediate Algebra*, Second Edition.


"Pass the Test" Interactive CD-ROM (ISBN 0-321-06206-X)

This CD helps students to master the course content by providing interactive pre-tests, chapter tests, section reviews, and InterAct tutorial exercises. After studying a chapter in class, students take a pre-test to determine what areas in that chapter need additional work. They are then directed to section reviews and tutorial exercises for continued practice. Students continue to take chapter tests and practice their skills until they have mastered the chapter. A unique graphing tool is provided for exploring the relationship between graphs and their algebraic representation.


World Wide Web Supplement (www.LialAlgebra.com)

Students can visit the Web site to explore additional real world applications related to the chapter themes, look up words in a complete glossary, and work through graphing calculator tutorials. The tutorials consist of step-by-step procedures as well as practice exercises for mastering basic graphing calculator skills.

MathXL (<http://www.mathxl.com>)

Available on-line with a pre-assigned ID and password by ordering a new copy of *Beginning and Intermediate Algebra*, Second Edition, with ISBN 0-201-68367-9, MathXL helps students prepare for tests by allowing them to take practice tests that are similar to the chapter tests in their text. Students also get a personalized study plan that identifies strengths and pinpoints topics where more review is needed. For more information on subscriptions, contact your Addison Wesley Longman sales representative.

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While Terry McGinnis has assisted us for many years “behind the scenes” in producing our texts, she has contributed far more to these revisions than ever. There is no question that these books are improved because of her attention to detail and consistency, and we are most grateful for her work above and beyond the call of duty. Kitty Pellissier continues to do an outstanding job in checking the answers to exercises.

An Introduction to Calculators



There is little doubt that the appearance of handheld calculators nearly three decades ago and the later development of scientific and graphing calculators have changed the methods of learning and studying mathematics forever. Where the study of computations with tables of logarithms and slide rules made up an important part of mathematics courses prior to 1970, today the widespread availability of calculators make their study a topic only of historical significance.

Most consumer models of calculators are inexpensive. At first, however, they were costly. One of the first consumer models available was the Texas Instruments SR-10, which sold for about \$150 in 1973. It could perform the four operations of arithmetic and take square roots, but could do very little more.

Today calculators come in a large array of different types, sizes, and prices. *For the course for which this textbook is intended, the most appropriate type is the scientific calculator, which costs \$10–\$20.*

In this introduction, we explain some of the features of scientific and graphing calculators. However, remember that calculators vary among manufacturers and models, and that while the methods explained here apply to many of them, they may not apply to your specific calculator. For this reason, it is important to remember that *this introduction is only a guide, and is not intended to take the place of your owner's manual.* Always refer to the manual in the event you need an explanation of how to perform a particular operation.

SCIENTIFIC CALCULATORS

Scientific calculators are capable of much more than the typical four-function calculator that you might use for balancing your checkbook. Most scientific calculators use *algebraic logic*. (Models sold by Texas Instruments, Sharp, Casio, and Radio Shack, for example, use algebraic logic.) A notable exception is Hewlett Packard, a company whose calculators use *Reverse Polish Notation* (RPN). In this introduction, we explain the use of calculators with algebraic logic.

ARITHMETIC OPERATIONS

To perform an operation of arithmetic, simply enter the first number, press the operation key ($+$, $-$, \times , or \div), enter the second number, and then press the $=$ key. For example, to add 4 and 3, use the following keystrokes.

$4 + 3 = 7$

CHANGE SIGN KEY

The key marked \pm allows you to change the sign of a display. This is particularly useful when you wish to enter a negative number. For example, to enter -3 , use the following keystrokes.

3 ± -3

MEMORY KEY

Scientific calculators can hold a number in memory for later use. The label of the memory key varies among models; two of these are M and STO . $M+$ and $M-$ allow you to

INVERSE KEY

Some calculators have an inverse key, marked $\boxed{\text{INV}}$. Inverse operations are operations that “undo” each other. For example, the operations of squaring and taking the square root are inverse operations. The use of the $\boxed{\text{INV}}$ key varies among different models of calculators, so read your owner’s manual carefully.

EXPONENTIAL KEY

The key marked $\boxed{x^y}$ or $\boxed{y^x}$ allows you to raise a number to a power. For example, if you wish to raise 4 to the fifth power (that is, find 4^5 , as explained in Chapter 5), use the following keystrokes.

$\boxed{4} \boxed{x^y} \boxed{5} \boxed{=} \boxed{1024}$

ROOT KEY

Some calculators have this key specifically marked $\boxed{\sqrt[y]{x}}$ or $\boxed{\sqrt[x]{y}}$; with others, the operation of taking roots is accomplished by using the inverse key in conjunction with the exponential key. Suppose, for example, your calculator is of the latter type and you wish to find the fifth root of 1024. Use the following keystrokes.

$\boxed{1} \boxed{0} \boxed{2} \boxed{4} \boxed{\text{INV}} \boxed{x^y} \boxed{5} \boxed{=} \boxed{4}$

Notice how this “undoes” the operation explained in the exponential key discussion above.

PI KEY

The number π is an important number in mathematics. It occurs, for example, in the area and circumference formulas for a circle. By pressing the $\boxed{\pi}$ key, you can display the first few digits of π . (Because π is irrational, the display shows only an approximation.) One popular model gives the following display when the $\boxed{\pi}$ key is pressed:

$\boxed{3.1415927}$

METHODS OF DISPLAY

When decimal approximations are shown on scientific calculators, they are either *truncated* or *rounded*. To see how a particular model is programmed, evaluate $1/18$ as an example. If the display shows .0555555 (last digit 5), it truncates the display. If it shows .0555556 (last digit 6), it rounds off the display.

When very large or very small numbers are obtained as answers, scientific calculators often express these numbers in scientific notation (Chapter 5). For example, if you multiply 6,265,804 by 8,980,591, the display might look like this:

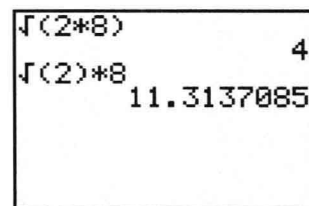
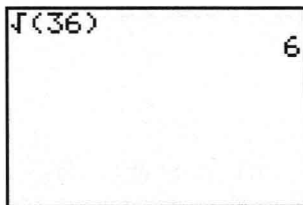
$\boxed{5.6270623} \boxed{13}$

The “13” at the far right means that the number on the left is multiplied by 10^{13} . This means that the decimal point must be moved 13 places to the right if the answer is to be expressed in its usual form. Even then, the value obtained will only be an approximation: 56,270,623,000,000.

GRAPHING CALCULATORS

Graphing calculators are becoming increasingly popular in mathematics classrooms. While you are not expected to have a graphing calculator to study from this book, we do include a feature in many exercise sets called *Technology Insights* that asks you to interpret typical graphing calculator screens. These exercises can help to prepare you for future courses where graphing calculators may be recommended or even required.

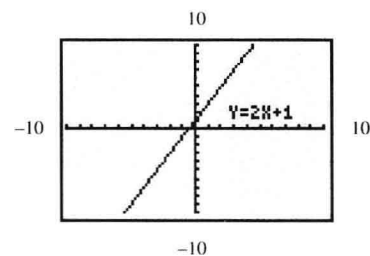
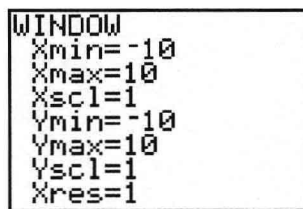
assist the user by inserting parentheses when typical errors might occur. The open parenthesis that follows the square root symbol is automatically entered by the calculator, so that an expression such as $\sqrt{2} \times 8$ will not be calculated incorrectly as $\sqrt{2 \times 8}$. Compare the two entries and their results in the screen on the right.



VIEWING WINDOWS

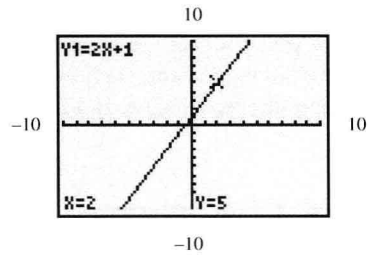
The viewing window for a graphing calculator is similar to the viewfinder in a camera. A camera usually cannot take a photograph of an entire view of a scene. The camera must be centered on some object and can only capture a portion of the available scenery. A camera with a zoom lens can photograph different views of the same scene by zooming in and out. Graphing calculators have similar capabilities. The xy -coordinate plane is infinite. The calculator screen can only show a finite, rectangular region in the plane, and it must be specified before the graph can be drawn. This is done by setting both minimum and maximum values for the x - and y -axes. The scale (distance between tick marks) is usually specified as well. Determining an appropriate viewing window for a graph is often a challenge, and many times it will take a few attempts before a satisfactory window is found.

The screen on the left shows a “standard” viewing window, and the graph of $y = 2x + 1$ is shown on the right. Using a different window would give a different view of the line.



LOCATING POINTS ON A GRAPH: TRACING AND TABLES

Graphing calculators allow you to trace along the graph of an equation, and, while doing this, display the coordinates of points on the graph. See the screen on the left at the top of the next page, which indicates that the point $(2, 5)$ lies on the graph of $y = 2x + 1$. Tables for equations can also be displayed. The screen on the right shows a partial table for this same equation. Note the middle of the screen, which indicates that when $x = 2$, $y = 5$.



X	Y1	
-1	-1	
0	1	
1	3	
2	5	
3	7	
4	9	
5	11	
Y1=2X+1		

ADDITIONAL FEATURES

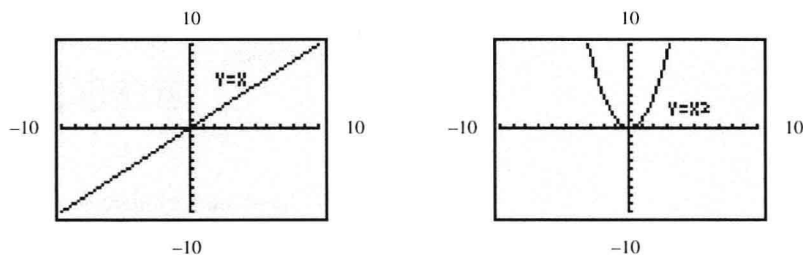
There are many features of graphing calculators that go far beyond the scope of this book. These calculators can be programmed, much like computers. Many of them can solve equations at the stroke of a key, analyze statistical data, and perform symbolic algebraic manipulations. Mathematicians from the past would have been amazed by today’s calculators. Many important equations in mathematics cannot be solved by hand. However, their solutions can often be approximated using a calculator. Calculators also provide the opportunity to ask “What if . . . ?” more easily. Values in algebraic expressions can be altered and conjectures tested quickly.

FINAL COMMENTS

Despite the power of today’s calculators, they cannot replace human thought. **In the entire problem-solving process, your brain is the most important component.** Calculators are only tools, and like any tool, they must be used appropriately in order to enhance our ability to understand mathematics. Mathematical insight may often be the quickest and easiest way to solve a problem; a calculator may neither be needed nor appropriate. By applying mathematical concepts, you can make the decision whether or not to use a calculator.

BASIC FEATURES

Graphing calculators provide many features beyond those found on scientific calculators. In addition to the typical keys found on scientific calculators, they have keys that can be used to create graphs, make tables, analyze data, and change settings. One of the major differences between graphing and scientific calculators is that a graphing calculator has a larger viewing screen with graphing capabilities. The screens below illustrate the graphs of $y = x$ and $y = x^2$.



If you look closely at the screens, you will see that the graphs appear to be “jagged” rather than smooth, as they should be. The reason for this is that graphing calculators have much lower resolution than a computer screen. Because of this, graphs generated by graphing calculators must be interpreted carefully.

EDITING INPUT

The screen of a graphing calculator can display several lines of text at a time. This feature allows you to view both previous and current expressions. If an incorrect expression is entered, an error message is displayed. The erroneous expression can be viewed and corrected by using various editing keys, much like a word-processing program. You do not need to enter the entire expression again. Many graphing calculators can also recall past expressions for editing or updating. The screen on the left below shows how two expressions are evaluated. The final line is entered incorrectly, and the resulting error message is shown in the screen on the right.

```
(8+12)/4+3      8
-5+4*6           19
36√(
```

```
ERR:SYNTAX
1:Quit
2:Goto
```

ORDER OF OPERATIONS

Arithmetic operations on graphing calculators are usually entered as they are written in mathematical equations. For example, to evaluate $\sqrt{36}$ on a typical scientific calculator, you would first enter 36 and then press the square root key. As seen above, this is not the correct syntax for a graphing calculator. To find this root, you would first press the square root key, and then enter 36. See the screen on the left at the top of the next page. The order of operations on a graphing calculator is also important, and current models

add to or subtract from the value currently in memory. The memory recall key, labeled $\boxed{\text{MR}}$, $\boxed{\text{RM}}$, or $\boxed{\text{RCL}}$, allows you to retrieve the value stored in memory.

Suppose that you wish to store the number 5 in memory. Enter 5, then press the key for memory. You can then perform other calculations. When you need to retrieve the 5, press the key for memory recall.

If a calculator has a constant memory feature, the value in memory will be retained even after the power is turned off. Some advanced calculators have more than one memory. It is best to read the owner's manual for your model to see exactly how memory is activated.

CLEARING/CLEAR ENTRY KEYS

These keys allow you to clear the display or clear the last entry entered into the display. They are usually marked $\boxed{\text{C}}$ and $\boxed{\text{CE}}$. In some models, pressing the $\boxed{\text{C}}$ key once will clear the last entry, while pressing it twice will clear the entire operation in progress.

SECOND FUNCTION KEY

This key is used in conjunction with another key to activate a function that is printed *above* an operation key (and not on the key itself). It is usually marked $\boxed{2\text{nd}}$. For example, suppose you wish to find the square of a number, and the squaring function (explained in more detail later) is printed above another key. You would need to press $\boxed{2\text{nd}}$ before the desired squaring function can be activated.

SQUARE ROOT KEY

Pressing the square root key, $\boxed{\sqrt{x}}$, will give the square root (or an approximation of the square root) of the number in the display. For example, to find the square root of 36, use the following keystrokes.

$\boxed{3} \boxed{6} \boxed{\sqrt{x}} \boxed{} 6$

The square root of 2 is an example of an irrational number (Chapter 10). The calculator will give an approximation of its value, since the decimal for $\sqrt{2}$ never terminates and never repeats. The number of digits shown will vary among models. To find an approximation of $\sqrt{2}$, use the following keystrokes.

$\boxed{2} \boxed{\sqrt{x}} \boxed{} 1.4142136$ An approximation

SQUARING KEY

This key, $\boxed{x^2}$, allows you to square the entry in the display. For example, to square 35.7, use the following keystrokes.

$\boxed{3} \boxed{5} \boxed{\cdot} \boxed{7} \boxed{x^2} \boxed{} 1274.49$

The squaring key and the square root key are often found on the same key, with one of them being a second function (that is, activated by the second function key, described above).

RECIPROCAL KEY

The key marked $\boxed{1/x}$ is the reciprocal key. (When two numbers have a product of 1, they are called *reciprocals*. See Chapter 1.) Suppose that you wish to find the reciprocal of 5. Use the following keystrokes.

$\boxed{5} \boxed{1/x} \boxed{} 0.2$

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Margaret L. Lial
John Hornsby



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