

A Custom Edition

Margaret L. Lial

John Hornsby

Terry McGinnis

Introductory Algebra



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Taken from:

Introductory Algebra,
Eighth Edition

by Margaret L. Lial, John Hornsby, and Terry McGinnis

Learning Solutions

New York Boston San Francisco
London Toronto Sydney Tokyo Singapore Madrid
Mexico City Munich Paris Cape Town Hong Kong Montreal

Taken from:

Introductory Algebra, Eighth Edition
by Margaret L. Lial, John Hornsby, and Terry McGinnis
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Videotape and CD Index

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SECTION	PAGE	TITLE	APPLICATION	OBJECTIVE
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8.4	590	The Golden Ratio—A Star Number	Investigate the golden ratio.	Use radical quotients.
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Preface

The eighth edition of *Algebra 1* continues our ongoing commitment to provide the best possible text and supplements package to help teachers and students succeed. To that end, we have tried to address the diverse needs of today's students through an attractive design, updated figures and graphs, helpful features, careful explanations of topics, and a comprehensive package of supplements and study aids. We have taken special care to respond to the suggestions of users and reviewers and have added new examples and exercises based on their feedback. Students who have never studied algebra—as well as those who require further review of basic algebraic concepts before taking additional courses in mathematics, business, science, nursing, or other fields—will benefit from the text's student-oriented approach.

This text is part of a series that also includes the following books:









- *Essential Mathematics*, Second Edition, by Lial and Salzman
- *Basic College Mathematics*, Seventh Edition, by Lial, Salzman, and Hestwood
- *Prealgebra*, Third Edition, by Lial and Hestwood
- *Algebra 2*, Eighth Edition, by Lial, Hornsby, and McGinnis
- *Introductory and Intermediate Algebra*, Third Edition, by Lial, Hornsby, and McGinnis.

HALLMARK FEATURES

We believe students and teachers will welcome the following helpful features.

- **Chapter Openers** New and updated chapter openers feature real-world applications of mathematics that are relevant to students and tied to specific material within the chapters. Examples of topics include the Olympics, credit card debt, and movie revenues. (See pp. 107, 193, and 273—Chapters 2, 3, and 4.)
- **Real-Life Applications** We are always on the lookout for interesting data to use in real-life applications. As a result, we have included new or updated examples and exercises from fields such as business, pop culture, sports, the life sciences, and technology that show the relevance of algebra to daily life. (See pp. 142, 208, and 308.) A comprehensive Index of Applications appears at the beginning of the text. (See pp. v–vii.)
- **Figures and Photos** Today's students are more visually oriented than ever. Thus, we have made a concerted effort to include mathematical figures, diagrams, tables, and graphs whenever possible. (See pp. 196, 246, and 316.) Many of the graphs use a style similar to that seen by students in today's print and electronic media. Photos have been incorporated to enhance applications in examples and exercises. (See pp. 134, 328, and 455.)
- **Emphasis on Problem Solving** Introduced in Chapter 2, our six-step problem-solving method is integrated throughout the text. The six steps, *Read, Assign a Variable, Write an Equation, Solve, State the Answer, and Check*, are emphasized in boldface type and repeated in examples and exercises to reinforce the problem-solving process for students. (See pp. 133, 301, and 445.) New **PROBLEM-SOLVING HINT** boxes provide students with helpful problem-solving tips and strategies. (See pp. 133, 135, and 529.)

Also new to this edition of the text is Appendix A: Strategies for Problem Solving. (See pp. 687–700.) This appendix provides examples of additional problem-solving techniques, such as working backward, using trial and error, and looking for patterns. A wide variety of applications are included.

-  **Learning Objectives** Each section begins with clearly stated, numbered objectives, and the included material is directly keyed to these objectives so that students know exactly what is covered in each section. (See pp. 31, 133, and 341.)
-  **Cautions and Notes** One of the most popular features of previous editions, **CAUTION** and **NOTE** boxes warn students about common errors and emphasize important ideas throughout the exposition. (See pp. 235, 367, and 498.) The text design makes them easy to spot: Cautions are highlighted in bright yellow and Notes are highlighted in purple.
-  **Calculator Tips** These optional tips, marked with calculator icons, offer basic information and instruction for students using calculators in the course. (See pp. 26, 160, and 387.) An Introduction to Calculators is included at the beginning of the text. (See pp. xxi–xxv.)
-  **Margin Problems** Margin problems, with answers immediately available at the bottom of the page, are found in every section of the text. (See pp. 69, 303, and 481.) This popular feature allows students to immediately practice the material covered in the examples in preparation for the exercise sets.
-  **Ample and Varied Exercise Sets** The text contains a wealth of exercises to provide students with opportunities to practice, apply, connect, and extend the algebraic skills they are learning. Numerous illustrations, tables, graphs, and photos have been added to the exercise sets to help students visualize the problems they are solving. Problem types include writing, estimation, and calculator exercises as well as applications and multiple-choice, matching, true/false, and fill-in-the-blank problems. In the *Annotated Instructor's Edition* of the text, writing exercises are marked with  icons so that teachers may assign these problems at their discretion. Exercises suitable for calculator work are marked in both the student and teacher editions with calculator icons . (See pp. 377, 455, and 479.)
-  **Relating Concepts Exercises** These sets of exercises help students tie together topics and develop problem-solving skills as they compare and contrast ideas, identify and describe patterns, and extend concepts to new situations. (See pp. 266, 298, and 362.) These exercises make great collaborative activities for pairs or small groups of students.
-  **Summary Exercises** Based on user feedback, every chapter now includes at least one set of in-chapter summary exercises. These special exercise sets provide students with the all-important *mixed* review problems they need to master topics. Summaries of solution methods or additional examples are often included. (See pp. 247, 299, and 525.)
-  **Study Skills Component** A desk-light icon at key points in the text directs students to a separate *Study Skills Workbook* containing activities correlated directly to the text. (See pp. 24, 189, and 423.) This unique workbook explains *how* the brain actually learns, so students understand *why* the study tips presented will help them succeed in the course. Students are introduced to the workbook in the To the Student section at the beginning of the text.
-  **Focus on Real-Data Applications** These one-page activities present a relevant and in-depth look at how mathematics is used in the real world. Designed to help teachers answer the often-asked question, “When will I ever use this stuff?,” these activities ask students to read and interpret data from newspaper articles, the Internet, and other familiar, real sources. (See pp. 140, 278, 410, and 486.) The activities are well-suited to collaborative work and can also be completed by individuals or used for open-ended class discussions. A comprehensive Index of Focus on Real-Data Applications appears at the beginning of the text. (See pp. ix and x.) Teaching notes and extensions for the activities are provided in the *Printed Test Bank and Instructor's Resource Guide*.
-  **Test Your Word Power** To help students understand and master mathematical vocabulary, this feature can be found in each chapter summary. Key terms from the chapter are presented along with four possible definitions in a multiple-choice format. Answers and examples illustrating each term are provided. (See pp. 258, 319, and 391.)

Ample Opportunity for Review Each chapter concludes with a Chapter Summary that features Key Terms with definitions and helpful graphics, New Symbols, Test Your Word Power, and a Quick Review of each section's content with additional examples. A comprehensive set of Chapter Review Exercises, keyed to individual sections, is included, as are Mixed Review Exercises and a Chapter Test. Beginning with Chapter 2, each chapter concludes with a set of Cumulative Review Exercises that cover material going back to Chapters R and 1. (See pp. 257, 391, and 457.)

Diagnostic Pretest A diagnostic pretest is included on p. xxix and covers material from the entire book, much like a sample final exam. This pretest can be used to facilitate student placement in the correct chapter according to skill level.

WHAT IS NEW IN THIS EDITION?

You will find many places in the text where we have polished individual presentations and added or updated examples, and exercises, and applications based on reviewer feedback. Specific content changes you may notice include the following:

- Section 2.1 on solving linear equations in one variable includes twice as many examples as in the previous edition. Linear equations with no solution or infinitely many solutions, formerly covered in this section, have been moved to Section 2.3.
- Section 3.4 includes new exposition, an example, and exercises on graphing linear equations using slope and y-intercept.
- Systems of linear equations and inequalities are presented in Chapter 4, earlier than in the previous edition.
- All new sets of summary exercises appear in Chapters 1–5 and 8.
- Appendix A: Strategies for Problem Solving and Appendix C: Mean, Median, and Mode are new to this edition.

WHAT SUPPLEMENTS ARE AVAILABLE?

For a comprehensive list of the supplements and study aids that accompany *Algebra 1*, Eighth Edition, see pages xv and xvi.

ACKNOWLEDGMENTS

Previous editions of this text were published after thousands of hours of work, not only by the authors, but also by reviewers, teachers, students, answer checkers, and editors. To these individuals and all those who have worked in some way on this text over the years, we are most grateful for your contributions. We could not have done it without you. We especially wish to thank the following reviewers whose valuable contributions have helped to refine this edition of this text.

Randall Allbritton, *Daytona Beach Community College*
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 Russell Campbell, *Fairmont State College*
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Lee Ann Spahr, *Durham Technical Community College*
Carol Stewart, *Fairmont State College*
Cora S. West, *Florida Community College at Jacksonville*
Johanna Windmueller, *Seminole Community College*
Gabriel Yimesghen, *Community College of Philadelphia*

Over the years, we have come to rely on an extensive team of experienced professionals. Our sincere thanks go to these dedicated individuals at Addison-Wesley, who worked long and hard to make this revision a success: Greg Tobin, Maureen O'Connor, Jay Jenkins, Lauren Morse, Marcia Emerson, Sharon Smith, Sara Anderson, Tracy Rabinowitz, Ron Hampton, and Dennis Schaefer.

Thanks are due Gina Linko, Phyllis Crittenden, and Elm Street Publishing Services for their excellent production work. Barb Brown provided invaluable assistance updating the real data used in applications throughout the text. Abby Tanenbaum and Paul Lorzak did an outstanding job accuracy checking page proofs. Special thanks to Bernice Eisen who prepared the Index and Becky Troutman who compiled the Index of Applications.

As an author team, we are committed to the goal stated earlier in this Preface—to provide the best possible text and supplements package to help teachers and students succeed. We are most grateful to all those over the years who have aspired to this goal with us. As we continue to work toward it, we would welcome any comments or suggestions you might have via e-mail to math@awl.com.


Margaret L. Lial
John Hornsby
Terry McGinnis

Student Supplements

Student's Solutions Manual

- By Jeffery A. Cole, *Anoka-Ramsey Community College*
 - Provides detailed solutions to the odd-numbered, section-level exercises and to all margin, Relating Concepts, Summary, Chapter Review, Chapter Test, and Cumulative Review Exercises
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Study Skills Workbook

- By Diana Hestwood and Linda Russell
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 - A desk-light icon  at key points directs students to correlated activities in the workbook
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Lesson Plans

- This booklet provides a section-by-section resource for teaching from the text.

Instructor's Solutions Manual

- By Jeffery A. Cole, *Anoka-Ramsey Community College*
 - Provides complete solutions to all even-numbered, section-level exercises
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Answer Book

- By Jeffery A. Cole, *Anoka-Ramsey Community College*
 - Provides answers to all the exercises in the text
- ISBN: 0-321-28576-X

Adjunct Support Manual

- Includes resources designed to help both new and adjunct faculty with course preparation and classroom management
 - Offers helpful teaching tips correlated to the sections of the text
- ISBN: 0-321-28586-7

Printed Test Bank and Instructor's Resource Guide

- By James J. Ball, *Indiana State University*
 - Contains two diagnostic pretests, six free-response and two multiple-choice test forms per chapter, and two final exams
 - Includes teaching suggestions for every chapter, additional practice exercises for each objective in every section, a correlation guide from the seventh to the eighth edition, phonetic spellings for all key terms in the text, and teaching notes and extensions for the Focus on Real-Data Applications in the text
- ISBN: 0-321-28575-1

TestGen

- Enables instructors to build, edit, print, and administer tests
 - Features a computerized bank of questions developed to cover all text objectives
 - Available on a dual-platform Windows/Macintosh CD-ROM
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InterAct Math Tutorial Web site: www.interactmath.com Get practice and tutorial help online! This interactive tutorial web site provides algorithmically generated practice exercises that correlate directly to the exercises in the textbook. Students can retry an exercise multiple times with new values each time for unlimited practice and mastery. Every exercise is accompanied by an interactive guided solution that provides helpful feedback for an incorrect answer. Students can also view a worked-out sample problem that steps them through an exercise similar to the one they're working on.



MathXL®—Optional MathXL is a powerful online homework, tutorial, and assessment system that accompanies your Addison-Wesley textbook in mathematics or statistics. With MathXL, teachers can create, edit, and assign online homework and tests using algorithmically generated exercises correlated at the objective level to the textbook. All student work is tracked in MathXL's online gradebook. Students can take chapter tests in MathXL and receive personalized study plans based on their test results. The study plan diagnoses weaknesses and links students directly to tutorial exercises for the objectives they need to study and retest. Students can also access supplemental video clips and animations directly from selected exercises. **MathXL is available for purchase only on an annual basis.** For more information, visit our web site at www.mathxl.com, or contact your Addison-Wesley sales representative for more information.



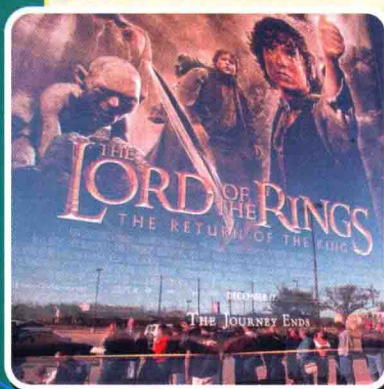
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Feature Walk-Through

Chapter Openers Chapter openers feature real-world applications of mathematics that are relevant to students and tied to specific material within the chapters.

Systems of Linear Equations and Inequalities

4



- 4.1 Solving Systems of Linear Equations by Graphing
- 4.2 Solving Systems of Linear Equations by Substitution
- 4.3 Solving Systems of Linear Equations by Elimination

Summary Exercises on Solving Systems of Linear Equations

- 4.4 Applications of Linear Systems
- 4.5 Solving Systems of Linear Inequalities

Although Americans continued their fascination with Hollywood and the movies in 2003, movie attendance and revenues dipped for the first time since 1991. Nonetheless, some 1.52 billion tickets were sold and revenues exceeded \$9 billion for the second year in a row. The top box office draws of the year—*The Lord of the Rings: The Return of the King* and *Finding Nemo*—attracted scores of adults and children wishing to get away from it all for a few hours. (Source: Exhibitor Relations Co., Nielsen EDI.)

In Exercise 13 of Section 4.4, we use a system of linear equations to find out how much money these top films earned.

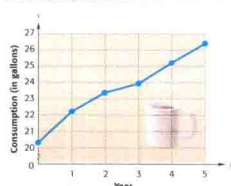
37. Use the results of Exercises 35(b) and 36(b) to determine the target heart rate zone for age 30.



- Section 3.2 Graphing Linear Equations in Two Variables 221
38. Should the graphs of the target heart rate zone in the Section 3.1 exercises be used to estimate the target heart rate zone for ages below 20 or above 80? Why or why not?

39. Per capita consumption of coffee increased for the years 1995 through 2000 as shown in the graph. If $x = 0$ represents 1995, $x = 1$ represents 1996, and so on, per capita consumption y in gallons can be modeled by the linear equation
- $$y = 1.13x + 20.67.$$

COFFEE CONSUMPTION



Source: U.S. Department of Agriculture.

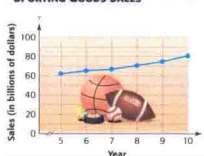
- (a) Use the equation to approximate consumption in 1995, 1996, and 1998 to the nearest tenth.

40. Sporting goods sales y (in billions of dollars) from 1995 through 2000 are modeled by the linear equation

$$y = 3.606x + 41.86,$$

where $x = 5$ corresponds to 1995, $x = 6$ corresponds to 1996, and so on.

SPORTING GOODS SALES



Source: U.S. Bureau of the Census.

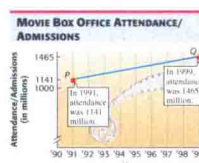
- (a) Use the equation to approximate sporting goods sales in 1995, 1997, and 2000. Round your answers to the nearest billion dollars.

Figures and Photos Today's students are more visually oriented than ever. Thus, a concerted effort has been made to include mathematical figures, diagrams, tables, and graphs whenever possible. Many of the graphs use a style similar to that seen by students in today's print and electronic media. Photos have been incorporated to enhance applications in examples and exercises.

Relating Concepts These sets of exercises help students tie together topics and develop problem-solving skills as they compare and contrast ideas, identify and describe patterns, and extend concepts to new situations. These exercises make great collaborative activities for pairs or small groups of students.

RELATING CONCEPTS (EXERCISES 41–46) For Individual or Group Work

Attending the movies is one of America's favorite forms of entertainment. The graph shows movie attendance from 1991 to 1999. In 1991, attendance was 1141 million, as represented by the point $P(1991, 1141)$. In 1999, attendance was 1465 million, as represented by the point $Q(1999, 1465)$. We can find an equation of line segment PQ using a system of equations, and then we can use the equation to approximate the attendance in any of the years between 1991 and 1999. **Work Exercises 41–46 in order.**



Source: Motion Picture Association of America.



41. The line segment has an equation that can be written in the form $y = ax + b$. Using the coordinates of point P with $x = 1991$ and $y = 1141$, write an equation in the variables a and b .
42. Using the coordinates of point Q with $x = 1999$ and $y = 1465$, write a second equation in the variables a and b .
43. Write the system of equations formed from the two equations in Exercises 41 and 42, and solve the system using the elimination method.
44. What is the equation of the segment PQ ?
45. Let $x = 1998$ in the equation of Exercise 44, and solve for y . How does the result compare with the actual figure of 1481 million?
46. The data points for the years 1991 through 1999 do not lie in a perfectly straight line. Explain the pitfalls of relying too heavily on using the equation in Exercise 44 to predict attendance.

Focus on

Real-Data Applications

The Magic Number in Sports



The climax of any sports season is the playoffs. Baseball fans eagerly debate predictions of which team will win the pennant for their division. The **magic number** for each first-place team is often used to predict the division winner. The **magic number** is the combined number of wins by the first-place team and losses by the second-place team that would clinch the title for the first-place team.

For Group Discussion

To calculate the magic number, consider the following conditions.

The number of wins for the first-place team (W_1) plus the magic number (M) is one more than the sum of the number of wins to date (W_2) and the number of games remaining in the season (N_2) for the second-place team.

1. First, use the variable definitions to write an equation involving the magic number. Second, solve the equation for the magic number. Write the formula for the magic number.

2. The American League standings with about 10 games left in the 2003 baseball season are shown at the left. There were 162 regulation games in the 2003 season. Find the magic number for each team. The number of games remaining in the season for the second-place team is calculated as

$$N_2 = 162 - (W_2 + L_2).$$

- (a) AL East: New York vs Boston

Magic No. _____

- (b) AL Central: Minnesota vs Chicago

Magic No. _____

- (c) AL West: Oakland vs Seattle

Magic No. _____

American League				
East Division				
	W	L	Pct.	GB
New York	84	68	.554	—
Boston	80	83	.500	5
Toronto	79	83	.488	10
Baltimore	66	96	.405	23
Tampa Bay	60	102	.368	29
Central Division				
	W	L	Pct.	GB
Minnesota	84	69	.549	—
Chicago	80	82	.526	4
Kansas City	79	83	.520	5
Cleveland	66	96	.405	23
Detroit	58	104	.356	31
West Division				
	W	L	Pct.	GB
Oakland	82	80	.510	—
Seattle	81	81	.500	1
Anaheim	72	90	.444	10
Texas	65	97	.401	17

Source: USA Today.

[Note: For the National League in the 2003 season, Atlanta and San Francisco were runaway winners of the Eastern and Western Divisions, respectively. Chicago, Houston, and St. Louis were locked in a dead heat for the Central Division lead, which was eventually won by Chicago.]

Focus on Real-Data Applications These one-page activities found throughout the text present even more relevant and in-depth looks at how mathematics is used in the real world. Designed to help instructors answer the often-asked question, “When will I ever use this stuff?” these activities ask students to read and interpret data from newspaper articles, the Internet, and other familiar, real sources. The activities are well suited to collaborative work and can also be completed by individuals or used for open-ended class discussions.

Calculator Tips These optional tips, marked with calculator icons, offer basic information and instruction for students using calculators in the course.

Calculator Tip Using a calculator to perform the arithmetic in Example 5 reduces the possibility of errors.

Work Problem 5 at the Side.

OBJECTIVE 1 Find percentages and percents. Percents are ratios where the second number is always 100. For example, 50% represents the ratio of 50 to 100, 27% represents the ratio of 27 to 100, and so on. We can use the techniques for solving proportions to solve percent problems. Recall from Section R.2 that the decimal point is moved two places to the left to change a percent to a decimal number. For example, 75% can be written as the decimal .75.

Calculator Tip Many calculators have a percent key that does this automatically.

We can solve a percent problem by writing it as the proportion

$$\frac{\text{amount}}{\text{base}} = \frac{\text{percent}}{100} \quad \text{or} \quad \frac{a}{b} = \frac{p}{100}$$

The **amount**, or **percentage**, is compared to the **base** (the whole amount). Since **percent means per 100**, we compare the numerical value of the percent to 100. Thus, we write 50% as

$$\frac{p}{100} = \frac{50}{100} \quad p = 50$$

Chapter 5

SUMMARY

Key Terms

- 5.1 polynomial**
A polynomial is a term or the sum of a finite number of terms with whole number exponents. A polynomial in x is written in descending powers if the exponents on x in its terms are in decreasing order.
- degree of a term**
The degree of a term is the sum of the exponents on the variables.
- degree of a polynomial**
The degree of a polynomial is the greatest degree of any term in the polynomial.
- monomial**
A monomial is a polynomial with one term.
- binomial**
A binomial is a polynomial with two terms.
- trinomial**
A trinomial is a polynomial with three terms.
- 5.3 FOIL**
FOIL is a shortcut method for finding the product of two binomials.
- outer product**
The outer product of $(2x + 3)(x - 5)$ is $2x(x - 5)$.
- inner product**
The inner product of $(2x + 3)(x - 5)$ is $3x$.
- 5.8 scientific notation**
A number written as $a \times 10^n$, where $1 \leq |a| < 10$ and n is an integer, is in scientific notation.

New Symbols

x^{-n} x to the negative n power

Test Your Word Power

See how well you have learned the vocabulary in this chapter. Answers, with examples, follow the Quick Review.

- A **polynomial** is an algebraic expression made up of
 - a term or a finite product of terms with positive coefficients and exponents
 - a term or a finite sum of terms with real coefficients and whole number exponents
 - the product of two or more terms with positive exponents
 - the sum of two or more terms with whole number coefficients and exponents.
- The **degree of a term** is
 - the number of variables in the term
 - the product of the exponents on the variables
 - the least exponent on the variables
 - the sum of the exponents on the variables.
- A **trinomial** is a polynomial with
 - only one term
 - exactly two terms
 - exactly three terms
 - more than three terms.
- A **binomial** is a polynomial with
 - only one term
 - exactly two terms
 - exactly three terms
 - more than three terms.
- A **monomial** is a polynomial with
 - only one term
 - exactly two terms
 - exactly three terms
 - more than three terms.
- FOIL** is a method for
 - adding two binomials
 - adding two trinomials
 - multiplying two binomials
 - multiplying two trinomials.

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End-of-Chapter Material One of the most admired features of the Lial textbooks is the extensive and well-thought-out end-of-chapter material. At the end of each chapter, students will find a Summary that includes the following:

Key Terms are listed, defined, and referenced back to the appropriate section number.

New Symbols are listed for easy reference and study.

Test Your Word Power helps students understand and master mathematical vocabulary. Students are quizzed on Key Terms from the chapter in a multiple-choice format. Answers and examples illustrating each term are provided.

A Chapter Test helps students practice for the real thing.

Chapter 5

TEST

Chapter 5 Test 399

Perform the indicated operations.

1. $(5t^4 - 3t^2 + 7t + 3) - (t^4 - t^3 + 3t^2 + 8t + 3)$

1. _____

2. $(2y^2 - 8y + 8) + (-3y^2 + 2y + 3) - (y^2 + 3y - 6)$

2. _____

3. Subtract.

$$\begin{array}{r} 9t^3 - 4t^2 + 2t + 2 \\ 9t^3 + 8t^2 - 3t - 6 \\ \hline \end{array}$$

3. _____

Simplify, and write each answer with only positive exponents.

4. $(-2)^3(-2)^2$

4. _____

5. $\left(\frac{6}{m^2}\right)^3, m \neq 0$

5. _____

6. $3x^2(-9x^3 + 6x^2 - 2x + 1)$

6. _____

7. $(2r - 3)(r^2 + 2r - 5)$

7. _____

8. $(t - 8)(t + 3)$

8. _____

Quick Review

Concepts

5.1 Adding and Subtracting Polynomials

Addition
Add like terms.

Subtraction

Change the signs of the terms in the second polynomial and add to the first polynomial.

5.2 The Product Rule and Power Rules for Exponents

For any integers m and n :

Product rule $a^m \cdot a^n = a^{m+n}$

Power rules (a) $(a^m)^n = a^{mn}$

(b) $(ab)^n = a^n b^n$

(c) $\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n} \quad (b \neq 0)$

5.3 Multiplying Polynomials

Multiply each term of the first polynomial by each term of the second polynomial. Then add like terms.

Examples

Add.

$$\begin{array}{r} 2x^2 + 5x - 3 \\ 5x^2 - 2x + 7 \\ 7x^2 + 3x + 4 \\ \hline \end{array}$$

Subtract. $(2x^2 + 5x - 3) - (5x^2 - 2x + 7)$

$$= (2x^2 + 5x - 3) + (-5x^2 + 2x - 7)$$

$$= -3x^2 + 7x - 10$$

$$2^3 \cdot 2^5 = 2^8$$

$$(3^2)^3 = 3^6$$

$$(6a)^3 = 6^3 a^3$$

$$\left(\frac{2}{3}\right)^4 = \frac{2^4}{3^4}$$

Multiply.

$$3x^3 - 4x^2 + 2x - 7$$

$$\begin{array}{r} 9x^2 - 12x^2 + 6x - 21 \\ \hline \end{array}$$

$$12x^4 - 16x^3 + 8x^2 - 28x$$

$$-12x^4 + 16x^3 - 8x^2 + 28x$$

Quick Review sections give students not only the main concepts from the chapter (referenced back to the appropriate section), but also an adjacent example of each concept.

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 The C or CE key allows you to clear the display or clear the last entry entered into the display. In some models, pressing the C key once will clear the last entry, while pressing it twice will clear the entire operation in progress.

Second Function Key This key, usually marked 2nd , is used in conjunction with another key to activate a function that is printed *above* an operation key (and not on the key itself). 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 2nd before the desired squaring function can be activated.

Square Root Key Pressing $\sqrt{}$ or \sqrt{x} will give the square root (or an approximation of the square root) of the number in the display. On some scientific calculators, the square root key is pressed *before* entering the number, while other calculators use the opposite order. Experiment with your calculator to see which method it uses. For example, to find the square root of 36, use the following keystrokes.

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

The square root of 2 is an example of an irrational number (**Chapter 8**). 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 for $\sqrt{2}$, use the following keystrokes.

$\sqrt{}$ 2 1.4142136 or 2 $\sqrt{}$ 1.4142136 An approximation for $\sqrt{2}$

Squaring Key The x^2 key allows you to square the entry in the display. For example, to square 35.7, use the following keystrokes.

3 5 7 x^2 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 previously described).

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

5 $1/x$ 0.2

Inverse Key Some calculators have an inverse key, marked 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 INV key varies among different models of calculators, so read your owner's manual carefully.

Exponential Key The key marked x^y or 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 1**), use the following keystrokes.

4 x^y 5 = 1024

Root Key Some calculators have this key specifically marked \sqrt{x} or $\sqrt[y]{x}$; 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.

1 0 2 4 INV x^y 5 = 4

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

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 π 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 π key is pressed.

3.1415927

An approximation for π

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 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:

5.6270623 13

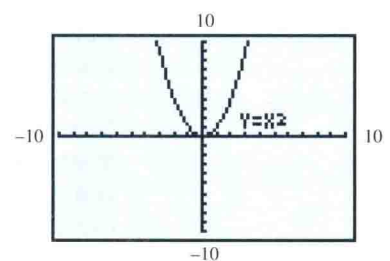
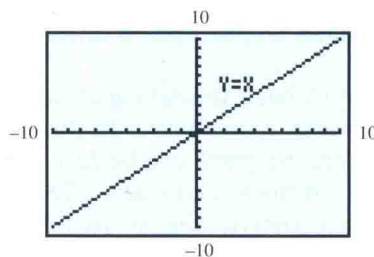
The 13 at the far right means that the number on the left is multiplied by 10^{13} . This means that the decimal point must be moved 13 places to the right if the answer is to be expressed in its usual form. Even then, the value obtained will only be an approximation: 56,270,623,000,000.

GRAPHING CALCULATORS

While you are not expected to have a graphing calculator to study from this book, we include the following as background information and reference should your course or future courses require the use of graphing calculators.

Basic Features

In addition to the typical keys found on scientific calculators, graphing calculators 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 computer screens. 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.