MILLER O'NEILL HYDE

# Intermediate Algebra

THIRD EDITION

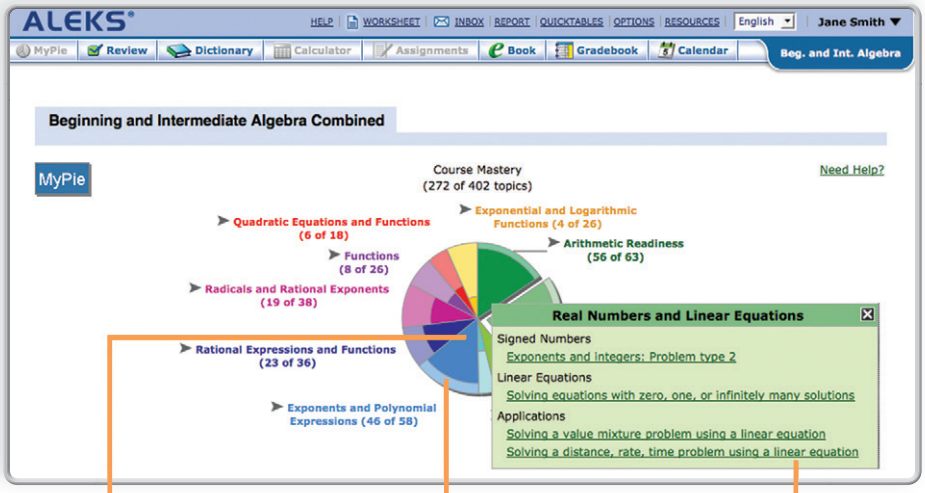
# Mastery Learning. Proven Results.

ALEKS® 360
With eBook Integration

**ALEKS is a unique, online program that uses artificial intelligence and adaptive questioning proven to raise student proficiency and success rates in math.**

## ALEKS Delivers a Unique Math Experience:

- **Research-Based, Artificial Intelligence** precisely measures each student's knowledge
- **Individualized Learning** presents the exact topics each student is most **ready to learn**
- **Adaptive, Open-Response Environment** includes comprehensive tutorials and resources
- **Detailed, Automated Reports** track student and class progress toward course mastery
- **Course Management Tools** include textbook integration, custom features, and more



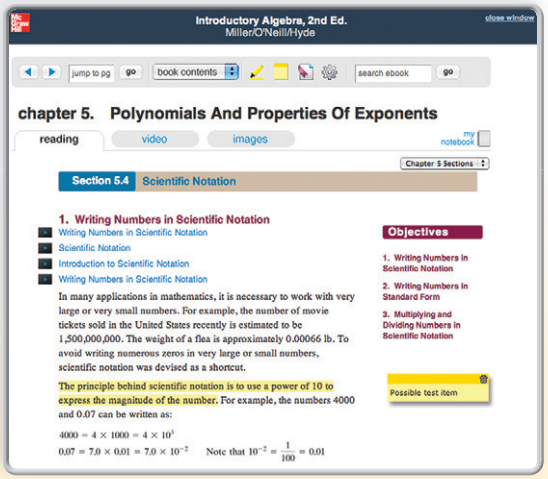

The ALEKS Pie summarizes a student's current knowledge and then delivers an individualized learning path with the exact topics the student is most ready to learn.

**Dark portion** represents what the student knows.

**Light portion** represents what the student still has to learn.

**Ready to Learn** topics appear in pop-up boxes when the student scrolls over a pie slice.

With ALEKS 360, the multimedia eBook is connected to every problem so students can quickly review the exact section they are working on.




"My experience with ALEKS has been effective, efficient, and eloquent. **Our students' pass rates improved from 49 percent to 82 percent with ALEKS.** We also saw student retention rates increase by 12% in the next course. Students feel empowered as they guide their own learning through ALEKS."

—**Professor Eden Donahou,** ***Seminole State College of Florida***

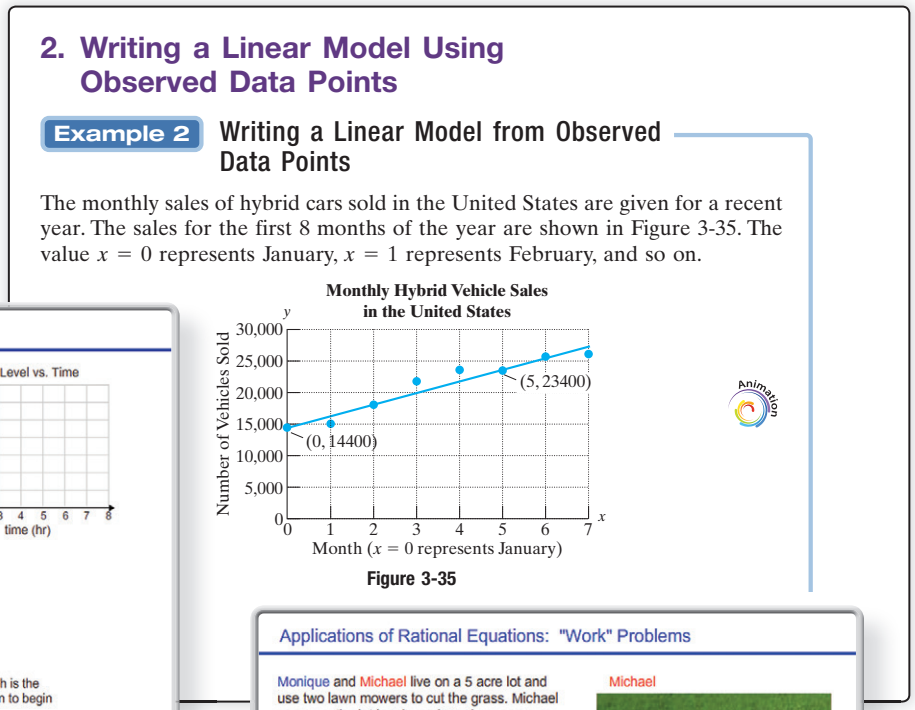


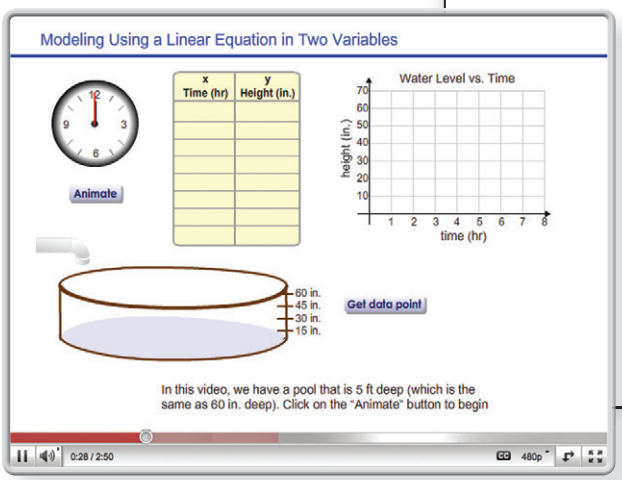
**To see ALEKS in action, please visit: www.SuccessInMath.com**

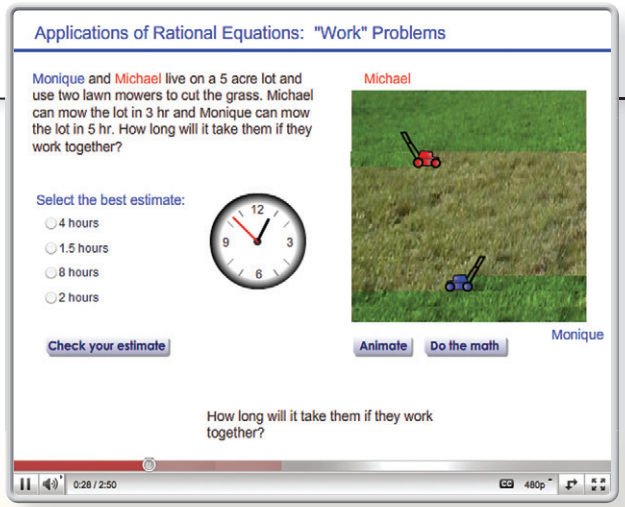
# Visualizing Math Concepts

## *Dynamic Math Animations*

**The Miller/O'Neill/Hyde author team has developed a series of Flash animations to illustrate difficult concepts where static images and text fall short.** The animations leverage the use of on-screen movement and morphing shapes to enhance conceptual learning.




**Through their classroom experience, the authors recognize that such media assets are great teaching tools for the classroom and excellent for online learning.** The Miller/O'Neill/Hyde animations are interactive and quite diverse in their use. Some provide a virtual laboratory for which an application is simulated and where students can collect data points for analysis and modeling. Others provide interactive question-and-answer sessions to test conceptual learning. For word problem applications, the animations ask students to estimate answers and practice "number sense."

# Intermediate Algebra

THIRD EDITION


**Julie Miller**
*Daytona State College*

**Molly O'Neill**
*Daytona State College*

**Nancy Hyde**
*Broward College—*
*Professor Emeritus*



Mc Graw Hill Education

INTERMEDIATE ALGEBRA, THIRD EDITION



This book is printed on acid-free paper.

1 2 3 4 5 6 7 8 9 0 DOW/DOW 1 0 9 8 7 6 5 4

ISBN 978–0–07–338442–9
MHID 0–07–338442–9

ISBN 978–0–07–734297–5 (Annotated Instructor's Edition)
MHID 0–07–734297–6

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Compositor: *Aptara®, Inc.*
Typeface: *10/12 Times Ten Roman*
Printer: *R. R. Donnelley*

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**Library of Congress Cataloging-in-Publication Data**

Miller, Julie, 1962-
Intermediate algebra / Julie Miller, Molly O'Neill, Nancy Hyde.–Third edition.
pages cm
Includes index.
ISBN 978–0–07–338442–9—ISBN 0–07–338442–9—ISBN 978–0–07–734297–5—
ISBN 0–07–734297–6 (hard copy : alk. paper) 1. Algebra–Textbooks.
I. O'Neill, Molly, 1953- II. Hyde, Nancy. III. Title.

QA154.3.M554 2014b
512—dc23
2013026119



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# About the Authors

**Julie Miller** is from Daytona State College, where she has taught developmental and upper-level mathematics courses for 20 years. Prior to her work at Daytona State College, she worked as a software engineer for General Electric in the area of flight and radar simulation. Julie earned a bachelor of science in applied mathematics from Union College in Schenectady, New York, and a master of science in mathematics from the University of Florida. In addition to her textbooks in developmental mathematics, Julie has authored a college algebra textbook and several course supplements for college algebra, trigonometry, and precalculus.

"My father is a medical researcher, and I got hooked on math and science when I was young and would visit his laboratory. I can remember using graph paper to plot data points for his experiments and doing simple calculations. He would then tell me what the peaks and features in the graph meant in the context of his experiment. I think that applications and hands-on experience made math come alive for me and I'd like to see math come alive for my students."

*—Julie Miller*

**Molly O'Neill** is also from Daytona State College, where she has taught for 22 years in the School of Mathematics. She has taught a variety of courses from developmental mathematics to calculus. Before she came to Florida, Molly taught as an adjunct instructor at the University of Michigan–Dearborn, Eastern Michigan University, Wayne State University, and Oakland Community College. Molly earned a bachelor of science in mathematics and a master of arts and teaching from Western Michigan University in Kalamazoo, Michigan. Besides this textbook, she has authored several course supplements for college algebra, trigonometry, and precalculus and has reviewed texts for developmental mathematics.

"I differ from many of my colleagues in that math was not always easy for me. But in seventh grade I had a teacher who taught me that if I follow the rules of mathematics, even I could solve math problems. Once I understood this, I enjoyed math to the point of choosing it for my career. I now have the greatest job because I get to do math every day and I have the opportunity to influence my students just as I was influenced. Authoring these texts has given me another avenue to reach even more students."

*—Molly O'Neill*

**Nancy Hyde** served as a full-time faculty member of the Mathematics Department at Broward College for 24 years. During this time she taught the full spectrum of courses from developmental math through differential equations. She received a bachelor of science degree in math education from Florida State University and a master's degree in math education from Florida Atlantic University. She has conducted workshops and seminars for both students and teachers on the use of technology in the classroom. In addition to this textbook, she has authored a graphing calculator supplement for *College Algebra*.

"I grew up in Brevard County, Florida, where my father worked at Cape Canaveral. I was always excited by mathematics and physics in relation to the space program. As I studied higher levels of mathematics I became more intrigued by its abstract nature and infinite possibilities. It is enjoyable and rewarding to convey this perspective to students while helping them to understand mathematics."

*—Nancy Hyde*

## *Dedications*

To my Mom
—Nancy Hyde

To my granddaughter, Kira
—Molly O'Neill

To: Bella and Rosie
—Julie Miller

# Contents

# How Will Miller/O'Neill/Hyde Help Your Students *Get Better Results?*

## *Better* Clarity, Quality, and Accuracy!

Julie Miller, Molly O'Neill, and Nancy Hyde know what students need to be successful in mathematics. Better results come from clarity in their exposition, quality of step-by-step worked examples, and accuracy of their exercises sets; but it takes more than just great authors to build a textbook series to help students achieve success in mathematics. Our authors worked with a strong team of mathematics instructors from around the country to ensure that the clarity, quality, and accuracy you expect from the Miller/O'Neill/Hyde series was included in this edition.

"The most complete text at this level in its thoroughness, accuracy, and pedagogical soundness. The best developmental mathematics text I have seen."
—Frederick Bakenhus, *Saint Phillips College*

## *Better* Exercise Sets!

Comprehensive sets of exercises are available for every student level. Julie Miller, Molly O'Neill, and Nancy Hyde worked with a board of advisors from across the country to offer the appropriate depth and breadth of exercises for your students. **Problem Recognition Exercises** were created to improve student performance while testing.

Practice exercise sets help students progress from skill development to conceptual understanding. Student tested and instructor approved, the Miller/O'Neill/Hyde exercise sets will help your students *get better results*.

- **Problem Recognition Exercises**
- **Skill Practice Exercises**
- **Study Skills Exercises**
- **Concept Connections Exercises**
- **Mixed Exercises**
- **Expanding Your Skills Exercises**
- **Vocabulary and Key Concepts Exercises**

"This series was thoughtfully constructed with students' needs in mind. The Problem Recognition section was extremely well designed to focus on concepts that students often misinterpret."
—Christine V. Wetzel-Ulrich, *Northampton Community College*

## *Better* Step-By-Step Pedagogy!

*Intermediate Algebra* provides enhanced step-by-step learning tools to help students *get better results.*

- **Worked Examples** provide an "easy-to-understand" approach, clearly guiding each student through a step-by-step approach to master each practice exercise for better comprehension.
- **TIPs** offer students extra cautious direction to help improve understanding through hints and further insight.
- **Avoiding Mistakes** boxes alert students to common errors and provide practical ways to avoid them. Both of these learning aids will help students get better results by showing how to work through a problem using a clearly defined step-by-step methodology that has been class tested and student approved.

"The book is designed with both instructors and students in mind. I appreciate that great care was used in the placement of 'Tips' and 'Avoiding Mistakes' as it creates a lot of teachable moments in the classroom."
—Shannon Vinson, *Wake Tech Community College*

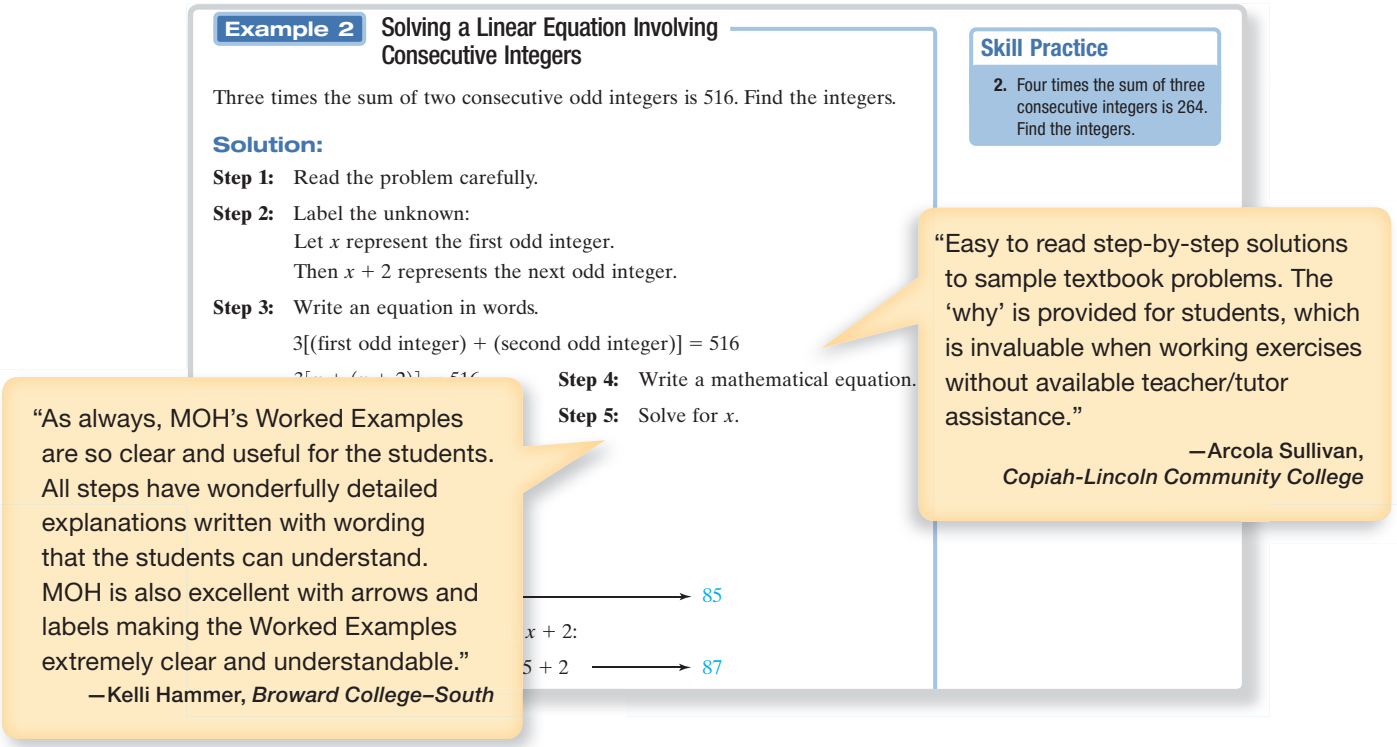
# Get Better Results

## *Formula for Student Success*

### Step-by-Step Worked Examples

- Do you get the feeling that there is a disconnection between your students' class work and homework?
- Do your students have trouble finding worked examples that match the practice exercises?
- Do you prefer that your students see examples in the textbook that match the ones you use in class?

**Miller/O'Neill/Hyde's *Worked Examples* offer a clear, concise methodology that replicates the mathematical processes used in the authors' classroom lectures!**



**Example 2** Solving a Linear Equation Involving Consecutive Integers

Three times the sum of two consecutive odd integers is 516. Find the integers.

**Solution:**

**Step 1:** Read the problem carefully.

**Step 2:** Label the unknown:
Let $x$ represent the first odd integer.
Then $x + 2$ represents the next odd integer.

**Step 3:** Write an equation in words.

3[(first odd integer) + (second odd integer)] = 516

**Step 4:** Write a mathematical equation.

**Step 5:** Solve for $x$.

→ 85

$x + 2$:

$5 + 2$ → 87

**Skill Practice**

**2.** Four times the sum of three consecutive integers is 264. Find the integers.

"Easy to read step-by-step solutions to sample textbook problems. The 'why' is provided for students, which is invaluable when working exercises without available teacher/tutor assistance."

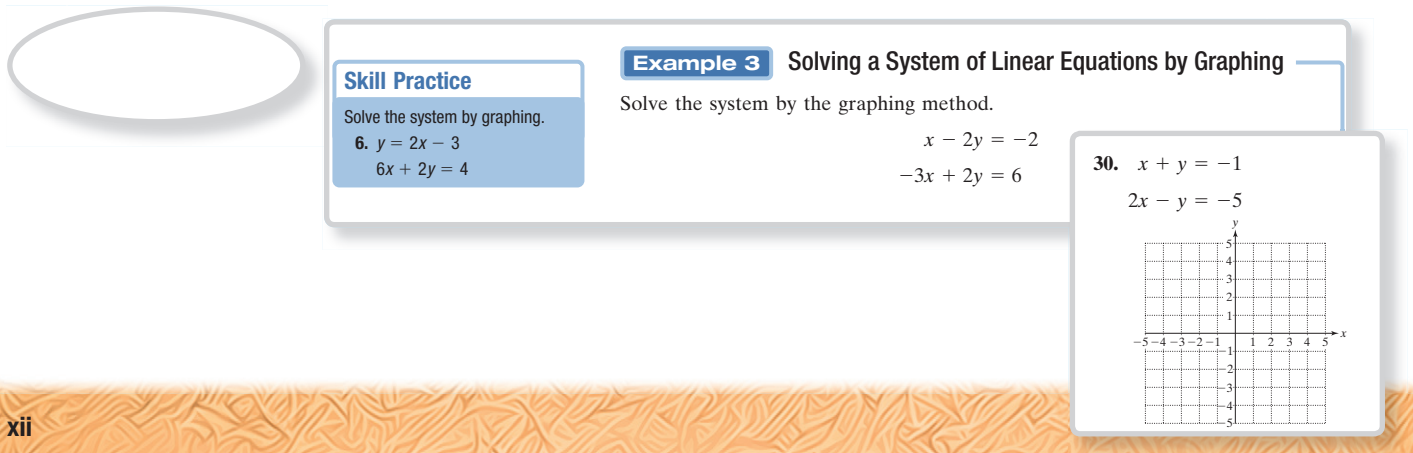
—Arcola Sullivan, *Copiah-Lincoln Community College*

"As always, MOH's Worked Examples are so clear and useful for the students. All steps have wonderfully detailed explanations written with wording that the students can understand. MOH is also excellent with arrows and labels making the Worked Examples extremely clear and understandable."

—Kelli Hammer, *Broward College–South*

### Classroom Examples

To ensure that the classroom experience also matches the examples in the text and the practice exercises, we have included references to even-numbered exercises to be used as Classroom Examples. These exercises are highlighted in the Practice Exercises at the end of each section.



**Skill Practice**

Solve the system by graphing.

**6.** $y = 2x - 3$
$6x + 2y = 4$

**Example 3** Solving a System of Linear Equations by Graphing

Solve the system by the graphing method.

$x - 2y = -2$
$-3x + 2y = 6$

**30.** $x + y = -1$
$2x - y = -5$

# Better Learning Tools

## Concept Connection Boxes

Concept Connections help students understand the conceptual meaning of the problems they are solving—a vital skill in mathematics.

> "This feature is one of my favorite parts in the textbook. It is useful when trying to get students to think critically about types of problems."
>
> —Sue Duff, *Guilford Technical Community College*

**Concept Connections**

Determine if the given value is a solution to the equation.

1. $x + 2 = 8$; $-10$
2. $3y - 1 = 11$; $4$
3. Write a linear equation whose solution is 3. (Answers may vary.)

| Equation | Solution | Check | |
|---|---|---|---|
| $p + 3 = 11$ | 8 | $p + 3 = 11$<br>$\downarrow$<br>$8 + 3 = 11$ ✓ | Substitute 8 for $p$.<br>Right-hand side equals left-hand side. |
| $-2z = -20$ | 10 | $-2z = -20$<br>$\downarrow$<br>$-2(10) = -20$ ✓ | Substitute 10 for $z$.<br>Right-hand side equals left-hand side. |

## TIP and Avoiding Mistakes Boxes

**TIP** and **Avoiding Mistakes** boxes have been created based on the authors' classroom experiences—they have also been integrated into the **Worked Examples.** These pedagogical tools will help students get better results by learning how to work through a problem using a clearly defined step-by-step methodology.

**Example 1** Multiplying Rational Expressions

Multiply. $\dfrac{5a - 5b}{10} \cdot \dfrac{2}{a^2 - b^2}$

**Solution:**

$$\frac{5a - 5b}{10} \cdot \frac{2}{a^2 - b^2}$$

$$= \frac{5(a - b)}{5 \cdot 2} \cdot \frac{2}{(a - b)(a + b)}$$ Factor numerator and denominator.

$$= \frac{\overset{1}{\cancel{5}}(a - b)}{\cancel{5} \cdot 2} \cdot \frac{\overset{1}{\cancel{2}}}{(a - b)(a + b)}$$ Simplify.

$$= \frac{1}{a + b}$$

**Avoiding Mistakes**

If all factors in the numerator simplify to 1, do not forget to w the factor of 1 in the numerato

### Avoiding Mistakes Boxes:

*Avoiding Mistakes* boxes are integrated throughout the textbook to alert students to common errors and how to avoid them.

> "MOH presentation of reinforcement concepts builds students' confidence and provides easy to read guidance in developing basic skills and understanding concepts. I love the visual clue boxes 'Avoiding Mistakes.' Visual clue boxes provide tips and advice to assist students in avoiding common mistakes."
>
> —Arcola Sullivan, *Copiah-Lincoln Community College*

### TIP Boxes

Teaching tips are usually revealed only in the classroom. Not anymore! TIP boxes offer students helpful hints and extra direction to help improve understanding and provide further insight.

**TIP:** The acronym, FOIL (first outer inner last) can be used as a memory device to multiply the two binomials.

Outer terms: First, Outer
First terms: Inner, Last

$$(3y + 2)(7y - 6) = (3y)(7y) + (3y)(-6) + (2)(7y) + (2)(-6)$$

Inner terms

$$= 21y^2 - 18y + 14y - 12$$

Last terms

$$= 21y^2 - 4y - 12$$

*Note:* It is important to realize that the acronym FOIL may only be used when finding the product of two *binomials*.

# Get Better Results

## Better Exercise Sets! Better Practice! Better Results!

- Do your students have trouble with problem solving?
- Do you want to help students overcome math anxiety?
- Do you want to help your students improve performance on math assessments?

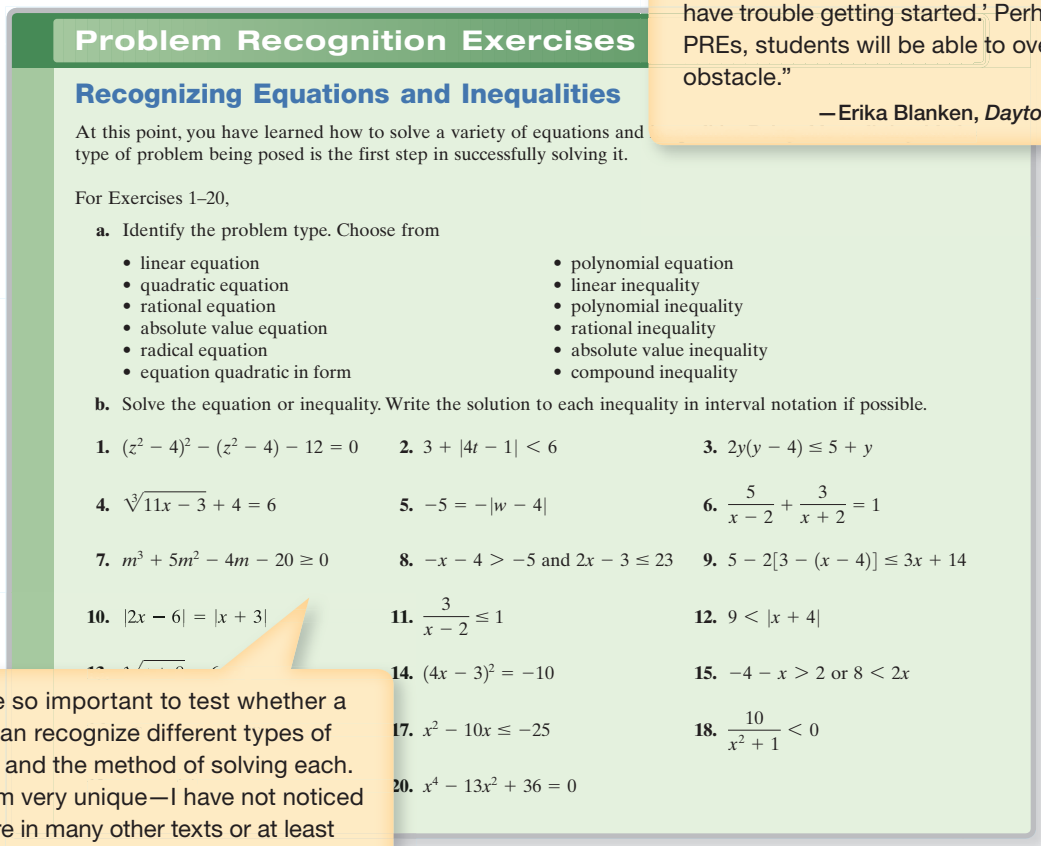
## Problem Recognition Exercises

*Problem Recognition Exercises* present a collection of problems that look similar to a student upon first glance, but are actually quite different in the manner of their individual solutions. Students sharpen critical thinking skills and better develop their "solution recall" to help them distinguish the method needed to solve an exercise—an essential skill in developmental mathematics.

**Problem Recognition Exercises** were tested in the authors' developmental mathematics classes and were created to improve student performance on tests.

"The PREs are an excellent source of additional mixed problem sets. Frequently students have questions/comments like 'Where do I start?' or 'I know what to do once I get started, but I have trouble getting started.' Perhaps with these PREs, students will be able to overcome this obstacle."

—Erika Blanken, *Daytona State College*



**Problem Recognition Exercises**

**Recognizing Equations and Inequalities**

At this point, you have learned how to solve a variety of equations and … type of problem being posed is the first step in successfully solving it.

For Exercises 1–20,

**a.** Identify the problem type. Choose from

- linear equation
- quadratic equation
- rational equation
- absolute value equation
- radical equation
- equation quadratic in form
- polynomial equation
- linear inequality
- polynomial inequality
- rational inequality
- absolute value inequality
- compound inequality

**b.** Solve the equation or inequality. Write the solution to each inequality in interval notation if possible.

**1.** $(z^2 - 4)^2 - (z^2 - 4) - 12 = 0$

**2.** $3 + |4t - 1| < 6$

**3.** $2y(y - 4) \le 5 + y$

**4.** $\sqrt[3]{11x - 3} + 4 = 6$

**5.** $-5 = -|w - 4|$

**6.** $\frac{5}{x - 2} + \frac{3}{x + 2} = 1$

**7.** $m^3 + 5m^2 - 4m - 20 \ge 0$

**8.** $-x - 4 > -5$ and $2x - 3 \le 23$

**9.** $5 - 2[3 - (x - 4)] \le 3x + 14$

**10.** $|2x - 6| = |x + 3|$

**11.** $\frac{3}{x - 2} \le 1$

**12.** $9 < |x + 4|$

**14.** $(4x - 3)^2 = -10$

**15.** $-4 - x > 2$ or $8 < 2x$

**17.** $x^2 - 10x \le -25$

**18.** $\frac{10}{x^2 + 1} < 0$

**20.** $x^4 - 13x^2 + 36 = 0$

"These are so important to test whether a student can recognize different types of problems and the method of solving each. They seem very unique—I have not noticed this feature in many other texts or at least your presentation of the problems is very organized and unique."

—Linda Kuroski, *Erie Community College*

## Student Centered Applications!

The Miller/O'Neill/Hyde Board of Advisors partnered with our authors to bring the *best applications* from every region in the country! These applications include real data and topics that are more relevant and interesting to today's student.

**Mixed Exercises**

**37.** How much pure gold (24K) must be mixed with 60% gold to get 20 grams (g) of 75% gold?

**38.** A granola mix contains 5% nuts. How many ounces of nuts must be added to get 25 oz of granola with 24% nuts?

**39.** A rowing team trains on the Halifax River. It can row upstream 10 mi against the current in 2.5 hr and 16 mi downstream with the current in the same amount of time. Find the speed of the boat in still water and the speed of the current.

**40.** In her kayak, Bonnie can travel 31.5 mi downstream with the current in 7 hr. The return trip against the current takes 9 hr. Find the speed of the kayak in still water and the speed of the current.

**41.** There are two types of tickets sold at the Canadian Formula One Grand Prix race. The price of 6 grandstand tickets and 2 general admission tickets costs $2330. The price of 4 grandstand tickets and 4 general admission tickets cost $2020. What is the price of each type of ticket?

**42.** A basketball player scored 19 points by shooting two-point and three-point baskets. If she made a total of eight baskets, how many of each type did she make?

## Group Activities!

Each chapter concludes with a Group Activity to promote classroom discussion and collaboration—helping students not only to solve problems but to explain their solutions for better mathematical mastery. Group Activities are great for both full-time and adjunct instructors—bringing a more interactive approach to teaching mathematics! All required materials, activity time, and suggested group sizes are provided in the end-of-chapter material.

**Group Activity**

### Computing the Future Value of an Investment

**Materials:** Calculator

**Estimated time:** 15 minutes

**Group Size:** 3

Suppose you are able to save $100 per month. If you invest the money in an account that pays 6% annual interest, how much money would you have at the end of 10 yr? This question can be answered by using the following formula.

$$S = R\left[\frac{(1+i)^n - 1}{i}\right]$$

Where $S$ is the future value of the investment.
$R$ is the amount saved per period.
$i$ is the interest rate per period.
$n$ is the total number of periods.

In this example, $R = \$100$ (amount invested per month)

$$i = \frac{0.06}{12} = 0.005$$ (annual interest rate divided by 12 months)

$$n = (12)(10) = 120$$ (12 months per year times 10 years)

Therefore, $S = \$100\left[\frac{(1 + 0.005)^{120} - 1}{0.005}\right]$

$S = \$16{,}387.93$

future value of an account if you save $150 per month for 30 yr at an annual interest rate

$S =$ _____

nvest $5000 in an account on July 1 each year for 20 yr. If the annual growth on your 8%, how much will the account be worth in 20 yr?

"MOH's group activity involves true participation and interaction."
—Monika Bender, *Central Texas College*

"This is one part of the book that would have me adopt the MOH book. I am very big on group work and many times it is difficult to think of an activity. I would conclude the chapter doing the group activity in the class. Many books just have problems for this, but the MOH book provides an actual activity."
—Sharon Giles, *Grossmont College*

# Additional Supplements

## Media Suite

### NEW Lecture Videos Created by the Authors

Julie Miller began creating these lecture videos for her own students to use when they were absent from class. The student response was overwhelmingly positive, prompting the author team to create the lecture videos for their entire developmental math book series. In these new videos, the authors walk students through the learning objectives using the same language and procedures outlined in the book. Students learn and review right alongside the author! Students can also access the written notes that accompany the videos.

### Dynamic Math Animations

The authors have constructed a series of Flash animations to illustrate difficult concepts where static images and text fall short. The animations leverage the use of on-screen movement and morphing shapes to give students an interactive approach to conceptual learning. Some provide a virtual laboratory for which an application is simulated and where students can collect data points for analysis and modeling. Others provide interactive question-and-answer sessions to test conceptual learning.

### NEW Exercise Videos

The authors, along with a team of faculty who have used the Miller/O'Neill/Hyde textbooks for many years, have created new exercise videos for designated exercises in the textbook. These videos cover a representative sample of the main objectives in each section of the text. Each presenter works through selected problems, following the solution methodology employed in the text.

The video series is available online as part of Connect Math hosted by ALEKS as well as in ALEKS 360. The videos are closed-captioned for the hearing impaired, and meet the Americans with Disabilities Act Standards for Accessible Design.

## Student Resource Manual

The *Student Resource Manual (SRM),* created by the authors, is a printable, electronic supplement available to students through Connect Math hosted by ALEKS. Instructors can also choose to customize this manual and package with their course materials. With increasing demands on faculty schedules, this resource offers a convenient means for both full-time and adjunct faculty to promote active learning and success strategies in the classroom.

This manual supports the series in a variety of different ways:

- NEW Additional Group Activities developed by the authors to supplement what is already available in the text.
- Discovery-based classroom activities written by the authors for each section
- Worksheets for extra practice written by the authors including Problem Recognition Exercise Worksheets
- NEW Lecture Notes designed to help students organize and take notes on key concepts
- Materials for a student portfolio

## Annotated Instructor's Edition

In the *Annotated Instructor's Edition* (*AIE*), answers to all exercises appear adjacent to each exercise in a color used *only* for annotations. The *AIE* also contains Instructor Notes that appear in the margin. These notes offer instructors assistance with lecture preparation. In addition, there are Classroom Examples referenced in the text that are highlighted in the Practice Exercises. Also found in the *AIE* are icons within the Practice Exercises that serve to guide instructors in their preparation of homework assignments and lessons.

## Powerpoints

The Powerpoints present key concepts and definitions with fully editable slides that follow the textbook. An instructor may project the slides in class or post to a website in an online course.

## Instructor's Solutions Manual

The *Instructor's Solutions Manual* provides comprehensive, worked-out solutions to all exercises in the Chapter Openers, the Practice Exercises, the Problem Recognition Exercises, the end-of-chapter Review Exercises, the Chapter Tests, and the Cumulative Review Exercises.

## Student's Solutions Manual

The *Student's Solutions Manual* provides comprehensive, worked-out solutions to the odd-numbered exercises in the Practice Exercise sets, the Problem Recognition Exercises, the end-of-chapter Review Exercises, the Chapter Tests, and the Cumulative Review Exercises. Answers to the Chapter Opener Puzzles are also provided.

## Instructor's Test Bank

Among the supplements is a computerized test bank using the algorithm-based testing software TestGen® to create customized exams quickly. Hundreds of text-specific, open-ended, and multiple-choice questions are included in the question bank.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- Connect Math hosted by ALEKS also links students to an interactive eBook with a variety of media assets and a place to study, highlight, and keep track of class notes.

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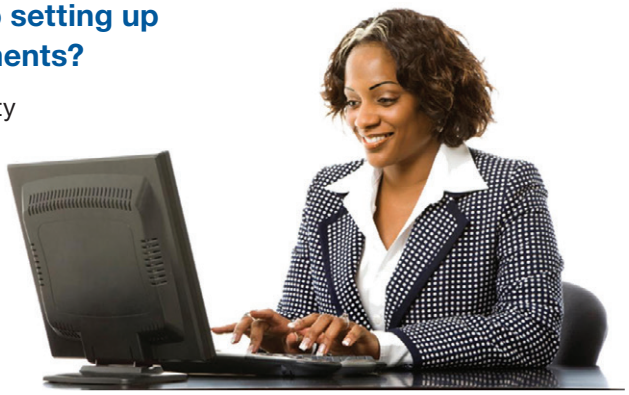

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1. 2 drafts of author manuscript
2. 2 rounds of manuscript review
3. Multiple focus groups
4. 2 accuracy checks
5. 2 rounds of proofreading and copyediting
6. Toward the final stages of production, we are able to incorporate additional rounds of quality assurance from instructors as they help contribute toward our digital content and print supplements

This process then will start again immediately upon publication in anticipation of the next edition. With our commitment to this process, we are confident that our series has the most developed content the industry has to offer, thus pushing our desire for quality and accurate content that meets the needs of today's students and instructors.

# Acknowledgments and Reviewers

Paramount to the development of this series was the invaluable feedback provided by the instructors from around the country who reviewed the manuscript or attended a market development event over the course of the several years the text was in development.

Albert Groccia, *Valencia College–Osceola*
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## The author team most humbly would like to thank all the people who have contributed to this project.

Special thanks to our team of digital authors for their thousands of hours of work: Jody Harris, Linda Schott, Lizette Hernandez Foley, Michael Larkin, Alina Coronel, and to the masters of ceremonies in the digital world: Donna Gerken, Nicole Lloyd, and Steve Toner. We also offer our sincerest appreciation to the video talent: Jody Harris, Alina Coronel, Didi Quesada, Tony Alfonso, and Brianna Kurtz. You folks are the best! To Mitchel Levy our exercise consultant, thank you for your watchful eye fine-tuning the exercise sets and for your ongoing valuable feedback. To Gene Rumann, thank you so much for ensuring accuracy in our manuscripts.

Finally, we greatly appreciate the many people behind the scenes at McGraw-Hill without whom we would still be on page 1. To Emily Williams, the best developmental editor in the business and steady rock that has kept the train on the track. To Mary Ellen Rahn, our executive editor and overall team leader. We're forever grateful for your support and innovative ideas. To our copy editor Pat Steele who has watched over our manuscript for many years and has been a long-time mentor for our writing. You're amazing. To the marketing team Alex Gay, Peter Vanaria, Tim Cote, John Osgood, and Cherie Harshmann, thank you for your creative ideas in making our books come to life in the market. To the director of digital content, Nicole Lloyd, we are most grateful for your long hours of work and innovation in a world that changes day-to-day. And many thanks to the team at ALEKS that oversees quality control in the digital content. To the production team Peggy Selle, Laurie Janssen, and Carrie Burger for making the manuscript beautiful and bringing it all together. And finally to Ryan Blankenship, Marty Lange, and Kurt Strand, thank you for supporting our projects over the years and for the confidence you've always shown in us.

Most importantly, we give special thanks to the students and instructors who use our series in their classes.

***Julie Miller*** ***Molly O'Neill*** ***Nancy Hyde***

# New and Updated Content for Miller, O'Neill, and Hyde's *Intermediate Algebra*, Third Edition:

## Updates throughout the Text:

- New Vocabulary and Key Concept Exercises
- New Tips, Avoiding Mistakes boxes, and Concept Connections
- New and Revised Study Skills Exercises
- Updated Applications and Data in all instances where appropriate
- Writing has been reworked throughout the text in order to improve clarity and understanding

## Chapter by Chapter Changes:

**Chapter R**
- Separated the first three sections of the previous edition Chapter 1 into a new Chapter R
- New Chapter Opener
- New Section on Study Skills
- New Group Activity
- 10 New Exercises

**Chapter 1**
- Now includes three sections from the previous edition Chapter 8
- Now includes the Problem Recognition Exercise Set from the previous edition Chapter 8
- New Chapter Opener
- New Group Activity

**Chapter 2**
- Separated previous edition Chapter 2 into current edition Chapter 2 and Chapter 3
- New Chapter Opener
- New Group Activity
- New Cumulative Review with 20 new exercises
- 1 New Example
- 27 New Exercises

**Chapter 3**
- New Chapter Opener
- New Definition Box of a Quadratic Function
- 12 New Exercises

**Chapter 4**
- New Section on Linear Inequalities and Systems of Linear Inequalities from previous edition Chapter 8
- New Chapter Opener
- New narrative on the Addition Method
- 32 New Exercises
- 1 New Example

**Chapter 5**
- New Section on Properties of Integer Exponents and Scientific Notation from previous edition Chapter 1
- New Chapter Opener
- New Problem Recognition Exercise Set
- New Factoring Strategy Procedure Box
- 22 New Exercises

**Chapter 6**
- New narrative on Restricted Values of a Rational Expression and the Domain of a Rational Function
- 7 New Exercises

**Chapter 7**
- New Chapter Opener
- New Property Box on Evaluating an $n$th Root
- 41 New Exercises
- 7 New Examples

**Chapter 8**
- New Chapter Opener
- New Section on Polynomial and Rational Inequalities from previous edition Chapter 8
- New Problem Recognition Exercise Set
- New Procedure Box on Methods to Solve a Quadratic Equation
- 42 New Exercises
- 4 New Examples

**Chapter 9**
- New Chapter Opener
- New figures to represent one-to-one functions
- New Definition Box on an Inverse Function
- New Inverse Function Property Box
- Separated Solving Exponential and Logarithmic Equations into two sections
- New Narrative on Solving Exponential Equations
- New Property Box on Equivalence of Logarithmic Expressions
- 67 New Exercises
- 5 New Examples

**Chapter 10**
- New Chapter Opener
- New figures to illustrate a vertical axis of symmetry for a parabola
- New Procedure Boxes on Graphing an Ellipse and a Hyperbola
- New Problem Recognition Exercise Set
- 9 New Exercises
- 2 New Examples

**Additional Topics Appendix**
- 14 New Exercises
- 4 New Examples

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# Review of Basic Algebraic Concepts

# R

## CHAPTER OUTLINE



## *Chapter R*

In this chapter, we begin our study of algebra by reviewing the sets of numbers used in day-to-day life. We also review how to simplify numerical expressions and algebraic expressions. To prepare for this chapter, practice the following operations on whole numbers, decimals, fractions, and mixed numbers.

### Review Your Skills

For Exercises 1–12, simplify each expression. Then find the answer on the right and record the corresponding letter at the bottom of the page. When you are finished, you will have a key definition for this chapter.

| Exercises | | Answers | |
|---|---|---|---|
| **1.** $36{,}636 \div 43$ | **2.** $0.25 \times 6340$ | **I.** 389.7842 | **B.** 1585 |
| **3.** $24.0842 + 365.7$ | **4.** $\frac{4}{7} \times \frac{21}{10}$ | **R.** $\frac{1}{6}$ | **D.** $\frac{6}{5}$ |
| **5.** $\frac{7}{3} \div 14$ | **6.** $\frac{5}{3} - \frac{1}{2}$ | **T.** 852 | **S.** 11.95 |
| **7.** $\frac{2}{3} - \frac{7}{12}$ | **8.** $4\frac{5}{9} - 1\frac{1}{3}$ | **E.** $3\frac{2}{9}$ | **P.** $\frac{1}{12}$ |
| **9.** $3\frac{1}{5} \times 2\frac{1}{2}$ | **10.** $3.75 + 8\frac{1}{5}$ | **Y.** $\frac{7}{6}$ | **O.** 8 |
| **11.** $582 \div 0.01$ | **12.** $582 \times 0.01$ | **V.** 58,200 | **U.** 5.82 |

In this chapter we will show that $a(b + c) = ab + ac$. This important property is called the:

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ |
| 4 | 3 | 10 | 1 | 5 | 3 | 2 | 12 | 1 | 3 | 11 | 8 | 7 | 5 | 9 | 7 | 8 | 5 | 1 | 6 |

# Section R.1 Study Skills

## Concepts

1. Before the Course
2. During the Course
3. Preparation for Exams
4. Where to Go for Help

In taking a course in algebra, you are making a commitment to yourself, your instructor, and your classmates. Following some or all of the study tips below can help you be successful in this endeavor. The features of this text that will assist you are printed in blue.

## 1. Before the Course

- Purchase the necessary materials for the course before the course begins or on the first day.
- Obtain a three-ring binder to keep and organize your notes, homework, tests, and any other materials acquired in the class. We call this type of notebook a *portfolio*.
- Arrange your schedule so that you have enough time to attend class and to do homework. A common rule is to set aside at least 2 hours for homework for every hour spent in class. That is, if you are taking a 4-credit-hour course, plan on at least 8 hours a week for homework. If you experience difficulty in mathematics, plan for more time. A 4-credit-hour course will then take *at least* 12 hours each week—about the same as a part-time job.
- Communicate with your employer and family members the importance of your success in this course so that they can support you.
- Be sure to find out the type of calculator (if any) that your instructor requires. Also determine if there will be online homework or other computer requirements.

## 2. During the Course

- To prepare yourself for the next day's class, read the section in the text *before* coming to class. This will help you familiarize yourself with the material and terminology.
- Attend every class and be on time.
- Take notes in class. Write down all of the examples that the instructor presents. Read the notes after class, and add any comments to make your notes clearer to you. Use a tape recorder to record the lecture if the instructor permits the recording of lectures.
- Ask questions in class.
- Read the section in the text *after* the lecture, and pay special attention to the Tip boxes and Avoiding Mistakes boxes.
- After you read an example, try the accompanying Skill Practice problem. The skill practice problem mirrors the example and tests your understanding of what you have read.
- Do homework every night. Even if your class does not meet every day, you should still do some work every night to keep the material fresh in your mind.
- Check your homework with the answers that are supplied in the back of this text. Analyze what you did wrong and correct the exercises that do not match. Circle or star those that you cannot correct yourself. This way you can easily find them and ask your instructor the next day.
- Be sure to do the Vocabulary and Key Concepts exercises found at the beginning of the Practice Exercises.
- The Problem Recognition Exercises are found in Chapters 1–10. These provide additional practice distinguishing among a variety of problem types. Sometimes the most difficult part of learning mathematics is retaining all that you learn. These exercises are excellent tools for retention of material.

- Form a study group with fellow students in your class, and exchange phone numbers. You will be surprised by how much you can learn by talking about mathematics with other students.
- If you use a calculator in your class, read the Calculator Connections boxes to learn how and when to use your calculator.
- Ask your instructor where you might obtain extra help if necessary.

## 3. Preparation for Exams

- Look over your homework and rework exercises that gave you trouble. Pay special attention to the exercises you have circled or starred to be sure that you have learned that concept.
- Read through the Summary at the end of the chapter. Be sure that you understand each concept and example. If not, go to the section in the text and reread that section.
- Give yourself enough time to take the Chapter Test uninterrupted. Then check the answers. For each problem you answered incorrectly, go to the Review Exercises and do all of the problems that are similar.
- To prepare for the final exam, complete the Cumulative Review Exercises at the end of each chapter, starting with Chapter 2. If you complete the cumulative reviews after finishing each chapter, then you will be preparing for the final exam throughout the course. The Cumulative Review Exercises are another excellent tool for helping you retain material.

## 4. Where to Go for Help

- At the first sign of trouble, see your instructor. Most instructors have specific office hours set aside to help students. Don't wait until after you have failed an exam to seek assistance.
- Get a tutor. Most colleges and universities have free tutoring available.
- When your instructor and tutor are unavailable, use the Student Solutions Manual for step-by-step solutions to the odd-numbered problems in the exercise sets.
- Work with another student from your class.
- Work on the computer. Many mathematics tutorial programs and websites are available on the Internet, including the website that accompanies this text.

# Group Activity

## Becoming a Successful Student

**Materials:** Computer with Internet access (Optional)

**Estimated time:** 15 minutes

**Group Size:** 4

Good time management, good study skills, and good organization will help you be successful in this course. Answer the following questions and compare your answers with your group members.

**1.** To motivate yourself to complete a course, it is helpful to have clear reasons for taking the course. List your goals for taking this course and discuss them with your group.

**2.** Taking 12 credit-hours is the equivalent of a full-time job. Often students try to work too many hours while taking classes at school.

**a.** Write down the number of hours you work per week and the number of credit-hours you are taking this term.

Number of hours worked per week _____

Number of credit-hours this term _____

**b.** The table gives a recommended limit to the number of hours you should work for the number of credit-hours you are taking at school. (Keep in mind that other responsibilities in your life such as your family might also make it necessary to limit your hours at work even more.) How do your numbers from part (a) compare to those in the table? Are you working too many hours?

| Number of Credit-Hours | Maximum Number of Hours of Work per Week |
|---|---|
| 3 | 40 |
| 6 | 30 |
| 9 | 20 |
| 12 | 10 |
| 15 | 0 |

**c.** It is often suggested that you devote two hours of study and homework time outside of class for each credit-hour you take at school. For example:

12 credit-hours
+ 24 study hours
36 total hours ← full-time job!

Based on the number of credit-hours you are taking, how many study hours should you plan for? _____

What is the total number of hours (class time plus study time) that you should devote to school? _____

**3.** For the following week, write down the times each day that you plan to study math.

| Monday | Tuesday | Wednesday | Thursday | Friday | Saturday | Sunday |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

**4.** Write down the date of your next math test. _____

**5.** Look through the book in Chapter 2 and find the page number corresponding to each feature in the book. Discuss with your group members how you might use each feature.

Problem Recognition Exercises: page _____

Chapter Summary: page _____

Chapter Review Exercises: page _____

Chapter Test: page _____

Cumulative Review Exercises: page _____

**6.** Look at the Skill Practice exercises next to each example (for instance, find Skill Practice exercise 4 in Section 1.2). Where are the answers to these exercises located? Discuss with your group members how you might use the Skill Practice exercises.

**7.** Discuss with your group members places where you can go for extra help in math. Then write down three of the suggestions.

_____

_____

**8.** Do you keep an organized notebook for this class? Can you think of any suggestions that you can share with your group members to help them keep their materials organized?

**9.** Do you think that you have math anxiety? Read the following list for some possible solutions. Check the activities that you can realistically try to help you overcome this problem.

_____ Read a book on math anxiety.

_____ Search the Web for help tips on handling math anxiety.

_____ See a counselor to discuss your anxiety.

_____ Talk with your instructor to discuss strategies to manage math anxiety.

_____ Evaluate your time management to see if you are trying to do too much. Then adjust your schedule accordingly.

**10.** Some students favor different methods of learning over others. For example, you might prefer:

- Learning through listening and hearing.
- Learning through seeing images, watching demonstrations, and visualizing diagrams and charts.
- Learning by experience through a hands-on approach.
- Learning through reading and writing.

Most experts believe that the most effective learning comes when a student engages in *all* of these activities. However, each individual is different and may benefit from one activity more than another. You can visit a number of different websites to determine your "learning style." Try doing a search on the Internet with the key words "*learning styles assessment.*" Once you have found a suitable website, answer the questionnaire and the site will give you feedback on what method of learning works best for you.

# Sets of Numbers and Interval Notation

# Section R.2

## 1. The Set of Real Numbers

Algebra is a powerful mathematical tool that is used to solve real-world problems in science, business, and many other fields. We begin our study of algebra with a review of basic definitions and notations used to express algebraic relationships.

### Concepts