Intermediate Algebra: A STEM Approach
First Edition

George Woodbury
College of the Sequoias

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Manufacturing Buyer: Carol Melville, LSC Communications
Production Coordination, Composition, and Illustrations: SPI Global
Text and Cover Design: Studio Montage
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Preface

George Woodbury’s primary goal as a teacher, and author, has always been to empower students to succeed in algebra and beyond. He learned early on that to teach algebra foundations successfully, instructors must find a way to achieve two equally important goals: 1) fully prepare students for collegiate-level mathematics, and 2) build students’ confidence in their mathematical abilities.

He could not be a better-equipped teacher and author to publish this first edition textbook, *Intermediate Algebra: A STEM Approach*, which also incorporates extensive integrated review.

Some of the ways George prepares students for College Algebra is by:

- Introducing the fundamental concepts of graphing and functions early. He then consistently and frequently incorporates these concepts throughout.
- He provides strong exercise sets that provide volume and variety and incorporate not only a substantial amount of skill and drill, but also plenty of writing exercises to encourage critical thinking and creativity.
- He incorporates a focus on STEM, and uses a Discover, Engage, Reflect teaching method that will well serve future STEM and non-STEM students, time and time again.
- He also knows the key to success for students is often not just about math—it’s about making sure students understand how to study and prepare for a math class. To help give students the confidence they require to succeed, George integrates study strategies in the new Guided Notebook. He also incorporates student success materials and tips instructors can use with students in his Instructor’s Resource Manual + George Woodbury’s Guide to MyLab Math.

With the text, supplements, and technology available with *Intermediate Algebra: A STEM Approach*, George strives to help students not simply “make it through” to College Algebra or Precalculus, but to help them truly gain the skills and conceptual understanding necessary for further success in those courses and potential future STEM paths.
Woodbury Hallmarks That Empower Student Success

Early-and-Often Approach to Graphing and Functions

The approach concerning functions in this text is “Early and Often.” Functions are first introduced in Chapter 2 (Sections 2.5 and 2.6). The overall goal from Chapter 2 through Chapter 7 is to help students to be comfortable with functions before reaching the difficult material in Chapter 8 (composition of functions, inverse functions, exponential functions, and logarithmic functions). The approach focuses on helping students to be comfortable with evaluating functions, graphing functions, interpreting the graphs of functions, understanding domain and range of functions, and performing algebra with functions.

Discover, Engage, Reflect—And Practice, Practice, Practice Makes Perfect!

For each section, and throughout all of his material, George integrates a three-step teaching approach that he refers to as The Cycles of Learning—Discover, Engage, Reflect. He developed this approach through his own teaching philosophy. He believes that when it comes to learning mathematics, watching and discovering, participating and engaging, and reflecting will lead students to a greater conceptual understanding.

This Discover, Engage, Reflect approach is found in . . .

The Beginning of Sections: The Cycles of Learning approach has been integrated throughout the entire program. Each section kicks off with an integrated review of previous concepts, encouraging students to reflect upon the path that has brought them there.

The Example and Quick Check Videos that drive the teaching of each section:

• DISCOVER: Through Conceptual, Example, and Quick Check Videos, students can begin learning each objective with videos that guide them through the discovery of concepts, asking Socratic questions and explaining the “why” behind a particular problem solving method.

• ENGAGE: The Quick Check A Videos engage students by asking questions and prompting them to think about the next step in solving a problem, reinforcing the problem solving method and procedure.

• REFLECT: The Quick Check B Videos encourage students to solve the problem on their own while reflecting on what they have learned. George points out the differences and commonalities between the previous concepts to help students develop a true understanding of the material.

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End of Section Exercises: George’s text provides more exercises than most other texts, allowing students ample opportunity to develop their skills and increase their understanding. The exercise sets are filled with both traditional skill- and drill-type exercises, as well as unique exercise types that require thoughtful and creative responses.

- The Engage and Reflect pedagogy is worked into the exercise sets as well, including designated Engage and Reflect exercise sets.
- Vocabulary Exercises kick off each exercise set to help check students’ understanding of the vocabulary covered in the preceding section.
- Mixed Practice exercises are provided as appropriate throughout the text to give students an opportunity to practice multiple types of problems in one setting. These interweaving exercises require students to focus on determining the correct method to use to solve the problem and reduce their tendency to simply memorize steps to solving the problems for each objective.
- Writing in Mathematics Exercises ask students to explain their answer in written form to lead to a higher level of understanding as acknowledged by the AMATYC Standards.

- Solutions Manual Exercises require students to solve a problem completely with step-by-step explanations as if they were writing their own solutions manual.
- Newsletter Exercises encourage students to be creative in their mathematical writing, and ask students to explain a mathematical topic. The explanation should be in the form of a short, visually appealing article that might be published in a newsletter read by people who are interested in learning mathematics.

A STEM Approach

George Woodbury is passionate about empowering STEM (Science, Technology, Engineering, and Math) students with the mathematical skills necessary to be successful in their math courses and their ultimate field of study, and promoting the study and pursuit of well-rounded educations, including a broad understanding of STEM disciplines. The features in the text and MyLab Math course are tailored to prepare students for their next math course—often College Algebra—who have decided to major in STEM—or, for students who are undecided about their major, but have an interest in STEM, and are also likely College Algebra bound.

Features that foster the STEM Approach include

Applying Skills and Problem Solving

Problem solving is a skill that is required daily in the real world, in mathematics, and definitely in STEM fields. Based on George Polya’s 1945 publication, How to Solve It, which helped shape the mathematical problem solving methods used today, George Woodbury presents a six-step problem-solving strategy in Chapter 1 that lays the foundation for solving applied problems. He then expands on this problem-solving strategy throughout the text by incorporating hundreds of applied problems on topics such as motion, geometry, and mixture problems. Interesting themes in the applied problems include many STEM topics, and also other topics such as investing and saving money, understanding sports statistics, landscaping, home ownership, and cell phone usage.

Heading Toward College Algebra

Most STEM-bound majors will move from this course into College Algebra or Precalculus. To motivate and inspire students to continue forward in mathematics, where applicable, George makes connections between topics that students are learning in Intermediate Algebra, and how those topics will be particularly relevant or taken further in their future math courses like College Algebra and Calculus. Instructors can
pick and choose from topics they enjoy, that they feel would also motivate their students. Many of these topics can be found in Heading Toward College Algebra, and George also provides a list in his Instructor’s Resource Manual + George Woodbury’s Guide to MyLab Math.

**STEM-Labeled Material**
Specific STEM applications and topics are called out with a STEM icon. This allows students to know exactly why they are learning the material and how it will be applied in future classes. Some sections have more than one STEM question set, showing the variety of uses in a similar problem. Again, instructors can pick and choose the topics they enjoy, that they feel would also motivate students. For specifics, check out Section 1.7—How Statistics is used in STEM—, Section 2.1—Using Data and Modeling—, and Section 3.4—Balancing Chemical Equations.

**STEM Exercises and Applications**
Homework exercises include STEM applications to show students that the mathematical topics they are learning in their math course will be highly relevant in future STEM courses.

**STEM-Driven Topics**
While many of George’s exercises bring in STEM-oriented applications, others focus on particular mathematical skills that are necessary for future STEM courses, such as Chemistry. George talked to many STEM instructors to land on the most relevant and necessary topics to include. In some cases, this means a special emphasis is placed on a topic, whereas in other cases, topics have actually been pulled into this course that you might not typically experience in Intermediate Algebra.

**Motivate Students with STEM Careers and Industries**
**STEM Discipline & Career Spotlights**
Each chapter highlights a specific STEM field, with a teaser about the field at the start of the chapter, and end-of-chapter infographics that highlight the field. This end-of-chapter feature includes discipline and career advice from experts in the field, with information about the STEM discipline and interesting facts about the field to motivate students and pique their interest. The experts provide advice and encourage students to persist and follow their path.

**STEM**
Gregor Mendel, an Austrian monk who came to be known as the father of modern genetics, found the same pattern as brown and blue eyes among the color of pea pods. Green alleles (G) are dominant to yellow alleles (g), and a plant can only have yellow pods if it is homozygous yellow (yy). When two heterozygous pea plants (Gg) are crossed, we would expect 3 out of every 4 offspring to have green pods.

47. If 200 plants are created by crossing two heterozygous pea plants, how many of them would we expect to have green pods? 150

48. If 168 plants are created by crossing two heterozygous pea plants, how many of them would we expect to have yellow pods? 42

**STEM**
In chemistry Avogadro’s number \(6.02 \times 10^{23}\) tells us how many atoms of an element are in 1 mole (mol) of that element, as well as how many molecules of a compound are in 1 mole of that compound.

**Avogadro’s Number**

There are \(6.02 \times 10^{23}\) atoms of an element in 1 mole of that element.

There are \(6.02 \times 10^{23}\) molecules of a compound in 1 mole of that compound.

This number can be used, along with molar mass (the mass of 1 mole), to convert from grams of an element or a compound to a number of atoms or molecules, or to convert a number of atoms (element) or molecules (compound) to a mass in grams. We will use a process like the one we used with dimensional analysis in Section 1.4.
STEM Spotlight videos in the MyLab Math course expand upon the in-text feature, and provide more insight into the disciplines and careers featured in the book, as well as captivate students’ interest with fun and interesting facts displayed in a dynamic way. Follow-up STEM Video Assessment Questions are available in MyLab Math so that instructors can easily assign a follow-up homework assignment to assess students completion and comprehension of the material and video. Additionally STEM Activities are available to assign in the student Guided Notebook for more involved projects and/or group work.

4.1 Integrated Review

1. Simplify a fraction to lowest terms.

In this section you need to be able to simplify a fraction to lowest terms when simplifying a fraction that also contains variable factors. To simplify a fraction to lowest terms, divide the numerator and denominator by their greatest common factor (GCF).

**EXAMPLE**

Simplify $\frac{21}{56}$ to lowest terms.

The GCF of 21 and 56 is 7, so divide the numerator and denominator by 7.

\[
\frac{21}{56} = \frac{21 \div 7}{56 \div 7} = \frac{3}{8}
\]

**Review Exercises**

Simplify to lowest terms.

1. $\frac{40}{120}$
2. $\frac{108}{156}$
3. $\frac{24}{8}$

2. Simplify exponents. (Section R.2)

In addition to understanding the meaning of an exponent, many of the problems in this section require that you are able to raise a numerical base to a given power. The exponent tells us how many times to use the base as a factor.

Address Under-Preparedness

Integrated Review

Because many institutions are trying to teach an accelerated STEM track and cover all “principles of algebra topics” in one course, and because many students often enter Intermediate Algebra needing a refresher of prerequisite skills, George has pulled in worked-out examples and practice exercises on key prerequisite skills for each section. The Integrated Review is featured in the text preceding each section where relevant, and also expanded upon in the MyLab Math course and the Guided Notebook. It provides students and instructors with resources to help students review and re-learn topics needed for particular sections and chapters.

[Contact Information]

pearson.com/mylab/math
Resources for Success

Get the Most Out of MyLab Math for *Intermediate Algebra: A STEM Approach* by George Woodbury

When it comes to developmental math, one size does not fit all. George Woodbury’s new Intermediate Algebra STEM-focused text offers market-leading content written by an author-educator, tightly integrated with the #1 choice in digital learning--MyLab Math. MyLab Math courses can be tailored to the needs of instructors and students, while weaving the author’s voice and unique approach into all elements of the course.

George Woodbury believes in empowering potential future STEM students with the mathematical skills necessary to be successful in both College Algebra and their ultimate field of study. With the resources available in George’s text and MyLab Math course, students are exposed to a variety of STEM fields and the growing demand for them, encouraged to succeed in math in order to pursue a STEM program, and motivated to believe that any student can achieve a successful career in STEM.

Take advantage of the following resources to get the most out of your MyLab Math course.

Motivate Students through STEM

**STEM Spotlight videos**
The STEM Spotlights from the text are brought to life in these videos, which showcase the variety of careers that STEM programs of study open up for students. Each Spotlight video features industry- and discipline-specific professionals who explain their career path, provide advice and encouragement, and demonstrate how success in math allowed them to pursue their field, and above all conveys that students of any background can and should pursue STEM fields.

**STEM Video Assessment Questions**
George has also created follow-up questions to the videos so that instructors can easily assign a follow-up homework assignment to assess students completion and comprehension of the material and video.

[ pearson.com/mylab/math ]
Support Conceptual and Skill Development

Instructional videos throughout the course and eText—including more than 3,000 Conceptual, Example, and Quick Check videos—bring George Woodbury’s teaching methods directly to the student, no matter where they are. All videos are created by George for a consistent tone and approach as they walk students step-by-step through examples and concepts from every section in the text, and incorporate George’s Discover, Engage, Reflect pedagogy. Videos can be played on any device and offer a modern interface with intuitive navigation.

Personalize Learning

Skill Builder exercises offer just-in-time additional adaptive practice. The adaptive engine tracks student performance and delivers questions to each individual that adapt to his or her level of understanding. This new feature allows instructors to assign fewer questions for homework, allowing students to complete as many or as few questions needed.

Create Your Course More Easily

Enhanced Sample Assignments make course set-up easier by giving instructors a starting point for each section and chapter. Homework assignments have been carefully curated for this specific text, and includes a thoughtful mix of question types. Find these sample assignments in the Assignment Manager, under Copy and Assign Sample Assignments.

pearson.com/mylab/math
Resources for Success

Instructor Resources

The following instructor resources are available to download from the Instructor Resource Center at www.pearson.com, or in your MyLab Math course.


This is a two part instructor’s supplement. The first part contains instructor resources to accompany the text, including practice chapter tests and final exams with answers, and teaching notes for each section of the text. The second part includes George Woodbury’s Guide to MyLab Math, where George shares implementation tips for setting up homework in MLM, ideas for incorporating videos, ideas for using the Discover, Engage, Reflect pedagogy, and much more!

Instructor’s Solutions Manual

This manual includes complete solutions to the even-numbered exercises in the homework sections of the text.

PowerPoints

These fully editable lecture slides include definitions, key concepts, and examples for use in a lecture setting and are available for each section of the text.

TestGen

TestGen® (www.pearsoned.com/testgen) enables instructors to build, edit, print, and administer tests using a computerized bank of questions developed to cover all the objectives of the text. TestGen is algorithmically based, allowing instructors to create multiple but equivalent versions of the same question or test with the click of a button. Instructors can also modify test bank questions or add new questions. The software and test bank are available for download from Pearson’s Instructor Resource Center.

Student Resources

Guided Notebook with STEM Activities and Integrated Review

For each section of the text the Guided Notebook is available to point students to useful videos associated with the section objectives, to provide extra practice problems, and to give students a place to take notes and stay organized throughout the course. Additionally, there are STEM activities that can be used in conjunction with the STEM Discipline & Career Spotlight videos and text, and additional review practice problems to expound on the integrated review that is incorporated in the text.

Student’s Solutions Manual

This manual contains the complete solutions to the odd-numbered section-level exercises in the text.

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