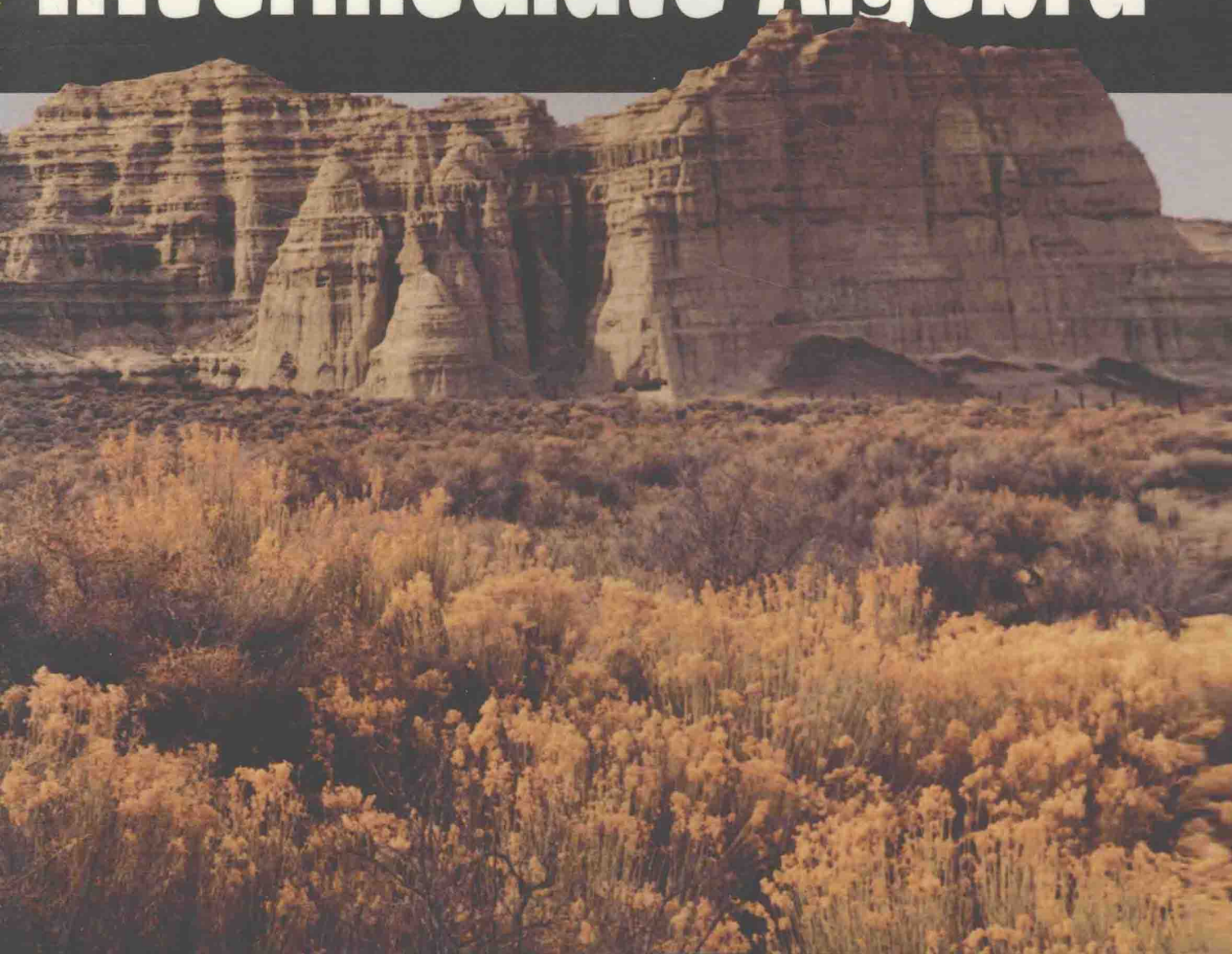


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**James Streeter**  
**Donald Hutchison**  
**Louis Hoelzle**

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# Intermediate Algebra



**Second Edition**

**Form A**

# **Intermediate Algebra, Form A**

**Second Edition**

**James Streeter**

Late Professor of Mathematics  
*Clackamas Community College*

**Donald Hutchison**

*Clackamas Community College*

**Louis Hoelzle**

*Bucks County Community College*

**McGraw-Hill, Inc.**

New York St. Louis San Francisco Auckland Bogotá Caracas  
Lisbon London Madrid Mexico Milan Montreal New Delhi Paris  
San Juan Singapore Sydney Tokyo Toronto

Intermediate Algebra, Form A

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This book is printed on recycled, acid-free paper containing a minimum of 50% recycled de-inked fiber.

3 4 5 6 7 8 9 0 DOW DOW 9 0 9 8 7 6 5

ISBN 0-07-031719-4

This book was set in Times Roman by York Graphic Services, Inc. The editors were Michael Johnson, Karen Minette, and Jack Maisel; the design was done by Caliber/Phoenix Color Corp.; the production supervisor was Al Rihner. R. R. Donnelley & Sons Company was printer and binder.

Library of Congress Cataloging-in-Publication Data

Streeter, James (James A.)

Intermediate algebra: form A/James Streeter, Donald Hutchison, Louis Hoelzle.—2nd ed.

p. cm.

Includes index.

ISBN 0-07-031719-4

I. Algebra. I. Hutchison, Donald (date). II. Hoelzle, Louis

F. III. Title.

QA154.2.S7819 1993

512'.9—dc20

92-12379

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# ABOUT THE AUTHORS

While a graduate student at the University of Washington, James Streeter paid for his education as a math tutor. It was here that he began to formulate the ideas that would eventually become this package. Upon graduation he taught for two years at Centralia Community College. In 1968 he moved on to Clackamas Community College to become their first mathematics chair.

At the community college, Jim recognized that he faced a very different population than the one for whom he had tutored at UW. Jim was convinced that, in order to reach the maximum number of these students, he would have to utilize every medium available to him. Jim opened a math lab that included CAI, original slides and tapes (which were eventually published by Harper and Row), and original worksheets and text materials. With the assistance of the people at McGraw-Hill, that package has been refined to include media and supplements that did not even exist when this project began.

Donald Hutchison spent his first 10 years of teaching working with disadvantaged students. He taught in an intercity elementary school and an intercity high school. He also worked for two years at Wassaic State School in New York and two years at the Portland Habilitation Center. He worked with both physically and mentally disadvantaged students in these two settings.

In 1982 he was hired by Jim Streeter to teach at Clackamas Community College. It was here that he discovered the two things that, along with his family, serve as a focus for his life. Jim introduced him to the joy of writing (with the first edition of *Beginning Algebra*) and Jack Scrivener converted him to a born-again environmentalist.

Don is also active in several professional organizations. He is a member of the ACM committee that has undertaken the writing of computer curriculum for the two-year college. Since 1990 he has chaired the Technology in Mathematics Education committee for AMATYC.

In 1989 Don became Chair of the Mathematics department at Clackamas Community College.

Louis Hoelzle has been teaching at Bucks County Community College for 23 years. He has taught the entire range of courses from Arithmetic to Calculus. This gives him the perspective of the current and future needs of developmental students.

Over the past 30 years Lou has also taught Physics courses at four year colleges. This gives him the perspective of the practical applications of mathematics.

In addition, Lou has done extensive reviewing of manuscripts and writing of several solutions manuals for major texts. In these he has focused on writing for the student.

Lou is also active in professional organizations and has served on the Placement and Assessment Committee for AMATYC since 1989.

In 1989, Lou became Chair of the Mathematics Department at Bucks County Community College.

*A teacher affects eternity; he can never tell where his influence stops.*

—*Henry Brooks Adams 1838–1918*

This series is dedicated to the memory of James Arthur Streeter, an artisan with words, a genius with numbers, and a virtuoso with pictures from 1940 until 1989.

There is a German proverb that has been translated, “More is to be got from one teacher than from two books.” This reflects the essence of what I have learned about writing from Jim Streeter. Jim was always a teacher who wrote, and never a writer who taught. Jim was a teacher in the classroom, in his office, during meetings, and behind his word processor. From Jim’s perspective, it seemed that life’s single challenge was to find the components that, when properly assembled, would reveal the concept that he wanted to explain. One night Jim and I went out to celebrate the completion of a manuscript. I taught him a dart game called “301.” He was fascinated. I doubt that he ever played again, but he used the game in the classroom and in his writing. He found it an entertaining medium for teaching subtraction, multiplication, and critical thinking skills (e.g., “If you need 15 points, and you must finish with a double score, how many different ways can you win with two darts?”)

Jim did not believe in platitudes, but he did convince me that “writing makes one a better teacher and teaching makes one a better writer.” Because I knew Jim, I have become a better writer, a better teacher, and a better person.

*Donald Hutchison*



# PREFACE

When we study mathematics, we study questions at three levels:

What is mathematics?

What can we do with mathematics?

How do we do it?

The first question is reserved for higher-level mathematics and philosophy courses (where one can pursue the debate about whether mathematics is a product of human endeavor or rather the discovery of a natural system).

The remaining two questions are at the core of every lecture in every mathematics class we teach. The purpose of this textbook is to help the student discover answers to the last two questions.

The focus in teaching this course is to make our students better problem-solvers. Our emphasis as writers is to communicate this to our audience. The language must be at the appropriate level. The topics must be broad enough to include all the concepts that the student will need both in future mathematics classes and future employment. And the problems must relate enough to student experience to motivate the topic.

One of our goals has been to create a set of applications that would be more relevant to the students' lives to enable the student to judge them worthy of the time and effort involved in learning the techniques needed to solve them. A greater part of our goal was reached by incorporating a theme.

The *environmental theme* is an important new element of this new edition of *Intermediate Algebra*. The reason for this focus is twofold: our own concern, and the mathematics community's concern for the state of the earth and our realization that most students share this concern. As a result, students become more interested in learning how to use mathematics when they are interested in what can be solved.

Each chapter of this text opens with an *environmental essay*. These essays were written by Jack Scrivener, who teaches both intermediate algebra and environmental science at Clackamas Community College in Oregon City, Oregon. The essays have been written specifically for these students at this level. Professor Scrivener's ten years of teaching these two courses makes him uniquely qualified to reach this audience.

Within each chapter are exercises that specifically relate to the environmental essay for that chapter. These were also written by Professor Scrivener. They are easily identified by the tree logo that appears over the exercise number. Our goal was to produce a set of noncontrived problems that students could solve with the skills they have just learned. We are very pleased with the results. Occasionally one of the problems will be a stretch for all of the students, but it's a reachable stretch. It is also a stretch that motivated students are more likely to attempt.

**SEVERAL OTHER FEATURES NEW TO THE SECOND EDITION OF THIS TEXT ARE DESIGNED TO BETTER TEACH STUDENTS HOW TO DO THE MATHEMATICS. AMONG THOSE FEATURES, WE HAVE**

*An early introduction of graphs and graphing techniques.* The vast majority of students are visual learners. The early introduction of graphs makes this a less abstract course.

*Early and consistent use of functional notation.* Although a formal development of the functions topic is reserved for later in the text, students are introduced to the notation when they first encounter polynomials. The notation is then used consistently wherever two variable polynomial equations exist.

*A worktext format printed on recycled paper* that incorporates *four colors* to guide students through critical steps and increase clarity in graphs.

Also new to this edition are the *expression screens*. In teaching this course (and beginning algebra as well) we have discovered that many students are unable to identify whether they are working on an expression or on an equation. When this is the case, they do not know what form the answer should take. We have tried to address this problem in two ways. First, we have expanded the discussion about the difference, and we have included several exercises in which the student is to do no more than identify whether each item is an expression or an equation. Then, to avoid confusion, we have *screened the expression* in any example in which the student is asked to simplify. By screening the expression, it is clear to the student just what it is they are simplifying.

*Think about These* are new exercises that require the student to extend or generalize from the skills just learned. These exercises promote and utilize critical thinking skills.

This new edition also includes the *Retain Your Skills* exercise sets. These twenty question review quizzes appear at the end of chapters 5, 7, 8, 9, 10, and 11. They remind the student of skills learned and encourage regular cumulative review of the material.

## **OTHER FEATURES RETAINED FROM THE FIRST EDITION INCLUDE**

*Check Yourself* These exercises accompany the text examples and are designed to involve the student actively in the learning process. Answers are provided at the end of the section for immediate feedback.

*Build Your Skills* Exercises that allow the student to practice and master the skills of the section.

*Skillscan* Draws problems from previous sections of the text. Designed to aid the student in the process of reviewing concepts that will be applied to the following section.

*Chapter Summaries and Summary Exercises* These sections give the student an opportunity to practice and review at the end of each chapter. Answers are provided with section references to aid in the process of review.

*Self-Tests* Each chapter concludes with a self-test to give students guidance in preparing for in-class tests. Answers are provided at the end of the book.

*Cumulative Tests* These are designed to give the student further opportunity for building skills which should be especially useful for students preparing for midterm and final exams.

We continue to encourage the participation of students in the learning process by directing our attention to readability and student involvement. Each topic is developed in a straightforward fashion with numerous examples to clarify the subject being developed. All important definitions, rules, and algorithms are enhanced with color for easy identification and reference.

All the features are designed to encourage, facilitate, and motivate problem solving among the students. This is not just the nature of the text, it is the primary basis for the inclusion of mathematics in virtually every curriculum.

## **Supplements**

There are a number of supplements available for both the student and instructor. The *Teacher's Edition* includes answers to all exercises and tests. These answers are printed in a second color for easier use by the instructor. The *Instructor's Solutions Manual* contains worked-out solutions and answers to all of the exercises in the text. The *Student's Solutions Manual* contains worked-out solutions to the odd-

numbered exercises in the text. The *Instructor's Resource Manual* contains multiple-choice placement tests for two levels, three forms of multiple-choice and open-ended chapter tests, two forms of multiple-choice and open-ended cumulative tests, two forms of multiple-choice and open-ended final tests, and an answer section. The *Video Series* provides the student with additional instructional and visual lesson support. *The Professor's Assistant* is a computerized test generator that allows the instructor to create tests using algorithmically generated test questions and those from a standard testbank. This testing system enables the instructor to choose questions either manually or randomly by section, question type, difficulty level, and other criteria. This system is available for IBM, IBM compatible, and Macintosh computers. The *Print Test Bank* is a printed and bound copy of the questions found in the standard testbank. The *Interactive Tutorial Software* is a self-paced interactive tutorial specifically linked to the text. The tutorial reinforces selected topics and provides unlimited opportunities to review concepts and to practice problem solving. It requires virtually *no* computer training on the part of the student and is available for IBM, IBM compatible, and Macintosh computers. The *Calculator Enhancement Manual* presents an integrated approach that utilizes calculator-based graphing to enhance understanding and development. It includes calculator exercises and examples as well as appendices on how to use the most popular calculators. For further information about these supplements, please contact your local college division sales representative.

### Acknowledgments

The people at McGraw-Hill have made this a better and more exciting project. Special thanks go to each of the following: Michael Johnson, our editor, constantly asked good questions, looked for ways to improve the text, and found excellent reviewers and problem checkers; Denise Schanck challenged us to effectively use an incredible array of resources; Jack Maisel provided communications between the marvelous graphic design people at York Graphic and the authors; Karen Minette was the one person with more answers than questions; and Marni Centor provided a much needed contact between authors and programmers.

We would also like to thank the students and faculty at Bucks County Community College and Clackamas Community College. They have helped us in the development of the material by asking the right questions. Special thanks to Barry Bergman, Susan Hopkirk, Betsy Farber, and Maryann Klicka.

The copy-editors and problem-checkers have done a remarkable job of helping us work toward the elusive goal of an error-free text. Particular thanks go to Patti Scott and Betsy Farber.

As mentioned, we had many contributions to the development of this edition and the previous edition. Thanks to:

Rita P. Hussung, College of Mount Saint Joseph

Margaret A. Karpinski, Holy Family College

Lou Ann Mahaney, Tarrant County Junior College, Northeast

Richard D. Semmler, Northern Virginia Community College

Margaret Stevenson, Massasoit Community College

Barbara Buhr, Fresno City College

Robert Calabrese, Miami-Dade Community College

Glenn E. Johnston, Morehead State University

Philip Montgomery, University of Kansas

Linda S. Murphy, Northern Essex College

Nancy K. Nickerson, Northern Essex College

Carol O'Loughlin, Northern Essex College

Murray B. Peterson, College of Marin

Mark Serebransky, Camden County College

Edith A. Silver, Mercer County College

Ara B. Sullenberger, Tarrant County Junior College

The ancillary material has been provided in an unusually timely and efficient manner. Along with Karen Minette, the following people deserve recognition:

Richard & Beth Morel, Strong House, Inc.

John R. Martin, Tarrant County Junior College—Northeast

Carolyn Meitler, Concordia University

John Garlow, Tarrant County Junior College—Northeast

Linda Dodge, Greenfield Community College

Finally, none of this would have happened without the support of our families. We especially want to thank our wives, Claudia Hutchison and Rose Hoelzle. Their lessons in patience by example were among the most important that we have learned.

*Donald Hutchison  
Louis Hoelzle*

# TO THE STUDENT

You are about to begin a course in intermediate algebra. We have made every attempt to provide a textbook that will help you understand what algebra is about and how to effectively use it. In this text we assume that you have taken a previous course in beginning algebra. However, we understand that your level of skills in the topics of beginning algebra depends on what you gained from a previous course and on how long you have been away from algebra. Therefore, we have provided a thorough review of all the basic concepts that you will need as a foundation for this course.

There are some specific features in this textbook that will aid you in your studies. Here are some of our suggestions on how to use those features and how, in general, to be successful in your study of mathematics.

1. In a lecture class, make sure that you take the time to read the appropriate section of the text *before* your instructor's lecture on the subject. You may not understand everything that is developed in the text before the lecture, but reading in advance will greatly help you understand the concepts that are being presented in the lecture setting. Take careful notes on the examples that your instructor presents during class.

*Attend all class sessions.* You should not depend on other students' notes. The only way that you will know exactly what your instructor is expecting of you is to be there yourself.

An important note: a set of Skillscan exercises concludes many of the section exercise sets. These refer to concepts learned earlier that will be applied in the next section. It is helpful to review the exercises before you begin to read a new chapter section.

2. After class, use the text to work through examples that are similar to those that were presented during the lecture. Try to understand each of the steps that are shown in the text. Examples are followed by Check Yourself exercises. Algebra is best learned by a student's being involved in the process, which is the purpose of the Check Yourself exercises. Always have a pencil and paper in hand, work the problems that are presented, and check your results immediately. If you have difficulty with any of the problems, go back and carefully review the previous examples. Make sure that you understand what you are doing and why. A good test of whether you understand a concept is whether you can explain that concept to one of your fellow students. Try working together.
3. At the end of each chapter section, you will find a set of section exercises. Work these exercises on a regular (preferably daily) basis.

Our experience with students has shown that consistent study of the concepts is one of the most important keys to success in studying mathematics. Again, learning algebra requires becoming involved. As is the case with learning any other skill, the main ingredient is practice.

You will find the answers for the odd-numbered exercises after each problem set. If you have difficulties with any of the exercises, by all means do not become discouraged. You cannot expect to completely understand all the topics that are presented on your first reading. Go back and review the appropriate parts of the chapter section. If your questions are not completely cleared up, ask your instructor or an available tutor for further assistance.

4. To aid your retention of the topics you have studied in a chapter, chapter summaries are provided. In these summaries, you will find all the important terms, definitions, and algorithms along with examples illustrating the techniques that were developed in the chapter. Following each summary are exercises for further practice. These exercises are keyed to the appropriate chapter sections so that you will know exactly where to turn if you are still having problems with the material.

5. After you have successfully completed the summary exercises for a chapter, the Self-Test that concludes each chapter will help you check your mastery of the material and also provide you with an actual practice test to use in preparation for in-class testing.
6. Finally, another key element of success in studying mathematics lies in the process of cumulative review. This will give you a means of assimilating related concepts as you progress through the course. We have provided a series of Cumulative Tests throughout the textbook (located after Chapters 4, 7, 9, and 12) and Retain Your Skills exercises (after Chapters 5, 7, 8, 9, 10, and 11). These will help you in reviewing not only the concepts of the chapter that you have just completed, but also those of previous chapters. You may want to use these in preparation for any midterm or final examinations. If it appears that you have forgotten some of the topics that are being tested, go back and review the sections where the idea was initially explained or study the appropriate chapter summary.

We hope that you will find the suggestions above helpful as you work through this material, and we wish you the best of luck in this intermediate algebra course.

*Donald Hutchison  
Louis Hoelzle*

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