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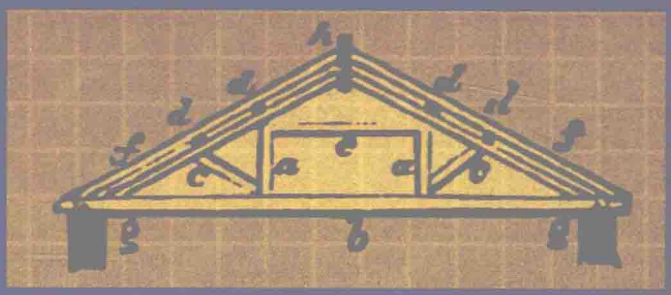
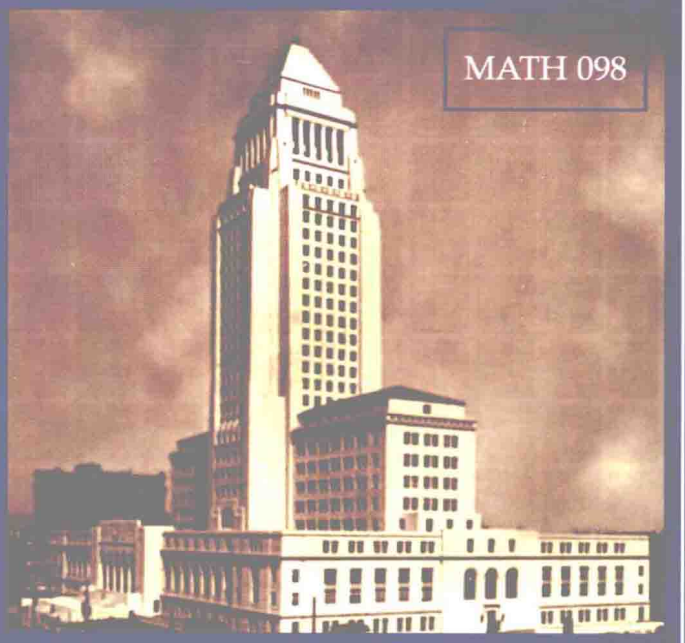


Introductory Algebra for College Students with Geometry



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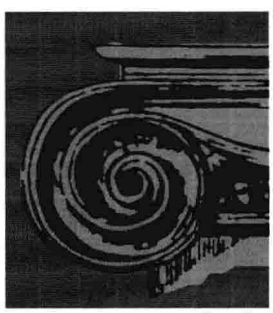
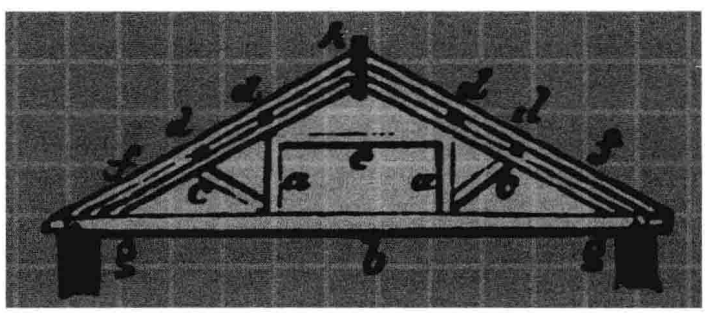
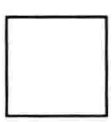
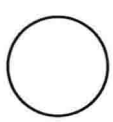
MATH 098

Introductory Algebra for College Students with Geometry

Robert Blitzer

THIRD CUSTOM EDITION FOR HAROLD WASHINGTON COLLEGE

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by Robert Blitzer

Elementary Algebra
by Michael Sullivan, III, and Katherine R. Struve

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PREFACE

Introductory Algebra for College Students, Fifth Edition, provides comprehensive, in-depth coverage of the topics required in a one-term course in beginning or introductory algebra. The book is written for college students who have no previous experience in algebra and for those who need a review of basic algebra concepts. I wrote the book to help diverse students, with different backgrounds and career plans, to succeed in beginning algebra. *Introductory Algebra for College Students,* Fifth Edition, has two primary goals:

1. To help students acquire a solid foundation in the basic skills of algebra.
2. To show students how algebra can model and solve authentic real-world problems.

One major obstacle in the way of achieving these goals is the fact that very few students actually read their textbook. This has been a regular source of frustration for me and for my colleagues in the classroom. Anecdotal evidence gathered over years highlights two basic reasons why students do not take advantage of their textbook:

- "I'll never use this information."
- "I can't follow the explanations."

I've written every page of the Fifth Edition with the intent of eliminating these two objections. The ideas and tools I've used to do so are described in the features that follow. These features and their benefits are highlighted for the student in "A Brief Guide to Getting the Most from This Book," which appears inside the front cover.

What's New in the Fifth Edition?

- **New Applications and Real World Data.** I'm on a constant search for real-world data that can be used to illustrate unique algebraic applications. I researched hundreds of books, magazines, newspapers, almanacs, and online sites to prepare the Fifth Edition. With 214 worked-out examples and application exercises based on new data sets, the Fifth Edition contains a greater array of applications than any previous revision of this book.
- **"Make Sense?" Classroom Discussion Exercises.** Each exercise set contains four Critical Thinking exercises intended for classroom discussion in order to engage participation in the learning process. These items test conceptual understanding by asking students to determine whether statements are sensible, and to explain why or why not. Although sample answers are provided, students have skills and perspectives that frequently differ from those of math teachers, so answers and explanations may vary. The important part of this new feature is to let you ask students what they think about selected statements, determine whether they understand the concepts, and give them feedback to clarify any misunderstandings.
- **New Directions for the True/False Critical Thinking Exercises.** The Fifth Edition asks students to determine whether each statement in an itemized list is true or false. If the statement is false, students are then asked to make the necessary change or changes to produce a true statement.
- **Preview Exercises.** Each exercise set concludes with three problems to help students prepare for the next section. Some of these problems review previously covered material that students will need to be successful in the forthcoming section. Other problems are designed to get students thinking about concepts they will soon encounter.
- **More Detailed Directions When Comparing Mathematical Models with Actual Data.** The Fifth Edition asks students if values obtained from mathematical models underestimate or overestimate data displayed by graphs, and, if so, by how much.

- **Increased Study Tip Boxes.** The book's Study Tip boxes offer suggestions for problem solving, point out common errors to avoid, and provide informal hints and suggestions. These invaluable hints appear in greater abundance in the Fifth Edition. Within the book's first few chapters, many of the new study tips involve general study skills and confidence building, encouraging students with negative past experiences to open their minds and efforts to math. Some of these tips are based on suggestions given by Cheryl Ooten in *Managing the Mean Math Blues* (Prentice Hall, 2003) and Cal Newport in *How to Win at College* (Broadway Books, 2005).
- **New Chapter-Opening and Section-Opening Scenarios.** Every chapter and every section open with a scenario based on an application, the majority of which are unique to the Fifth Edition. These scenarios are revisited in the course of the chapter or section in one of the book's new examples, exercises, or discussions. The often-humorous tone of these openers is intended to help fearful and reluctant students overcome their negative perceptions about math.
- **922 New Examples and Exercises.** The Fifth Edition contains 23 detailed worked-out examples involving new data, 191 new application exercises, 240 "make sense" discussion exercises, 177 preview exercises, and 291 new exercises that appear in the various other categories of the exercise sets.
- **New Blitzer Bonuses.** The Fifth Edition contains a variety of new, but optional, enrichment essays. Examples include "Deceptions in Visual Displays of Data," which appears in Section 3.3 (Problem Solving in Geometry) and is an outgrowth of the section's discussion on area and volume, and "Art, Nature, and Quadratic Equations," which appears in Section 10.3 (The Quadratic Formula).

What Content and Organizational Changes Have Been Made to the Fifth Edition?

- **Section 1.1** (Introduction to Algebra: Variables and Mathematical Models) is a new section that sets the stage for the entire book. The implications of using letters to represent numbers allows students to understand how algebra is used to model data, with connections to graphing through data displayed by bar and line graphs. This early introduction to algebraic expressions, equations, and mathematical models changes the chapter's focus from real numbers, a topic for a pre-algebra class, to a broader perspective reflected by the chapter's new title: **Variables, Real Numbers, and Mathematical Models**. Although the rectangular coordinate system is no longer introduced in Chapter 1, the models that appear throughout the book's early chapters are all connected to bar and line graphs. This leads to a fluid transition into rectangular coordinates, introduced in Chapter 4 when students begin graphing linear equations.
- **Section 1.2** (Fractions in Algebra) still reviews fractions and their operations, but now discusses problems involving fractions that appear in algebraic expressions, equations, and mathematical models.
- **Section 2.6** (Solving Linear Inequalities) introduces interval notation, using both interval notation and set-builder notation to express solution sets of inequalities.
- **Section 4.1** (Graphing Linear Equations in Two Variables) introduces the rectangular coordinate system and uses point plotting to graph linear equations. The section focuses exclusively on linear equations, postponing discussions on graphing of nonlinear equations until Chapter 6 (Exponents and Polynomials).
- **Section 4.3** (Slope) contains a new discussion of slope and perpendicular lines.
- **Section 5.2** (Solving Systems of Linear Equations by the Substitution Method) presents supply and demand models in forms students will encounter if they take an economics course.

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- **Section 6.1** (Adding and Subtracting Polynomials) includes a brief discussion on graphing equations defined by polynomials of degree 2, using point plotting to graph $y = x^2 - 4$.
- **Section 6.6** (Dividing Polynomials by Binomials) illustrates the steps involved in long division of whole numbers before considering the similar process for dividing a polynomial by a binomial.
- **Appendix** (Mean, Median, and Mode) has been added to familiarize students with common statistical measures of central tendency.

What Familiar Features Have Been Retained in the Fifth Edition?

- **Detailed Worked-Out Examples.** Each worked example is titled, making clear the purpose of the example. Examples are clearly written and provide students with detailed step-by-step solutions. No steps are omitted and key steps are thoroughly explained to the right of the mathematics.
- **Explanatory Voice Balloons.** Voice balloons are used in a variety of ways to demystify mathematics. They translate algebraic ideas into everyday English, help clarify problem-solving procedures, present alternative ways of understanding concepts, and connect problem solving to concepts students have already learned.
- **Check Point Examples.** Each example is followed by a similar matched problem, called a Check Point, offering students the opportunity to test their understanding of the example by working a similar exercise. The answers to the Check Points are provided in the answer section.
- **Extensive and Varied Exercise Sets.** An abundant collection of exercises is included in an exercise set at the end of each section. Exercises are organized within eight category types: Practice Exercises, Practice Plus Exercises, Application Exercises, Writing in Mathematics, Critical Thinking Exercises, Technology Exercises, Review Exercises, and Preview Exercises. This format makes it easy to create well-rounded homework assignments. The order of the practice exercises is exactly the same as the order of the section's worked examples. This parallel order enables students to refer to the titled examples and their detailed explanations to achieve success working the practice exercises.
- **Practice Plus Problems.** This category of exercises contains more challenging practice problems that often require students to combine several skills or concepts. With an average of ten practice plus problems per exercise set, instructors are provided with the option of creating assignments that take practice exercises to a more challenging level.
- **Mid-Chapter Check Points.** At approximately the midway point in each chapter, an integrated set of review exercises allows students to review and assimilate the skills and concepts they learned separately over several sections.
- **Early Graphing.** Chapter 1 connects formulas and mathematical models to data displayed by bar and line graphs. The rectangular coordinate system is introduced in Chapter 4. Graphs appear in nearly every section and exercise set. Examples and exercises use graphs to explore relationships between data and to provide ways of visualizing a problem's solution.
- **Geometric Problem Solving.** Chapter 3 on problem solving contains a section that teaches geometric concepts that are important to a student's understanding of algebra. There is frequent emphasis on problem solving in geometric situations, as well as on geometric models that allow students to visualize algebraic formulas.
- **Section Objectives.** Learning objectives are clearly stated at the beginning of each section. These objectives help students recognize and focus on the section's most important ideas. The objectives are restated in the margin at their point of use.

- **Thorough, Yet Optional Technology.** Although the use of graphing utilities is optional, they are utilized in Using Technology boxes to enable students to visualize and gain numerical insight into algebraic concepts. The use of graphing utilities is also reinforced in the technology exercises appearing in the exercise sets for those who want this option. With the book's early introduction to graphing, students can look at the calculator screens in the Using Technology boxes and gain an increased understanding of an example's solution even if they are not using a graphing utility in the course.
- **Chapter Review Grids.** Each chapter contains a review chart that summarizes the definitions and concepts in every section of the chapter. Examples that illustrate these key concepts are also included in the chart.
- **End-of-Chapter Materials.** A comprehensive collection of review exercises for each of the chapter's sections follows the review grid. This is followed by a chapter test that enables students to test their understanding of the material covered in the chapter. Beginning with Chapter 2, each chapter concludes with a comprehensive collection of mixed cumulative review exercises.
- **Chapter Test Prep Video CD.** Packaged at the front of the text, this video CD provides students with step-by-step solutions for each of the exercises in the book's chapter tests.
- **Blitzer Bonuses.** These enrichment essays provide historical, interdisciplinary, and otherwise interesting connections to the algebra under study, showing students that math is an interesting and dynamic discipline.
- **Discovery.** Discover for Yourself boxes, found throughout the text, encourage students to further explore algebraic concepts. These explorations are optional and their omission does not interfere with the continuity of the topic under consideration.
- **Chapter Projects.** At the end of each chapter is a collaborative activity that gives students the opportunity to work cooperatively as they think and talk about mathematics. Additional group projects can be found in the *Instructor's Resource Manual*. Many of these exercises should result in interesting group discussions.

I hope that my passion for teaching, as well as my respect for the diversity of students I have taught and learned from over the years, is apparent throughout this new edition. By connecting algebra to the whole spectrum of learning, it is my intent to show students that their world is profoundly mathematical, and indeed, π is in the sky.

Robert Blitzer

Resources for the Fifth Edition

FOR STUDENTS

Student Solutions Manual Fully worked solutions to the odd-numbered section exercises plus all Check Points, Review/Preview Exercises, Mid-Chapter Check Points, Chapter Reviews, Chapter Tests, and Cumulative Reviews.

Worksheets Provide a ready-to-use lesson and exercise set for every section of the text with ample student work space.

CD Lecture Series A comprehensive set of CD-ROMS, tied to the textbook, containing short video clips of an instructor working key text examples/exercises. (Also available separately on DVD.)

MathXL® Tutorials on CD This interactive tutorial CD-ROM provides algorithmically generated practice exercises that are correlated at the objective level to the exercises in the textbook. Every practice exercise is accompanied by an example and a guided solution designed to involve students in the solution process.

Chapter Test Prep Video CD Provides step-by-step video solutions to each problem in each Chapter Test in the textbook. Packaged with a new text, inside the front cover.

FOR INSTRUCTORS

Instructor Resource Distribution Most instructor resources can be downloaded from the Web site, *www.prenhall.com*. Select "Browse our catalog," then click on "mathematics," select your course and choose your text. Under "resources," on the left side, select "instructor" and choose the supplement you need to download. You will be required to run through a one time registration before you can complete this process.

Math Adjunct Support Center The Pearson Math Adjunct Support Center is staffed by qualified mathematics instructors with over 50 years of combined experience at both the community college and university level. Assistance is provided for faculty in the following areas:

- Suggested syllabus consultation
- Tips on using materials packed with your book
- Book-specific content assistance
- Teaching suggestions including advice on classroom strategies

Instructor's Solutions Manual Fully worked solutions to every exercise in the text.

Instructor's Resource Manual with Tests Includes a Mini-Lecture, Skill Builder, and Additional Exercises for every section of the text; two short group Activities per chapter, several chapter test forms, both free-response and multiple-choice, as well as cumulative tests and final exams. Answers to all items also included.

TestGen® Easily create tests from section objectives. Questions are algorithmically generated allowing for unlimited versions. Edit problems or create your own. There's a chapter test file for each Chapter Test in the text.

Annotated Instructor's Edition Answers to exercises are printed on the same text page with graphing answers in a special Graphing Answer Section in the back of the text.

FOR BOTH

MathXL®

MathXL® is a powerful online homework, tutorial, and assessment system that accompanies this textbook. Instructors can create, edit, and assign online homework and tests using algorithmically generated exercises correlated at the objective level to the textbook. Student work is tracked in an online gradebook. Students can take chapter tests and receive personalized study plans based on their results. The study plan diagnoses weaknesses and links students directly to tutorial exercises for objectives they need to study. Students can also access video clips directly from selected exercises. MathXL is available to qualified adopters. For more information, visit our website at *www.mathxl.com* or contact your Prentice Hall sales representative.

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Acknowledgments

An enormous benefit of authoring a successful series is the broad-based feedback I receive from the students, dedicated users, and reviewers. Every change to this edition is the result of their thoughtful comments and suggestions. I would like to express my appreciation to all the reviewers, whose collective insights form the backbone of this revision. In particular, I would like to thank the following people for reviewing *Introductory Algebra for College Students.*

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Robert Blitzer

TO THE STUDENT

I have written this book so that you can learn about the power of algebra and how it relates directly to your life outside the classroom. All concepts are carefully explained, important definitions and procedures are set off in boxes, and worked-out examples that present solutions in a step-by-step manner appear in every section. Each example is followed by a similar matched problem, called a Check Point, for you to try so that you can actively participate in the learning process as you read the book. (Answers to all Check Points appear in the back of the book.) Study Tips offer hints and suggestions and often point out common errors to avoid. A great deal of attention has been given to applying algebra to your life to make your learning experience both interesting and relevant.

As you begin your studies, I would like to offer some specific suggestions for using this book and for being successful in this course:

- **Attend all lectures.** No book is intended to be a substitute for valuable insights and interactions that occur in the classroom. In addition to arriving for lecture on time and being prepared, you will find it useful to read the section before it is covered in lecture. This will give you a clear idea of the new material that will be discussed.
- **Read the book.** Read each section with pen (or pencil) in hand. Move through the worked-out examples with great care. These examples provide a model for doing exercises in the exercise sets. As you proceed through the reading, do not give up if you do not understand every single word. Things will become clearer as you read on and see how various procedures are applied to specific worked-out examples.
- **Work problems every day and check your answers.** The way to learn mathematics is by doing mathematics, which means working the Check Points and assigned exercises in the exercise sets. The more exercises you work, the better you will understand the material.
- **Review for quizzes and tests.** After completing a chapter, study the chapter review chart, work the exercises in the Chapter Review, and work the exercises in the Chapter Test. Answers to all these exercises are given in the back of the book.

  The methods that I've used to help you read the book, work the problems, and review for tests are described in "A Brief Guide to Getting the Most from This Book" that appears inside the front cover. Spend a few minutes reviewing the guide to familiarize yourself with the book's features and their benefits.

- **Use the resources available with this book.** Additional resources to aid your study are described on page xiii. These resources include a Solutions Manual; a Chapter Test Prep Video CD; MyMathLab®, an online version of the book with links to multimedia resources; MathXL®, an online homework, tutorial, and assessment system of the text; and tutorial support at the Pearson Tutor Services.

I wrote this book in Point Reyes National Seashore, 40 miles north of San Francisco. The park consists of 75,000 acres with miles of pristine surf-washed beaches, forested ridges, and bays bordered by white cliffs. It was my hope to convey the beauty and excitement of mathematics using nature's unspoiled beauty as a source of inspiration and creativity. Enjoy the pages that follow as you empower yourself with the algebra needed to succeed in college, your career, and in your life.

Regards,
Bob
Robert Blitzer

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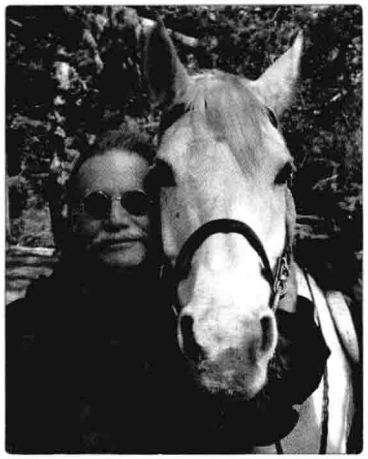

Bob and his horse Jerid

ABOUT THE AUTHOR

Bob Blitzer is a native of Manhattan and received a Bachelor of Arts degree with dual majors in mathematics and psychology (minor: English literature) from the City College of New York. His unusual combination of academic interests led him toward a Master of Arts in mathematics from the University of Miami and a doctorate in behavioral sciences from Nova University. Bob's love for teaching mathematics was nourished for nearly 30 years at Miami Dade College, where he received numerous teaching awards, including Innovator of the Year from the League for Innovations in the Community College and an endowed chair based on excellence in the classroom. In addition to *Introductory Algebra for College Students,* Bob has written textbooks covering intermediate algebra, college algebra, algebra and trigonometry, precalculus, and liberal arts mathematics, all published by Prentice Hall. When not secluded in his Northern California writer's cabin, Bob can be found hiking the beaches and trails of Point Reyes National Seashore, and tending to the chores required by his beloved entourage of horses, chickens, and irritable roosters.

Taken from *Introductory Algebra for College Students*, Fifth Edition
by Robert Blitzer

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CHAPTER 1

Real Numbers, and Mathematical Models

Why...

the decline in the percentage of African-American Major League Baseball players?
whether I'm overdoing my workouts or not pushing myself hard enough?
the widening imbalance between numbers of women and men on college campuses?
a relationship between age and number of car accidents?
how rapidly cyberspace is reshaping our lives?
how many people watched *The Sopranos*, cable's violent and satiric profile of an angst-ridden criminal family man and his dysfunctional domestic clan?

In this chapter, you will learn how the special language of algebra describes your world.

Here's where you'll find these applications:

African–American baseball players:
Exercise Set 1.1, Exercises 83–84

Workouts: Exercise Set 1.2,
Exercises 125–128

College gender imbalance:
Section 1.7, Example 9

Age and car accidents:
Section 1.8, Example 12

The growth of cyberspace:
Exercise Set 1.4, Exercises 77-78;
Exercise Set 1.8, Exercises 99-101

The Sopranos:
Chapter 1 Test, Exercise 27.

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