KEEDY/BITTINGER Intermediate Algebra

6th edition

# Intermediate Algebra

6 TH EDITION

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# Intermediate Algebra

6
TH EDITION

# **Preface**

Intended for students who have a firm background in introductory algebra, this text is appropriate for a one-term course in intermediate algebra. It is the third in a series of texts that includes the following:

Keedy/Bittinger: *Basic Mathematics*, Sixth Edition, Keedy/Bittinger: *Introductory Algebra*, Sixth Edition, Keedy/Bittinger: *Intermediate Algebra*, Sixth Edition.

*Intermediate Algebra*, Sixth Edition, provides the necessary preparation for any introductory college-level mathematics course, including courses in college algebra, precalculus, finite mathematics, or brief calculus.

Intermediate Algebra, Sixth Edition, is a significant revision of the Fifth Edition, with respect to content, pedagogy, and an expanded supplements package. Its unique approach, which has been developed over many years, is designed to help today's students both learn and retain mathematical concepts. The Sixth Edition is accompanied by a comprehensive supplements package that has been integrated with the text to provide maximum support for both instructor and student.

Following are some distinctive features of the approach and pedagogy that we feel will help meet some of the challenges all instructors face teaching developmental mathematics.

## APPROACH

**CAREFUL DEVELOPMENT OF CONCEPTS** We have divided each section into discrete and manageable learning objectives. Within the presentation of each objective, there is a careful buildup of difficulty through a series of developmental and followup examples. These enable students to thoroughly understand the mathematical concepts involved at each step. Each objective is constructed in a similar way, which gives students a high level of comfort with both the text and their learning process.

**FOCUS ON "WHY"** Throughout the text, we present the appropriate mathematical rationale for a topic, rather than mathematical "shortcuts." For example, when manipulating rational expressions, we remove factors of 1 rather than cancel, although cancellation is mentioned with appropriate cautions. This helps prevent student errors in cancellation and other incorrectly remembered shortcuts in later courses.

**PROBLEM SOLVING** We include real-life applications and problem-solving techniques throughout the text to motivate students and encourage them to think about how mathematics can be used. We also introduce a five-step problem-solving process early in the text and use the basic steps of this process (Familiarize, Translate, Solve, Check, and State the Answer) whenever a problem is solved.

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x =

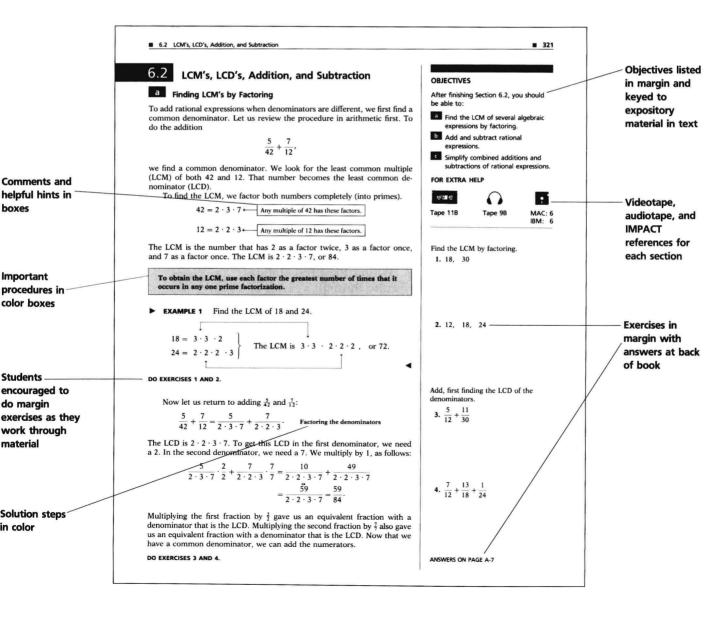
**GRAPHING** Although introduced in Chapter 2, graphing is integrated throughout the remainder of the text to provide a visual interpretation of different types of equations and their solutions. This gives students a better intuitive understanding of the material. In addition, familiarity and practice with graphing techniques make students more comfortable with this essential tool when they move on to later courses.

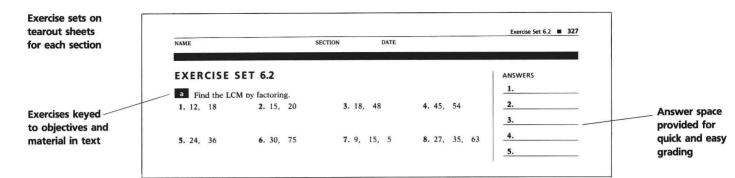
# PEDAGOGY

**INTERACTIVE WORKTEXT APPROACH** The pedagogy of this text is designed to provide students with a clear set of learning objectives, and involve them with the development of the material, providing immediate and continual reinforcement.

Section objectives are keyed to appropriate sections of the text, exercises, and answers, so that students can easily find appropriate review material if they are unable to do an exercise.

Numerous *margin exercises* throughout the text provide immediate reinforcement of concepts covered in each section.





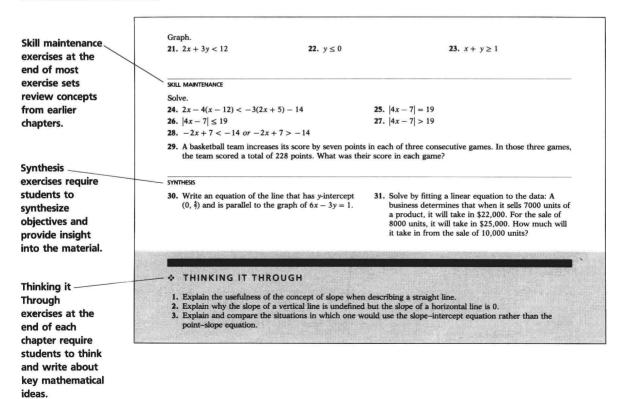
**STUDY AID REFERENCES** Many valuable study aids accompany this text. Each section is referenced to appropriate videotape, audiotape, and software diskette numbers to make it easy for students to find and use the correct support materials.

**VERBALIZATION SKILLS AND "THINKING IT THROUGH"** Students' perception that mathematics is a foreign language is a significant barrier to their ability to think mathematically and is a major cause of math anxiety. In the Sixth Edition we have encouraged students to think through mathematical situations, synthesize concepts, and verbalize mathematics whenever possible.

"Thinking it Through" exercises at the end of each chapter encourage students to both think and write about key mathematical ideas that they have encountered in the chapter.

"Synthesis Exercises" at the end of most exercise sets require students to synthesize several learning objectives or to think through and provide insight into the present material.

In addition, many important definitions, such as the laws of exponents, are presented verbally as well as symbolically, to help students learn to read mathematical notation.



**SKILL MAINTENANCE** Because retention of skills is critical to students' future success, skill maintenance is a major emphasis of the Sixth Edition.

Each chapter begins with a "Points to Remember" box, which highlights key formulas and definitions from previous chapters.

In addition, we include *Skill Maintenance Exercises* at the end of most exercise sets. These review skills and concepts from earlier sections of the text.

At the end of each chapter, our *Summary and Review* summarizes important properties and formulas and includes extensive review exercises.

Each *Chapter Test* tests four review objectives from preceding chapters as well as the chapter objectives.

We also include a *Cumulative Review* at the end of each chapter; this reviews material from all preceding chapters.

At the back of the text are answers to all review exercises, together with section and objective references, so that students know exactly what material to restudy if they miss a review exercise.

**TESTING AND SKILL ASSESSMENT** Accurate assessment of student comprehension is an important factor in a student's long-term success. In the Sixth Edition, we have provided many assessment opportunities.

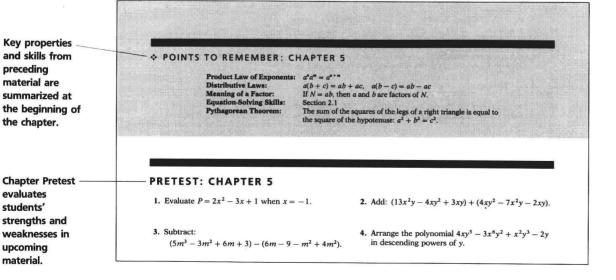
A *Diagnostic Pretest* at the beginning of the text can place students in the appropriate chapter for their skill level, and identifies both familiar material and specific trouble areas later in the text.

Chapter Pretests diagnose student skills and place the students appropriately within each chapter, allowing them to concentrate on topics with which they have particular difficulty.

Chapter Tests at the end of each chapter allow students to review and test comprehension of chapter skills.

Answers to each question on all tests are included at the back of the text.

For additional testing options, we have developed a printed test bank with many alternative forms of each chapter test in both open-ended and multiple-choice formats. For a greater degree of flexibility in creating chapter tests, the text is also accompanied by extensive computerized testing programs for IBM, MAC, and Apple computers.



Preface ■ XiII

# FLEXIBILITY OF TEACHING MODES

The flexible worktext format of *Intermediate Algebra* allows the book to be used in many ways.

- In a standard lecture. To use the book in a lecture format, the instructor
  lectures in a conventional manner and encourages students to do the
  margin exercises while studying on their own. This greatly enhances
  the readability of the text.
- For a modified lecture. To bring student-centered activity into the class, the instructor stops lecturing and has the students do margin exercises.
- For a no-lecture class. The instructor makes assignments that students do on their own, including working the margin exercises. During the class period following the assignment, the instructor answers questions, and students have an extra day or two to polish their work before handing it in. In the meantime, they are working on the next assignment. This method provides individualization while keeping a class together. It also minimizes the number of instructor hours required and has been found to work well with large classes.
- In a learning laboratory. Because this text is highly readable and easy to understand, it can be used in a learning laboratory or any other selfstudy situation.

# **KEY CONTENT CHANGES**

In response to both extensive user comments and reviewer feedback, there have been many organizational changes and revisions to the Sixth Edition. Detailed information about the changes made in this material is available in the form of a Conversion Guide. Please ask your local Addison-Wesley sales representative for more information. Following is a list of the major organizational changes for this revision:

- Where possible, short sections have been combined to streamline the presentation and reduce the overall number of sections.
- More exercises have been added throughout the text, increasing the overall number by approximately 15%.
- A five-step problem-solving process is now introduced early in the text, and these steps are used throughout the text whenever a problem is solved.
- Chapter 1 has been revised to provide a more streamlined review of the operations and properties of real numbers. The arithmetic review material has been omitted, and the introduction to the real-number system now uses set terminology.
- Chapter 2 has been split into two chapters. The first contains material
  on solving equations, and the second contains the introduction to graphing linear equations.
- The graphing material has been revised to provide a more logical presentation of concepts involving slope.
- The material on inequalities from Chapter 4 has been moved earlier and integrated into appropriate equation-solving material in Chapters 2, 3, and 4.

The introduction to functions from Chapter 5 has been moved to a later
point in the text, where it is covered at the end of the chapter on conic
sections. This material now includes new material on composition of
functions and inverse functions.

# SUPPLEMENTS

This text is accompanied by a comprehensive supplements package. Below is a brief list of these supplements, followed by a detailed description of each one.

## For the Instructor

Teacher's Edition Instructor's Solutions Manual Instructor's Resource Guide Printed Test Bank Lab Resource Manual Answer Book Computerized Testing

# For the Student

Student's Solutions Manual Videotapes Audiotapes The Math Hotline Comprehensive Tutorial Software Drill and Practice Software

# SUPPLEMENTS FOR THE INSTRUCTOR

All supplements for the instructor are free upon adoption of this text.

# **Teacher's Edition**

This is a specially bound version of the student text with exercise answers printed in a third color. It also includes additional information on the skill maintenance exercises, suggested syllabi for different length courses, and some information about the teaching aids that accompany the text.

## Instructor's Solutions Manual

This manual by Judith A. Penna contains worked-out solutions to all evennumbered exercises and discussions of the "Thinking It Through" sections.

# Instructor's Resource Guide

This guide contains the following:

- Additional "Thinking It Through" exercises.
- Extra practice problems for some of the most challenging topics in the text.
- Teaching essays on math anxiety and study skills.
- Indexes to the videotapes, the audiotapes, and the software that accompany the text.
- Number lines and grids for test preparation.
- Conversion guide that cross-references the Fifth Edition to the Sixth Edition.
- Black-line transparency masters including a selection of key definitions, procedures, problem-solving strategies, graphs, and figures to use in class.

# **Printed Test Bank**

This is an extensive collection of alternative chapter test forms, including the following:

- 5 alternative test forms for each chapter with questions in the same topic order as the objectives presented in the chapter.
- 5 alternative forms for each chapter with the questions in a different order on each test form.
- 3 multiple-choice test forms for each chapter.
- 2 cumulative review tests for each chapter.
- 9 alternative forms of the final examination, 3 with questions organized by chapter, 3 with questions scrambled, and 3 with multiple-choice questions.

# Lab Resource Manual

This manual contains a selection of essays on setting up learning labs, including information on running large testing centers and setting up mastery learning programs. It also includes a directory of learning lab coordinators who are available to answer questions.

## **Answer Book**

The Answer Book will contain answers to all the exercises in the text for you to make available to your students.

# **Computerized Testing**

OmniTest (IBM PC), AWTest (Apple II series)

This text is accompanied by algorithm-driven testing systems for both IBM and Apple. With both machine versions, it is easy to create up to 99 variations of a customized test with just a few keystrokes, choosing from over 300 open-ended and multiple-choice test items. Instructors can also print out tests in chapter-test format.

The IBM testing program, OmniTest, also allows users to enter their own test items and edit existing items in an easy-to-use WYSIWYG format.

# LXR · Test<sup>TM</sup> (Macintosh)

This is a versatile and flexible test-item bank of more than 1200 multiple-choice and open-ended test items with complete math graphics and full editing capabilities. Tests can be created by selecting specific test items or by requesting the computer to select items randomly from designated objectives. LXR·TEST can create multiple test versions by scrambling the order of multiple-choice distractors or the order of the questions themselves.

# SUPPLEMENTS FOR THE STUDENT

# Student's Solutions Manual

This manual by Judith A. Penna contains completely worked-out solutions with step-by-step annotations for all the odd-numbered exercises in the text. It is free to adopting instructors and may be purchased by your students from Addison-Wesley Publishing Company.

# Videotapes [10]

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Using the chalkboard and manipulative aids, Donna DeSpain lectures in detail, works out exercises, and solves problems from most sections in the

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text on 19 70-minute videotapes. These tapes are ideal for students who have missed a lecture or who need extra help. Each section in the text is referenced to the appropriate tape number and section, underneath the icon . A complete set of videotapes is free to qualifying adopters.

# Audiotapes •

The audiotapes are designed to lead students through the material in each text section. Bill Saler explains solution steps to examples, cautions students about common errors, and instructs them to stop the tape and do exercises in the margin. He then reviews the margin-exercise solutions, pointing out potential errors. Each section in the text is referenced to the appropriate tape number and section, underneath the icon  $\Omega$ . Audiotapes are free to qualifying adopters.

# The Math Hotline

This telephone hotline is open 24 hours a day for students to receive detailed hints for exercises that have been developed by Larry Bittinger. Exercises covered include all the odd-numbered exercises in the exercise sets with the exception of the skill maintenance and synthesis exercises.

## **Tutorial Software**

A variety of tutorial software packages is available to accompany this text. Please contact your Addison-Wesley representative for a software sampler that contains demonstration disks for these packages and a summary of our distribution policy.

Comprehensive Tutorials

IMPACT: An Interactive Mathematics Tutorial by Wayne Mackey and Doug Proffer, Collin County Community College (IBM PC or MACINTOSH).

This software was developed exclusively for Addison-Wesley and is keyed section by section to this text. Icons at the beginning of each section reference the appropriate disk number. The disk menus correspond to the text's section numbers.

*IMPACT* is designed to generate practice exercises based on the exercise sets in this book. If students are having trouble with a particular exercise, they can ask to see an example or a step-by-step solution to the problem they are working on. Each step of the step-by-step solutions is treated interactively to keep students involved in the solution of the problem and help them identify precisely where they are having trouble. *IMPACT* also keeps detailed records of students' scores.

# Instructional Software for Algebra (Apple II series).

This software covers selected algebra topics. It also gives students brief explanations and examples, followed by practice exercises with interactive feedback for student error.

**Drill and Practice Packages** 

The Math Lab by Chris Avery and Chris Barker, DeAnza College (Apple II series, IBM PC, or Macintosh).

Students choose the topic, level of difficulty, and number of exercises. If they get a wrong answer, *The Math Lab* will prompt them with the first step of the solution. This software also keeps detailed records of student scores.

*Professor Weissman's Software* by Martin Weissman, Essex County College (IBM PC or compatible).

*Professor Weissman's Software* generates exercises based on the student's selection of topic and level of difficulty. If they get a wrong answer, the software gives them a step-by-step solution. The level of difficulty increases if students are successful.

In the back of this text is a coupon for *Professor Weissman's Software* that allows students to buy the software directly from Martin Weissman at a discount.

The Algebra Problem Solver by Michael Hoban and Kathirgama Nathan, La Guardia Community College (IBM PC).

After selecting the topic and exercise type, students can enter their own exercises or request an exercise from the computer. In each case, *The Algebra Problem Solver* will give the student detailed, annotated, step-by-step solutions.

# **ACKNOWLEDGMENTS**

Many of you who teach developmental mathematics have helped to shape the Sixth Edition of this text by reviewing, answering surveys, participating in focus groups, filling out questionnaires and spending time with us on your campuses. Our heartfelt thanks to all of you, and many apologies to anyone we have missed on the following list.

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M.L.K. M.L.B.

# To The Student

This text has many features that can help you succeed in intermediate algebra. To familiarize yourself with these, you might read the preface that starts on page ix and study the annotated pages that are included. Following are a few suggestions on how to use these features to enhance your learning process.

# **BEFORE YOU START THE TEXT**

If you are in a classroom setting, your instructor might ask you to take the diagnostic pretest at the beginning of the text, checking your answers at the back of the text, to find out what material you already know and what material you need to spend time on. You can also use this pretest to skip material that you already know from an independent learning situation.

# **BEFORE YOU START A CHAPTER**

The chapter opening page gives you an idea of the material that you are about to study and how it can be used. The chapter opening introduction also tells you what sections you will need to review in order to do the skill maintenance exercises on the chapter test. It's a good idea to restudy these sections to keep the material fresh in your mind for the midterm or final examination.

The first page of each chapter lists "Points to Remember" that will be needed to work certain examples and exercises in the chapter. You should try to review any skills listed here before beginning the chapter and learn any formulas or definitions.

This same page also includes a chapter pretest. You can work through this and check your answers at the back of the text to identify sections that you might skip or sections that give you particular difficulty and need extra concentration.

## **WORKING THROUGH A SECTION**

First you should read the learning objectives for the section. The symbol next to an objective ( a , b , c ) appears next to the text, exercises, and answers that correspond to that objective, so you can always refer back to the appropriate material when you need to review a topic.

You will also notice that there are references to the audiotapes, videotapes, and software that are available for extra help for the section underneath the objective listing. The software referenced is a program called IMPACT: An Interactive Mathematics Tutorial.

As you work through a section, you will see an instruction to "Do Exercises x-xx." This refers to the exercises in the margin of the page. You should always stop and do these to practice what you have just studied because they greatly enhance the readability of the text. Answers to the margin exercises are at the back of the text.

After you have completed a section, you should do the assigned exercises in the exercise set. The exercises are keyed to the section objectives, so that if you get an incorrect answer, you know that you should restudy the text section that corresponds to the symbol.

Answers to all the odd-numbered exercises are at the back of the text. A solutions manual with complete worked-out solutions to all the odd-numbered exercises is available from Addison-Wesley Publishing Company.

# PREPARING FOR A CHAPTER TEST

To prepare for a chapter test, you can review your homework and restudy sections that were particularly difficult. You should also learn the "Important Properties and Formulas" that begin the chapter's summary and review and study the review sections that are listed at the beginning of the review exercises.

After studying, you might set aside a block of time to work through the summary and review as if it were a test. You can check your answers at the back of the text after you are done. The answers are coded to sections and objectives, so you can restudy any areas in which you are having trouble. You can also take the chapter test as practice, again checking your answers at the back of the text.

If you are still having difficulties with a topic, you might try either going to see your instructor or working with the videotapes, audiotapes, or tutorial software that are referenced at the beginning of the text sections. Be sure to start studying in time to get extra help before you must take the test.

## PREPARING FOR A MIDTERM OR FINAL EXAMINATION

To keep material fresh in your mind for a midterm or final examination, you can work through the cumulative reviews at the end of each chapter. You can also use these as practice midterms or finals. In addition, there is a final examination at the end of the text. The answers to all exercises in the cumulative reviews and the final examination are at the back of the text.

# **OTHER STUDY TIPS**

There is a saying in the real-estate business: "The three most important things to consider when buying a house are *location, location, location*." When trying to learn mathematics, the three most important things are *time, time, time*. Try to carefully analyze your situation. Be sure to allow your-self *time* to do the lesson. Are you taking too many courses? Are you working so much that you do not have *time* to study? Are you taking *time* to maintain daily preparation? Other study tips are provided on pages marked "Sidelights" in the text.

# DIAGNOSTIC PRETEST

# Chapter 1

1. Subtract: 1.45 - (-2.12).

3. Simplify: 2x - 2[x - (4 + 3x)].

# Chapter 2

Solve.

5. 3(x+1) = 2 - (x-2)

7. |2x+3| > 1

# Chapter 3

Graph on a plane.

9.  $3x \le 6 - y$ 

11. Find an equation of the line containing the pair of points (1, 3) and (-1, 5).

# Chapter 4

Solve.

13. 3x - y = 5, x + 2y = 3

15. A motorboat took 6 hr to make a downstream trip with a 3-mph current. The return trip against the same current took 8 hr. Find the speed of the boat in still water.

# Chapter 5

17. Multiply:  $(3x - 5y)^2$ .

19. Solve:  $x^2 - 18 = 7x$ .

# Chapter 6

21. Divide and simplify:

$$\frac{x^2-9}{x^2+3x+2} \div \frac{x^2-6x+9}{2x+4}.$$

2. Multiply:  $-\frac{5}{6}\left(\frac{2}{15}\right)$ .

4. Simplify:  $\left[\frac{-3x^2y^{-3}}{2x^{-1}y^4}\right]^{-2}$ .

6.  $2 \le 4 - x \le 7$ 

8. Three less than eight times a number is two more than six times the number. Find the number.

10. x = -1

12. Find an equation of the line containing the point (0, 3) and perpendicular to the line 3x - y = 7.

14. x-4y+2z=-1, 2x + y - z = 8, -x-3y + z = -5

16. Graph. Find the coordinates of any vertices formed.

 $x \ge 3,$   $x \le 6 - 3y,$   $x - 2y \le 6$ 

18. Factor:  $x^4 - 1$ .

20. Three times the square of a number is two more than five times the number. Find the number.

22. Simplify:

 $\frac{x-\frac{1}{x}}{1+\frac{1}{x}}.$