

AUFMANN & LOCKWOOD

# PREALGEBRA

6



AN APPLIED APPROACH

## Aufmann Interactive Method **AIM**

The Aufmann Interactive Method (AIM) is a proven learning system that has helped thousands of students master concepts and achieve results.

To follow the **AIM**, step through the **HOW TO** examples that are provided and then work through the matched **EXAMPLE / YOU TRY IT** pairs.

### Aufmann

**HOW TO 2** What is  $33\frac{1}{3}\%$  of 90?

Use the basic percent equation.

$$\text{Percent} = 33\frac{1}{3}\% = \frac{1}{3}, \text{ base} = 90, \text{ amount} = n$$

$33\frac{1}{3}\%$  of 90 is 30.

Percent  $\cdot$  base = amount

$$\frac{1}{3} \cdot 90 = n$$

$$30 = n$$

### Interactive

#### EXAMPLE 3

60 is 2.5% of what?

#### Solution

Use the basic percent equation.

$$\text{Percent} = 2.5\% = 0.025, \text{ base} = n, \text{ amount} = 60$$

Percent  $\cdot$  base = amount

$$0.025 \cdot n = 60$$

$$\frac{0.025n}{0.025} = \frac{60}{0.025}$$

$$n = 2400$$

60 is 2.5% of 2400.

#### YOU TRY IT 3

$16\frac{2}{3}\%$  of what is 15?

#### Your solution

*Solution on p. S23*

For extra support, you can find the complete solutions to the **YOU TRY IT** problems in the back of the text.

### Method

#### Solutions to Chapter 8 "You Try It"

**Solution** Percent  $\cdot$  base = amount

$$\frac{1}{6} \cdot n = 15$$

$$6 \cdot \frac{1}{6}n = 15 \cdot 6$$

$$n = 90$$

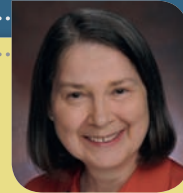
$16\frac{2}{3}\%$  of 90 is 15.

# Ask the Authors!

We have taught math for many years. During that time, we have had students ask us a number of questions about mathematics and this course. Here you find some of the questions we have been asked most often, starting with the big one.



Dick Aufmann



Joanne Lockwood

**Why do I have to take this course?** You may have heard that “*Math is everywhere.*” That is probably a slight exaggeration, but math does find its way into many disciplines. There are obvious places like engineering, science, and medicine. There are other disciplines such as business, social science, and political science where math may be less obvious but still essential. If you are going to be an artist, writer, or musician, the direct connection to math may be even less obvious. Even so, as art historians who have studied the Mona Lisa have shown, there is a connection to math. But, suppose you find these reasons not all that compelling. **There is still a reason to learn basic math skills: You will be a better consumer and be able to make better financial choices for you and your family.** For instance, is it better to buy a car or lease a car? Math can provide an answer.

**I find math difficult. Why is that?** It is true that some people, even very smart people, find math difficult. Some of this can be traced to previous math experiences. If your basic skills are lacking, it is more difficult to understand the math in a new math course. Some of the difficulty can be attributed to the ideas and concepts in math. They can be quite challenging to learn. Nonetheless, most of us can learn and understand the ideas in the math courses that are required for graduation. **If you want math to be less difficult, practice. When you have finished practicing, practice some more.** Ask an athlete, actor, singer, dancer, artist, doctor, skateboarder, or (name a profession) what it takes to become successful and the one common characteristic they all share is that they practiced—a lot.

**Why is math important?** As we mentioned earlier, math is found in many fields of study. There are, however, other reasons to take a math course. Primary among these reasons is to become a better problem solver. Math can help you learn critical thinking skills. It can help you develop a logical plan to solve a problem. Math can help you see relationships between ideas and to identify patterns. **When employers are asked what they look for in a new employee, being a problem solver is one of the highest ranked criteria.**

**What do I need to do to pass this course?** The most important thing you must do is to know and understand the requirements outlined by your instructor. These requirements are usually given to you in a syllabus. Once you know what is required, you can chart a course of action. Set time aside to study and do homework. If possible, choose your classes so that you have a free hour after your math class. Use this time to review your lecture notes, rework examples given by the instructor, and begin your homework. All of us eventually need help, so know where you can get assistance with this class. This means knowing your instructor’s office hours, the hours of the math help center, and how to access available online resources. And finally, do not get behind. **Try to do some math EVERY day, even if it is for only 20 minutes.**





# Prealgebra

AN APPLIED APPROACH

EDITION

6

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Australia • Brazil • Japan • Korea • Mexico • Singapore • Spain • United Kingdom • United States

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## AIM for Success

AIM-1

This important chapter outlines some study skills that are used by students who have been successful in this course. Topics include how to stay motivated, making a commitment to succeed, how to manage your time, and preparing for and taking tests. There is a complete guide to the textbook and how to use its features to become a successful student.

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# Preface

Among the many questions we ask when we begin the process of revising a textbook, the most important is, “How can we improve the learning experience for the student?” We find answers to this question in a variety of ways, but most commonly by talking to students and instructors and by evaluating the written feedback we receive from instructors. Bearing this feedback in mind, our ultimate goal as we set out to create the sixth edition of *Prealgebra: An Applied Approach* was to provide students with more materials to help them better understand the underlying concepts presented in this course. As a result, we have made the following changes to the new edition.

New to this edition is the **Focus on Success** vignette that appears at the beginning of each chapter. **Focus on Success** offers practical tips for improving study habits and performance on tests and exams.

We now include an **Apply the Concept** box within the objectives that teach addition, subtraction, multiplication, and division. The arithmetic operation is applied to a real-world situation so that students can relate the operation to their everyday lives. For example, multiplication of whole numbers is applied to determining the total number of cans of soda in eight six-packs of soda.

**HOW TO** examples offer detailed instructions for solving a variety of problems.

The definition and key concept boxes have been enhanced in this edition; they now include examples to show how the general case translates to specific cases.

In each exercise set, the first group of exercises is now titled **Concept Check**. The **Concept Check** exercises focus on the concepts that lie behind the skills developed in the section. We consider an understanding of these concepts essential to a student’s success in mastering the skills required to complete the exercises that follow.

**In the News** exercises are application exercises found within most exercise sets. These exercises are based on newsworthy data and are drawn from current events.

Every chapter contains **Check Your Progress** exercises. This feature appears approximately mid-chapter and tests students’ understanding of the concepts presented to that point in the chapter.

We trust that the new and enhanced features of the sixth edition will help students more successfully engage with the content. By narrowing the gap between the concrete and the abstract, between the real world and the theoretical, students should more plainly see that mastering the skills and topics presented is well within their reach and well worth the effort.

## New to This Edition

- **Apply the Concept** boxes are provided within objectives that teach arithmetic operations.
- **Concept Check** exercises appear at the beginning of each exercise set.
- Enhanced definition and key concept boxes now include examples that illustrate how the general case applies to specific cases.
- The **Focus on Success** feature at the beginning of each chapter offers practical guidance to help students develop positive study habits.
- **Check Your Progress** exercises appear approximately mid-chapter and test students’ understanding of the concepts presented up to that point in the chapter.

- **HOW TO** examples offer detailed explanations of problem-solving techniques.
- **Tips for Success** now appear in every chapter.
- **In the News** articles within the exercise sets relate the math skills being learned to current events.
- Application problems throughout the text have been updated.
- **Projects or Group Activities** are now included at the end of each exercise set.
- **Chapter A, AIM for Success**, now appears as the first chapter of the text. This chapter describes skills used by students who have been successful in this course. Topics include how to stay motivated, making a commitment to success, time management, and how to prepare for and take tests. A guide to the textbook is included to help students use its features effectively.
- More annotations have been added to the worked Examples, to more effectively explain the steps of the solutions.
- Many of the **Chapter Summaries** have been expanded to include more entries and more descriptive explanations.

## Organizational Changes

We have made the following changes in order to improve the effectiveness of the textbook and enhance the student's learning experience.

- In Section 2.1, the introduction to positive and negative numbers has been rewritten. The material is now easier for the student to understand, which will result in a better start to the semester!
- The introduction to Objective 3.3A has been reorganized and streamlined.
- In Section 5.1, the presentation of the Properties of Real Numbers has been reorganized. Additional examples of each property are provided. The new format makes it easier for students to understand and apply the concepts.
- Section 5.4 now includes more detailed examples of each Rule for Simplifying Exponential Expressions. Section 5.6 provides more detailed examples of the Rule for Dividing Exponential Expressions, the Definition of Zero as an Exponent, and the Definition of Negative Exponents.
- In Section 5.7, the table for translating verbal phrases into mathematical expressions has been expanded to include more of the verbal phrases students will encounter in application problems. The design is more prominent, and the table is easier to use as a reference.
- Objectives 6.2B and 6.3C now provide a wider range of application problems that make use of first-degree equations.
- The exposition in Section 6.6 has been expanded to provide more explanation and more annotated examples on the important topic of graphing linear equations in two variables.
- Section 7.1 contains a new introduction to the metric system.
- Chapter 8, Percent, has been revised substantially. In Section 8.1, the exposition was increased from two to four pages to provide a slower and more descriptive introduction to the crucial topic of percent. More examples are given in the exposition, and additional numbered Examples and You Try Its provide students with the exposure they need to understand the concepts. Two pages have been added to the Section 8.1 exercise set. The expanded exercise set provides more basic, concept-driven exercises; more application problems to help students un-

derstand how percent is used in the real world; and more practice in writing percents as fractions and decimals and in writing fractions and decimals as percents.

- The topic of the basic percent equation is presented in Section 8.2. In the new edition, the exposition is two pages longer, for a slower, more detailed introduction to solving percent problems.
- Three pages have been added to the Section 8.3 exercise set to provide students with more practice in solving percent problems. There are more hands-on exercises; for example, the student is asked to shade a given percent of a grid and circle a given percent of a number of objects.
- Objective 10.2B has been expanded to provide students with more examples of, and practice with, determining the five values that make up a box-and-whiskers plot. In Objective 10.2C, the flow and display of the material has been improved. Students will find it easier to follow the steps involved in calculating standard deviation.



# Take AIM and Succeed!

## An Objective-Based Approach

*Prealgebra: An Applied Approach* is organized around a carefully constructed hierarchy of **objectives**. This “objective-based” approach provides an integrated learning path that enables you to find resources such as assessment tools (both within the text and online), videos, tutorials, and additional exercises for each objective in the text.

**1** Each Chapter Opener outlines the learning **OBJECTIVES** that appear in each section of the chapter. The list of objectives serves as a resource to guide you in your study and review of the topics.

**2** Taking the **PREP TEST** for each chapter will help you determine which topics you need to study more carefully and which topics you need only review. The **ANSWERS** to the **PREP TEST** provide references to the **OBJECTIVES** on which the exercises are based.

**3** In every section, an **OBJECTIVE STATEMENT** introduces each new topic of discussion. Videos are available for each objective.

**4** Section exercises are keyed to **OBJECTIVE STATEMENTS**.

# An Objective-Based Review

This “objective-based” approach continues through the end-of-chapter review and addresses a broad range of study styles by offering a **wide variety of review tools**.

**New** **CHECK YOUR PROGRESS** exercises appear approximately mid-chapter and test your understanding of the concepts presented up to that point in the chapter.

At the end of each chapter, you will find a **CHAPTER SUMMARY** containing **KEY WORDS** and **ESSENTIAL RULES AND PROCEDURES** presented in the chapter. Each entry includes an objective reference and a page reference that show where in the chapter the concept was introduced. An example demonstrating the concept is also included.

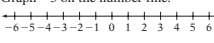
By completing the **CHAPTER REVIEW EXERCISES**, you can practice working on problems in an order that is different from the order in which they were presented in the chapter. The **ANSWER** to each Chapter Review exercise includes a reference to the objective on which the exercise is based. This reference will help you quickly identify where to go if you need further practice with a particular concept.

Each **CHAPTER TEST** is designed to simulate a typical test of the concepts covered in the chapter. Each **ANSWER** includes an objective reference as well as a reference to a numbered Example, You Try It, or HOW TO in the text that is similar to the given test question.

**CUMULATIVE REVIEW EXERCISES**, which appear at the end of each chapter (beginning with Chapter 2), help you maintain previously learned skills. The **ANSWERS** include references to the section objectives on which the exercises are based.

A **FINAL EXAM** is provided following the last chapter of the text. The Final Exam is designed to simulate a comprehensive exam covering all the concepts presented in the text. The **ANSWERS** to the Final Exam questions are provided in the appendix at the back of the text and include references to the section objectives on which the questions are based.

**CHECK YOUR PROGRESS: CHAPTER 2**

- Graph  $-3$  on the number line.  

- On the number line, which number is 5 units to the left of 2?
- Place the correct symbol,  $<$  or  $>$ , between the two numbers.  
 $-12$     $-16$
- Write the given numbers in order from smallest to largest.  
 $-8, 7, -19, 4$

**CHAPTER 2 Summary**

Key Words	Examples
Numbers greater than zero are called <b>positive numbers</b> . Numbers less than zero are called <b>negative numbers</b> . [2.1A, p. 86]	9, 87, and 603 are positive numbers. -5, -41, and -729 are negative numbers.

**CHAPTER 2 Review Exercises**

- Write the expression  $8 - (-1)$  in words.
- Evaluate  $-|-36|$ .
- Find the product of  $-40$  and  $-5$ .
- Evaluate  $-a \div b$  for  $a = -27$  and  $b = -4$ .

**CHAPTER 2 TEST**

- Write the expression  $-3 + (-5)$  in words.
- Evaluate  $-|-34|$ .
- What is 3 minus  $-15$ ?
- Evaluate  $a + b$  for  $a = -11$  and  $b = 2$ .

**Cumulative Review Exercises**

- Find the difference between  $-27$  and  $-32$ .
- Estimate the product of 439 and 28.
- Divide:  $19,254 \div 6$
- Simplify:  $16 \div (3 + 5) \cdot 9 - 2^3$

**FINAL EXAM**

- Estimate the sum of 672, 843, 509, and 417.
- Simplify:  $18 + 3(6 - 4)^2 \div 2$
- Simplify:  $-8 - (-13) - 10 + 7$
- Evaluate  $|a - b| - 3bc^3$  for  $a = -2$ ,  $b = 3$ , and  $c = -1$ .

# Understanding the Concepts

Each of the following features is designed to give you a fuller understanding of the key concepts.

**New** **CONCEPT CHECK** exercises promote conceptual understanding. Completing these exercises will deepen your understanding of the concepts you are learning and provide the foundation you need to successfully complete the remaining exercises in the exercise set.

7.4 EXERCISES

✓ Concept Check

1. An equation of the form  $\frac{a}{b} = \frac{c}{d}$ , which states that two ratios or rates are equal, is called a                     . The extremes are the terms            and           , and the means are the terms            and           . In a true proportion, the product of the means and the product of the extremes are                     .

2. The first step in solving the proportion  $\frac{x}{85} = \frac{5}{17}$  is to write the equation that states that the product of the means equals the product of the extremes:  $85 \cdot \underline{\hspace{1cm}} = \underline{\hspace{1cm}} \cdot 17$ .

Definition/key concept boxes contain examples to illustrate how each definition or key concept is applied in practice.

product of two negative numbers is positive was made in the book *Ars Magna*, by Girolamo Cardan, in 1545.

**Integrating Technology**

To multiply  $(-6)(-15)$  with your calculator, enter the following:

$6 \text{ +/- } \times 15 \text{ +/- } =$   
-6                      -15

The pattern for multiplication shown above is summarized in the following rule for multiplying integers.

Rule for Multiplying Two Integers

**To multiply two integers with the same sign,** multiply the absolute values of the factors. The product is **positive**.

**To multiply two integers with different signs,** multiply the absolute values of the factors. The product is **negative**.

**EXAMPLES**

1.  $-4(12) = -48$       • The signs are different. The product is negative.

2.  $(-6)(-15) = 90$     • The signs are the same. The product is positive.

**TAKE NOTE** boxes alert you to concepts that require special attention.

**Take Note**

For HOW TO 2 at the right, the product is the same if the numbers are multiplied in a different order. For instance,

$$\begin{aligned} 2(-3)(-5)(-7) &= 2(-3)(35) \\ &= 2(-105) \\ &= -210 \end{aligned}$$

3.  $(-5)(3) = 3(-5)$       4.  $(-6 \cdot 2) \cdot (-1) = -6 \cdot [2 \cdot (-1)]$

**Take Note**

When variables are placed next to each other, it is understood that the operation is multiplication.  $-ab$  means "the opposite of  $a$  times  $b$ ."

**HOW TO 2** Multiply:  $2(-3)(-5)(-7)$

Multiply the first two numbers.  $2(-3)(-5)(-7)$

Then multiply the product by the third number.  $= -6(-5)(-7)$

Continue until all the numbers have been multiplied.  $= 30(-7)$

$= -210$

By the Multiplication Property of One,  $1 \cdot 6 = 6$  and  $1 \cdot x = x$ . Applying the rules for multiplication, we can extend this to  $-1 \cdot 6 = -6$  and  $-1 \cdot x = -x$ .

**HOW TO 3** Evaluate  $-ab$  for  $a = -2$  and  $b = -9$ .

Replace  $a$  with  $-2$  and  $b$  with  $-9$ .  $-ab$

Simplify  $-(-2)$ .  $-(-2)(-9)$

Multiply.  $= 2(-9)$

$= -18$

**HOW TO 4** Is  $-4$  a solution of the equation  $5x = -20$ ?  $5x = -20$

Replace  $x$  by  $-4$  and then simplify.  $5(-4) = -20$

The results are equal.  $-20 = -20$

**POINT OF INTEREST** boxes, which relate to the topic under discussion, may be historical in nature or of general interest.

**Point of Interest**

Historical manuscripts indicate that mathematics is at least 4000 years old. Yet it was only 400 years ago that mathematicians started using variables to stand for numbers. Before that time, mathematics was written in words.

$\frac{a}{1} = a$        $\frac{a}{0}$  is undefined.

**EXAMPLES**

1.  $\frac{0}{-7} = 0$     2.  $\frac{-3}{-3} = 1$     3.  $\frac{-9}{1} = -9$     4.  $\frac{-18}{0}$  is undefined.

**HOW TO 5** Evaluate  $a \div (-b)$  for  $a = -28$  and  $b = -4$ .

Replace  $a$  with  $-28$  and  $b$  with  $-4$ .  $a \div (-b)$

Simplify  $-(-4)$ .  $-28 \div (-(-4))$

Divide.  $= -28 \div (4)$

$= -7$

**HOW TO 6** Is  $-4$  a solution of the equation  $\frac{-20}{x} = 5$ ?

$\frac{-20}{-4} = 5$

$5 = 5$

# Application of the Concepts

The section exercises offer many opportunities to put the concepts you are learning into practice.

**New** **APPLY THE CONCEPT** boxes illustrate how an arithmetic operation is applied to a real-world situation so that you understand how the operation is used in everyday life.

**HOW TO 3** Write  $\frac{7}{8}$  as a percent.

Multiply  $\frac{7}{8}$  by 100%.

$$\frac{7}{8} = \frac{7}{8}(100\%)$$

$$= \left(\frac{7}{8} \cdot 100\right)\%$$


$$= \frac{700}{8}\% = 87.5\%$$

**APPLY THE CONCEPT**

In a recent year,  $\frac{1}{4}$  of college students who were credit card holders used a credit card to pay for tuition. (Source: American Council on Education) What percent of college students who were credit card holders used a credit card to pay for tuition?

Write  $\frac{1}{4}$  as a percent by multiplying  $\frac{1}{4}$  by 100%.  $\frac{1}{4} = \frac{1}{4}(100\%) = 25\%$

**25% of students who were credit card holders used a credit card to pay for tuition.**



**THINK ABOUT IT** exercises promote deeper conceptual understanding. Completing these exercises will expand your understanding of the concepts being addressed.

50. **a.** Write a proportion in which the product of the means and the product of the extremes is 60.

**b.** Using different numbers than you used in part (a), write another proportion in which the product of the means and the product of the extremes is 60.

**CRITICAL THINKING** exercises may involve further exploration or analysis of the topic at hand. They may also integrate concepts introduced earlier in the text.

**Critical Thinking**

69. **Elections** A survey of voters in a city claimed that 2 people of every 5 who voted cast a ballot in favor of city amendment A, and 3 people of every 4 who voted cast a ballot against amendment A. Is this possible? Explain your answer.

70. Determine whether the statement is true or false.

**a.** A quotient  $(a \div b)$  is a ratio. **b.** If  $\frac{a}{b} = \frac{c}{d}$ , then  $\frac{b}{a} = \frac{d}{c}$ .

**c.** If  $\frac{a}{b} = \frac{c}{d}$ , then  $\frac{a}{c} = \frac{b}{d}$ . **d.** If  $\frac{a}{b} = \frac{c}{d}$ , then  $\frac{a}{d} = \frac{c}{b}$ .

71. **Lotteries** Three people put their money together to buy lottery tickets. The first person put in \$25, the second person put in \$30, and the third person put in \$35. One of the tickets was a winning ticket. If the winning ticket paid \$4.5 million, what was the first person's share of the winnings?

Working through the application exercises that contain **REAL DATA** will prepare you to answer questions and solve problems that you encounter outside of class, using facts and information that you gather on your own.

63. **Exercise** Walking 5 mi in 2 h will burn 650 calories. Walking at the same rate, how many miles would a person need to walk to lose 1 lb? (The burning of 3500 calories is equivalent to the loss of 1 lb.) Round to the nearest hundredth.

64. **Travel** An account executive bought a new car and drove 22,000 mi in the first 4 months. At the same rate, how many miles will the account executive drive in 3 years?

65. **Elections** A pre-election survey showed that 2 out of every 3 eligible voters would cast ballots in the county election. There are 240,000 eligible voters in the county. How many people are expected to vote in the election?

66. **Food Waste** Using the rate given in the news clipping at the right, find the cost of food wasted by **a.** the average family of three and **b.** the average family of five.

67. **Cartography** The scale on a map is  $\frac{1}{2}$  in. equals 8 mi. What is the actual distance between two points that are  $1\frac{1}{4}$  in. apart on the map?

68. **Candles** A slow-burning candle will burn 1.5 in. in 40 min. How many inches will the candle burn in 4 h?

**In the NEWS!**

**How Much Food Do You Waste?**


In the United States, the estimated cost of food wasted each year by the average family of four is \$590.  
Source: University of Arizona

**New** **IN THE NEWS** exercises help you understand the importance of mathematics in our everyday world. These application exercises are based on information taken from popular media sources such as newspapers, magazines, and the Internet.

By completing the **WRITING** exercises, you will improve your communication skills while increasing your understanding of mathematical concepts.

71. **Lotteries** Three people put their money together to buy lottery tickets. The first person put in \$25, the second person put in \$30, and the third person put in \$35. One of the tickets was a winning ticket. If the winning ticket paid \$4.5 million, what was the first person's share of the winnings?

72. **Nutrition** A pancake 4 in. in diameter contains 5 g of fat. How many grams of fat are contained in a pancake 6 in. in diameter? Explain how you arrived at your answer.



# Focus on Study Skills

An emphasis on setting a foundation of good study habits is woven into the text.

**CHAPTER A, AIM FOR SUCCESS,** outlines study skills that are used by students who have been successful in this course. By making Chapter A the first chapter of the text, the stage is set for a successful beginning to the course.

**UPDATED!**

**New** **FOCUS ON SUCCESS** appears at the start of each Chapter Opener. These tips are designed to help you make the most of the text and your time as you progress through the course and prepare for tests and exams.

**New** **TIPS FOR SUCCESS** boxes outline good study habits and function as reminders throughout the text.

# Focus on Skills and Problem Solving

The following features exemplify the emphasis on skills and the problem-solving process.

**New** **HOW TO** examples provide solutions with detailed explanations for selected topics in each section.

**HOW TO 2** What is  $33\frac{1}{3}\%$  of 90?

Use the basic percent equation.

Percent =  $33\frac{1}{3}\% = \frac{1}{3}$ , base = 90, amount =  $n$

$$\frac{1}{3} \cdot 90 = n$$

$$30 = n$$

$33\frac{1}{3}\%$  of 90 is 30.

The three elements of the basic percent equation are the percent, the base, and the amount. If any two elements of the basic percent equation are given, the third element can be

**INTEGRATING TECHNOLOGY** margin notes offer optional instruction in the use of a scientific calculator.


**OBJECTIVE B** To find the opposite of a number

**Integrating Technology**  
The **+** key on your calculator is used to find the opposite of a number. The **-** key is used to perform the operation of subtraction.

The distance from 0 to 3 on the number line is 3 units. The distance from 0 to -3 on the number line is 3 units. 3 and -3 are the same distance from 0 on the number line, but 3 is to the right of 0 and -3 is to the left of 0.

Two numbers that are the same distance from zero on the number line but on opposite sides of zero are called **opposites**.

-3 is the opposite of 3 and 3 is the opposite of -3.



The **EXAMPLE/YOU TRY IT** matched pairs are designed to actively involve you in the learning process. The You Try Its are based on the Examples. These problems are paired so that you can easily refer to the steps in the Example as you work through the accompanying You Try It.

**EXAMPLE 3** 60 is 2.5% of what?

**Solution**  
Use the basic percent equation.  
Percent = 2.5% = 0.025, base =  $n$ , amount = 60  
Percent  $\cdot$  base = amount  
 $0.025 \cdot n = 60$   
 $\frac{0.025n}{0.025} = \frac{60}{0.025}$   
 $n = 2400$   
60 is 2.5% of 2400.

**YOU TRY IT 3**  $16\frac{2}{3}\%$  of what is 15?

**Your solution**

*Solution on p. S23*

Complete, **WORKED-OUT SOLUTIONS** to the You Try Its are included in an appendix at the back of the text. Compare your solution to the solution given in the appendix to obtain immediate feedback and reinforcement of the concept you are studying.

**Solutions to Chapter 8 "You Try It"**

**SECTION 8.1**

**You Try It 1** 33% means 33 out of 100. 33 out of every 100 Americans carry balances up to \$10,000 on their credit cards.

**You Try It 2**  $110\% = 110 \left( \frac{1}{100} \right) = \left( \frac{110}{100} \right) = 1\frac{1}{10}$   
 $110\% = 110(0.01) = 1.10$

**You Try It 3**  $33\frac{1}{3}\% = 33\frac{1}{3} \left( \frac{1}{100} \right) = \frac{100}{3} \left( \frac{1}{100} \right)$   
 $= \frac{100}{300} = \frac{1}{3}$

**You Try It 3**  $n = 0.625 = 62.5\%$   
25 is 62.5% of 40.

**You Try It 3** **Strategy** To find the base, use the basic percent equation. Percent =  $16\frac{2}{3}\% = \frac{1}{6}$ , base =  $n$ , amount = 15  
**Solution** Percent  $\cdot$  base = amount  
 $\frac{1}{6} \cdot n = 15$   
 $6 \cdot \frac{1}{6}n = 15 \cdot 6$   
 $n = 90$   
 $16\frac{2}{3}\%$  of 90 is 15.

The **PROBLEM-SOLVING APPROACH** used throughout the text emphasizes the importance of problem-solving strategies. Model strategies are presented as guides for you to follow as you attempt the You Try Its that accompany the numbered Examples.

**EXAMPLE 9** A department store has a blue blazer on sale for \$114, which is 60% of the original price. What is the difference between the original price and the sale price?

**Strategy**  
To find the difference between the original price and the sale price:  
• Find the original price. Use the basic percent equation.  
Percent = 60% = 0.60.

**YOU TRY IT 9** An electrician's wage this year is \$30.13 per hour, which is 115% of last year's hourly wage. What is the increase in the hourly wage over the past year?

**Your strategy**


**PROJECTS OR GROUP ACTIVITIES** appear at the end of each exercise set. Your instructor may assign these individually, or you may be asked to work through the activities in groups.

**UPDATED!**

**Projects or Group Activities**

**24. Buying and Maintaining a Car** Suppose a student has an after-school job to earn money to buy and maintain a car. We will make assumptions about the monthly costs in several categories in order to determine how many hours per week the student must work to support the car. Assume that the student earns \$9.50 per hour.

a. Monthly payment  
Assume that the car cost \$8500 with a down payment of \$1020. The remainder is financed for 3 years at an annual simple interest rate of 9%.





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# AIM for Success

# A

## OBJECTIVES

### SECTION A.1

- Get Ready
- Motivate Yourself
- Develop a “Can Do” Attitude Toward Math
- Strategies for Success
- Time Management
- Habits of Successful Students

### SECTION A.2

- Get the Big Picture
- Understand the Organization
- Use the Interactive Method
- Use a Strategy to Solve Word Problems
- Ace the Test
- Ready, Set, Succeed!

## Focus on Success

This important chapter describes study skills that are used by students who have been successful in this course. Chapter A covers a wide range of topics that focus on what you need to do to succeed in this class. It includes a complete guide to the textbook and how to use its features to become a successful student.

## Prep Test



### Are you ready to succeed in this course?

1. Read this chapter. Answer all of the questions. Write down your answers on paper.
2. Write down your instructor's name.
3. Write down the classroom number.
4. Write down the days and times the class meets.
5. Bring your textbook, a notebook, and a pen or pencil to every class.
6. Be an active participant, not a passive observer.

SECTION

# A.1

## How to Succeed in This Course

### Get Ready

We are committed to your success in learning mathematics and have developed many tools and resources to support you along the way.

#### DO YOU WANT TO EXCEL IN THIS COURSE?

Read on to learn about the skills you'll need and how best to use this book to get the results you want.

We have written this text in an *interactive* style. More about this later but, in short, this means that you are supposed to interact with the text. Do not just read the text! Work along with it. Ready? Let's begin!

#### WHY ARE YOU TAKING THIS COURSE?

Did you interact with the text, or did you just read the last question? Get some paper and a pencil or pen and answer the question. Really—you will have more success in math and other courses you take if you **actively participate**. Now, **interact**. Write down one reason you are taking this course.

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Of course, we have no idea what you just wrote, but experience has shown us that many of you wrote something along the lines of “I have to take it to graduate” or “It is a pre-requisite to another course I have to take” or “It is required for my major.” Those reasons are perfectly fine. Every teacher has had to take courses that were not directly related to his or her major.

#### WHY DO YOU WANT TO SUCCEED IN THIS COURSE?

Think about why you want to succeed in this course. List the reasons here (not in your head . . . on the paper!):

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One reason you may have listed is that math skills are important in order to be successful in your chosen career. That is certainly an important reason. Here are some other reasons.

- Math is a skill that applies across careers, which is certainly a benefit in our world of changing job requirements. A good foundation in math may enable you to more easily make a career change.
- Math can help you learn critical thinking skills, an attribute all employers want.
- Math can help you see relationships between ideas and identify patterns.

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### Take Note

Motivation alone won't lead to success. For example, suppose a person who cannot swim is rowed out to the middle of a lake and thrown overboard. That person has a lot of motivation to swim, but most likely will drown without some help. You'll need motivation *and* learning in order to succeed.

## Motivate Yourself

You'll find many real-life problems in this book, relating to sports, money, cars, music, and more. We hope that these topics will help you understand how mathematics is used in everyday life. To learn all of the necessary skills and to understand how you can apply them to your life outside of this course, **motivate** yourself to learn.

One of the reasons we asked you why you are taking this course was to provide motivation for you to succeed. When there is a reason to do something, that task is easier to accomplish. We understand that you may not want to be taking this course but, to achieve your career goal, this is a necessary step. Let your career goal be your motivation for success.

### MAKE THE COMMITMENT TO SUCCEED!

With practice, you will improve your math skills. Skeptical? Think about when you first learned to drive a car, ride a skateboard, dance, paint, surf, or any other talent that you now have. You may have felt self-conscious or concerned that you might fail. But with time and practice, you learned the skill.

List a situation in which you accomplished your goal by spending time practicing and perfecting your skills (such as learning to play the piano or to play basketball):

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You do not get “good” at something by doing it once a week. **Practice** is the backbone of any successful endeavor—including math!

## Develop a “Can Do” Attitude Toward Math

You can do math! When you first learned the skills you just listed above, you may not have done them well. With practice, you got better. With practice, you will get better at math. Stay focused, motivated, and committed to success.

We cannot emphasize enough how important it is to overcome the “I Can't Do Math” syndrome. If you listen to interviews of very successful athletes after a particularly bad performance, you will note that they focus on the positive aspects of what they did, not the negative. Sports psychologists encourage athletes always to be positive—to have a “can do” attitude. Develop this attitude toward math and you will succeed.

Change your conversation about mathematics. Do not say “I can't do math,” “I hate math,” or “Math is too hard.” These comments just give you an excuse to fail. You don't want to fail, and we don't want you to fail. Write it down now: **I can do math!**

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## Strategies for Success

### PREPARE TO SUCCEED

There are a number of things that may be worrisome to you as you begin a new semester. List some of those things now.



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Here are some of the concerns expressed by our students.

- **Tuition**  
Will I be able to afford school?
- **Job**  
I must work. Will my employer give me a schedule that will allow me to go to school?
- **Anxiety**  
Will I succeed?
- **Child care**  
What will I do with my kids while I'm in class or when I need to study?
- **Time**  
Will I be able to find the time to attend class and study?
- **Degree goals**  
How long will it take me to finish school and earn my degree?

These are all important and valid concerns. Whatever your concerns, acknowledge them. Choose an education path that allows you to accommodate your concerns. Make sure they don't prevent you from succeeding.

### SELECT A COURSE

Many schools offer math assessment tests. These tests evaluate your present math skills. They don't evaluate how smart you are, so don't worry about your score on the test. If you are unsure about where you should start in the math curriculum, these tests can show you where to begin. You are better off starting at a level that is appropriate for you than starting with a more advanced class and then dropping it because you can't keep up. Dropping a class is a waste of time and money.

If you have difficulty with math, avoid short courses that compress the class into a few weeks. If you have struggled with math in the past, this environment does not give you the time to process math concepts. Similarly, avoid classes that meet once a week. The time delay between classes makes it difficult to make connections between concepts.

Some career goals require a number of math courses. If that is true of your major, try to take a math course every semester until you complete the requirements. Think about it this way. If you take, say, French I, and then wait two semesters before taking French II, you may forget a lot of material. Math is much the same. You must keep the concepts fresh in your mind.

### Time Management

One of the most important requirements in completing any task is to acknowledge the amount of time it will take to finish the job successfully. Before a construction company starts to build a skyscraper, the company spends months looking at how much time each of the phases of construction will take. This is done so that resources can be allocated when appropriate. For instance, it would not make sense to schedule the electricians to run wiring until the walls are up.

### MANAGE YOUR TIME!

We know how busy you are outside of school. Do you have a full-time or a part-time job? Do you have children? Do you visit your family often? Do you play school sports or participate in the school orchestra or theater company? It can be stressful to balance all of the important activities and responsibilities in your life. Creating a time management plan will help you schedule enough time to do everything you need to do. Let's get started.



First, you need a calendar. You can use a daily planner, a calendar for a smartphone, or an online calendar, such as the ones offered by Google, MSN, or Yahoo. It is best to have a calendar on which you can fill in daily activities and be able to see a weekly or monthly view as well.

Start filling in your calendar now, even if it means stopping right here and finding a calendar. Some of the things you might include are:

- The hours each class meets
- Time for driving to and from work or school
- Leisure time, an important aspect of a healthy lifestyle
- Time for study. Plan at least one hour of study for each hour in class. This is a *minimum!*
- Time to eat
- Your work schedule
- Time for extracurricular activities such as sports, music lessons, or volunteer work
- Time for family and friends
- Time for sleep
- Time for exercise



### Take Note

Be realistic about how much time you have. One gauge is that working 10 hours per week is approximately equivalent to taking one three-unit course. If your college considers 15 units a full load and you are working 10 hours per week, you should consider taking 12 units. The more you work, the fewer units you should take.

We really hope you did this. If not, please reconsider. One of the best pathways to success is understanding how much time it takes to succeed. When you finish your calendar, if it does not allow you enough time to stay physically and emotionally healthy, rethink some of your school or work activities. We don't want you to lose your job because you have to study math. On the other hand, we don't want you to fail in math because of your job.

If math is particularly difficult for you, consider taking fewer course units during the semesters you take math. This applies equally to any other subject that you may find difficult. There is no rule that you must finish college in four years. It is a myth—discard it now.

Now extend your calendar for the entire semester. Many of the entries will repeat, such as the time a class meets. In your extended calendar, include significant events that may disrupt your normal routine. These might include holidays, family outings, birthdays, anniversaries, or special events such as a concert or a football game. In addition to these events, be sure to include the dates of tests, the date of the final exam, and dates that projects or papers are due. These are all important semester events. Having them on your calendar will remind you that you need to make time for them.



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## CLASS TIME

To be successful, **attend class**. You should consider your commitment to attend class as serious as your commitment to your job or to keeping an appointment with a dear friend. It is difficult to overstate the importance of attending class. If you miss work, you don't get paid. If you miss class, you are not getting the full benefit of your tuition dollar. You are losing money.

If, by some unavoidable situation, you cannot attend class, find out as soon as possible what was covered in class. You might:

- Ask a friend for notes and the assignment.
- Contact your instructor and get the assignment. Missing class is no excuse for not being prepared for the next class.
- Determine whether there are online resources that you can use to help you with the topics and concepts that were discussed in the class you missed.

Going to class is important. Once you are there, **participate in class**. Stay involved and active. When your instructor asks a question, try to at least mentally answer the question. If you have a question, ask. Your instructor expects questions and wants you to understand the concept being discussed.

## HOMEWORK TIME

In addition to attending class, you must **do homework**. Homework is the best way to reinforce the ideas presented in class. You should plan on at least one to two hours of



homework and study for each hour you are in class. We've had many students tell us that one to two hours seems like a lot of time. That may be true, but if you want to attain your goals, you must be willing to devote the time to being successful in this math course.

You should schedule study time just as if it were class time. To do this, write down where and when you study best. For instance, do you study best at home, in the library, at the math center, under a tree, or somewhere else? Some psychologists who research successful study strategies suggest that just by varying where you study, you can increase the effectiveness of a study session. While you are considering where you prefer to study, also think about the time of day during which your study period will be most productive. Write down your thoughts.

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Look at what you have written, and be sure that you can consistently be in your favorite study environment at the time you have selected. Studying and homework are extremely important. Just as you should not miss class, **do not miss study time.**

Before we leave this important topic, we have a few suggestions. If at all possible, create a study hour right after class. The material will be fresh in your mind, and the immediate review, along with your homework, will help reinforce the concepts you are learning.

If you can't study right after class, make sure that you set aside some time *on the day of the class* to review notes and begin the homework. The longer you wait, the more difficult it will be to recall some of the important points covered during class. Study math in small chunks—one hour a day (perhaps not enough for most of us), every day, is better than seven hours in one sitting. If you are studying for an extended period of time, break up your study session by studying one subject for a while and then moving on to another subject. Try to alternate between similar or related courses. For instance, study math for a while, then science, and then back to math. Or study history for a while, then political science, and then back to history.

Meet some of the people in your class and try to **put together a study group.** The group could meet two or three times a week. During those meetings, you could quiz each other, prepare for a test, try to explain a concept to someone else in the group, or get help on a topic that is difficult for you.

After reading these suggestions, you may want to rethink where and when you study best. If so, do that now. Remember, however, that it is your individual style that is important. Choose what works for *you*, and stick to it.

## Habits of Successful Students

There are a number of habits that successful students use. Think about what these might be, and write them down.

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What you have written is very important. The habits you have listed are probably the things you know you must do to succeed. Here is a list of some responses from successful students we have known.

- **Set priorities.** You will encounter many distractions during the semester. Do not allow them to prevent you from reaching your goal.



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- **Take responsibility.** Your instructor, this textbook, tutors, math centers, and other resources are there to help you succeed. Ultimately, however, you must choose to learn. You must choose success.
- **Hang out with successful students.** Success breeds success. When you work and study with successful students, you are in an environment that will help you succeed. Seek out people who are committed to their goals.
- **Study regularly.** We have mentioned this before, but it is too important not to be repeated.
- **Self test.** Once every few days, select homework exercises from previous assignments and use them to test your understanding. Try to do these exercises without getting help from examples in the text. These self tests will help you gain confidence that you can do these types of problems on a test given in class.
- **Try different strategies.** If you read the text and are still having difficulty understanding a concept, consider going a step further. Contact the instructor or find a tutor. Many campuses have some free tutorial services. Go to the math or learning center. Consult another textbook. Be active and get the help you need.
- **Make flash cards.** This is one of the strategies that some math students do not think to try. Flash cards are a very important part of learning math. For instance, your instructor may use words or phrases such as *linear*, *quadratic*, *exponent*, *base*, *rational*, and many others. If you don't know the meanings of these words, you will not know what is being discussed.
- **Plod along.** Your education is not a race. The primary goal is to finish. Taking too many classes and then dropping some does not get you to the end any faster. Take only as many classes as you can successfully manage.

## SECTION

## A.2

## How to Use This Text to Succeed in this Course

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### Get the Big Picture

One of the major resources that you will have access to the entire semester is this textbook. We have written this text with you and your success in mind. The following is a guide to the features of this text that will help you succeed.

Actually, we want you to get the *really* big picture. Take a few minutes to read the table of contents. You may feel some anxiety about all the new concepts you will be learning. Try to think of this as an exciting opportunity to learn math. Now look through the entire book. Move quickly. Don't spend more than a few seconds on each page. Scan titles, look at pictures, and notice diagrams.

Getting this “big picture” view will help you see where this course is going. To reach your goal, it's important to get an idea of the steps you will need to take along the way.

As you look through the book, find topics that interest you. What's your preference? Racing? Sailing? TV? Amusement parks? Find the Index of Applications at the front of the book, and pull out three subjects that interest you. Write those topics here.

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## Understand the Organization

Look again at the Table of Contents. There are 10 chapters in this book. You'll see that every chapter is divided into sections, and each section contains a number of learning objectives. Each learning objective is labeled with a letter from A to E. Knowing how this book is organized will help you locate important topics and concepts as you're studying.

Before you start a new objective, take a few minutes to read the Objective Statement for that objective. Then, browse through the objective material. Especially note the words or phrases in bold type—these are important concepts that you'll need to know as you move along in the course. These words are good candidates for flash cards. If possible, include an example of the concept on the flash card, as shown at the left.

### Flash Card

*Rule for Multiplying  
Exponential Expressions*

*If  $m$  and  $n$  are integers,  
then  $x^m \cdot x^n = x^{m+n}$ .*

*Example*

$$a^4 \cdot a^5 = a^{4+5} = a^9$$

You will also see important concepts and rules set off in boxes. Here is one about exponents. These rules are also good candidates for flash cards.

### Rule for Multiplying Exponential Expressions

If  $m$  and  $n$  are positive integers, then  $x^m \cdot x^n = x^{m+n}$ .

#### EXAMPLE

Simplify:  $a^4 \cdot a^5$

$$a^4 \cdot a^5 = a^{4+5}$$

$$= a^9$$

- This is the product of two exponential expressions with the same base. Add the exponents.

Leaf through Section 2.1 of Chapter 2. Write down the words in bold and any concepts or rules that are displayed in boxes.

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## Use the Interactive Method

As we mentioned earlier, this textbook is based on an interactive approach. We want you to be actively involved in learning mathematics, and have given you many suggestions for getting “hands-on” with this book.

**HOW TO** Look on page 493. See the HOW TO 3? A HOW TO introduces a concept (in this case, solving a percent problem) and includes a step-by-step solution of the type of exercise you will find in the homework.

**HOW TO 3** 20 is what percent of 32?

Use the basic percent equation.

Percent =  $n$ , base = 32, amount = 20Solve for  $n$  by dividing each side of the equation by 32.

Write the decimal as a percent.

20 is 62.5% of 32.

Percent  $\cdot$  base = amount

$$n \cdot 32 = 20$$

$$\frac{32n}{32} = \frac{20}{32}$$

$$n = 0.625$$

$$n = 62.5\%$$

Grab paper and a pencil and work along as you're reading through the HOW TO. When you're done, get a clean sheet of paper. Write down the problem and try to complete the solution without looking at your notes or at the book. When you're done, check your answer. If you got it right, you're ready to move on.

Look through the text and find three instances of a HOW TO. Write the concept illustrated in each HOW TO here.

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**Example/You Try It Pair** You'll need hands-on practice to succeed in mathematics. When we show you an example, work it out yourself, right beside the solution. Use the Example/You Try It pairs to get the practice you need.

Take a look at page 377. Example 6 and You Try It 6 are shown here.

**EXAMPLE 6**Solve and check:  $3y - 7y = 8$ **Solution**

$$3y - 7y = 8$$

$$-4y = 8$$

• **Combine like terms.**

$$\frac{-4y}{-4} = \frac{8}{-4}$$

• **Divide by  $-4$ .**

$$y = -2$$

Check:

$$\begin{array}{r|l} 3y - 7y = 8 & \\ 3(-2) - 7(-2) & 8 \\ -6 - (-14) & 8 \\ -6 + 14 & 8 \\ 8 & 8 \end{array}$$

$-2$  checks as the solution.

The solution is  $-2$ .

**YOU TRY IT 6**Solve and check:  $\frac{1}{3}x - \frac{5}{6}x = 4$ **Your solution**

*Solution on p. S17*

You'll see that each Example is fully worked out. Study the Example by carefully working through each step. Then, try to complete the You Try It. Use the solution to the Example as a model for solving the You Try It. If you get stuck, the solutions to the You Try Its are provided in the back of the book. There is a page number directly following the You Try It that shows you where you can find the completely-worked-out solution. Use the solution to get a hint for the step on which you are stuck. Then, try again!

When you've arrived at your solution, check your work against the solution in the back of the book. Turn to page S17 to see the solution for You Try It 6.

Remember that sometimes there is more than one way to solve a problem. But your answer should always match the answer we've given in the back of the book. If you have any questions about whether your method will always work, check with your instructor.

## Use a Strategy to Solve Word Problems

Learning to solve word problems is one of the reasons you are studying math. This is where you combine all of the critical thinking skills you have learned to solve practical problems.

Try not to be intimidated by word problems. Basically, what you need is a strategy that will help you come up with the equation you will need to solve the problem. When you are looking at a word problem, try the following:

- **Read the problem.** This may seem pretty obvious, but we mean really **read** it. Don't just scan it. Read the problem slowly and carefully.
- **Write down what is known and what is unknown.** Now that you have read the problem, go back and write down everything that is known. Next, write down what it is you are trying to find. *Write* this—don't just think it! Be as specific as you can. For instance, if you are asked to find a distance, don't just write "I need to find the distance." Be specific and write "I need to find the distance between Earth and the moon."
- **Think of a method to find the unknown.** For instance, is there a formula that relates the known and unknown quantities? This is certainly the most difficult step. Eventually, you must write an equation to be solved.
- **Solve the equation.** Be careful as you solve the equation. There is no sense in getting to this point and then making a careless mistake. The unknown in most word problems will include a unit such as feet, dollars, or miles per hour. When you write your answer, include the unit. An answer such as 20 doesn't mean much. Is it 20 feet, 20 dollars, 20 miles per hour, or something else?
- **Check your solution.** Now that you have an answer, go back to the problem and ask yourself whether it makes sense. This is an important step. For instance, if, according to your answer, the cost of a car is \$2.51, you know that something went wrong.

In this text, the solution of every word problem is broken down into two steps, **Strategy** and **Solution**. The Strategy consists of the first three steps discussed above. The Solution is the last two steps. Here is an Example from page 507 of the text. Because you have not yet studied the concepts involved in the problem, you may not be able to solve it. However, note the detail in the Strategy. When you do the You Try It following an Example, be sure to include your own Strategy.

**EXAMPLE 1**

A sales associate was earning \$11.60 per hour before an 8% increase in pay. What is the new hourly wage? Round to the nearest cent.

**Strategy**

To find the new hourly wage:

- Use the basic percent equation to find the increase in pay.  
Percent = 8% = 0.08, base = 11.60,  
amount =  $n$
- Add the amount of increase to the original wage.

**Solution**

Percent · base = amount

$$0.08 \cdot 11.60 = n$$

$$0.93 \approx n$$

$$\$11.60 + \$0.93 = \$12.53$$

The new hourly wage is \$12.53.

**YOU TRY IT 1**

An automobile manufacturer increased the average mileage on a car from 17.5 mi/gal to 18.2 mi/gal. Find the percent increase in mileage.

**Your strategy****Your solution**

*Solution on p. S24*

When you have finished studying a section, **do the exercises your instructor has selected**. Math is not a spectator sport. You must practice every day. Do the homework and do not get behind.

**Ace the Test**

There are a number of features in this text that will help you prepare for a test. These features will help you even more if you do just one simple thing: When you are doing your homework, go back to each previous homework assignment for the current chapter and rework two exercises. That's right—just *two* exercises. You will be surprised at how much better prepared you will be for a test by doing this.

Here are some additional aids to help you **ace the test**.

**Chapter Summary** Once you've completed a chapter, look at the Chapter Summary. The Chapter Summary is divided into two sections: **Key Words** and **Essential Rules and Procedures**. Flip to page 525 to see the Chapter Summary for Chapter 8. The summary shows all of the important topics covered in the chapter. Do you see the reference following each topic? This reference shows you the objective and page in the text where you can find more information on the concept.

Write down one Key Word and one Essential Rule or Procedure. Explain the meaning of the reference "8.1A, page 482."

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**Chapter Review Exercises** Turn to page 527 to see the Chapter Review Exercises for Chapter 8. When you do the review exercises, you're giving yourself an important opportunity to test your understanding of the chapter. The answer to each review exercise is given at the back of the book, along with the objective the question relates to. When you're done with the Chapter Review Exercises, check your answers. If you had trouble with any of the questions, you can restudy the objectives and retry some of the exercises in those objectives for extra help.

Go to the Answer Section at the back of the text. Find the answers for the Chapter Review Exercises for Chapter 8. Write down the answer to Exercise 25. Explain the meaning of the reference "8.3A."

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**Chapter Test** The Chapter Test for each chapter can be found after the Chapter Review Exercises and can be used to help you prepare for your exam. The answer to each question is given at the back of the book, along with both an objective reference and a reference to a HOW TO, Example, or You Try It that the question relates to. Think of these tests as "practice runs" for your in-class tests. Take the test in a quiet place, and try to work through it in the same amount of time that will be allowed for your actual exam.

The aids we have mentioned above will help you prepare for a test. You should begin your review *at least* two days before the test—three days is better. These aids will get you ready for the test.

Here are some suggestions to try while you are actually taking the test.

- **Try to relax.** We know that test situations make some students quite nervous or anxious. These feelings are normal. Try to stay calm and focused on what you know. If you have prepared as we have suggested, the answers will begin to come to you.
- **Scan the test.** Get a feeling for the big picture.
- **Read the directions carefully.** Make sure you answer each question fully.
- **Work the problems that are easiest for you first.** This will help you with your confidence and help reduce any nervous feelings you may have.

## Ready, Set, Succeed!

It takes hard work and commitment to succeed, but we know you can do it! Doing well in mathematics is just one step you'll take on your path to success. Good luck. We wish you success.





# Whole Numbers

# 1

## OBJECTIVES

### SECTION 1.1

- A** To identify the order relation between two numbers
- B** To write whole numbers in words, in standard form, and in expanded form
- C** To round a whole number to a given place value
- D** To solve application problems and use statistical graphs

### SECTION 1.2

- A** To add whole numbers
- B** To subtract whole numbers
- C** To solve application problems and use formulas

### SECTION 1.3

- A** To multiply whole numbers
- B** To simplify expressions that contain exponents
- C** To divide whole numbers
- D** To factor numbers and find the prime factorization of numbers
- E** To solve application problems and use formulas

### SECTION 1.4

- A** To solve equations
- B** To solve application problems and use formulas

### SECTION 1.5

- A** To use the Order of Operations Agreement to simplify expressions

## Focus on Success

Have you read Chapter A, AIM for Success? It describes study skills used by students who have been successful in their math courses. It gives you tips on how to stay motivated, how to manage your time, and how to prepare for exams. Chapter A also includes a complete guide to the textbook and how to use its features to be successful in this course. It starts on page AIM-1.



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## Prep Test

Are you ready to succeed in this chapter? Take the Prep Test below to find out if you are ready to learn the new material.

1. Name the number of ♦s shown below.

♦ ♦ ♦ ♦ ♦ ♦ ♦ ♦

2. Write the numbers from 1 to 10.

1 \_ \_ \_ \_ \_ 10

3. Match the number with its word form.

- |      |          |
|------|----------|
| a. 4 | A. five  |
| b. 2 | B. one   |
| c. 5 | C. zero  |
| d. 1 | D. four  |
| e. 3 | E. two   |
| f. 0 | F. three |

4. How many American flags contain the color green?

5. Write the number of states in the United States of America as a word, not a number.



## SECTION

## 1.1

## Introduction to Whole Numbers

## OBJECTIVE A

To identify the order relation between two numbers

The **natural numbers** are 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, . . . .

The three dots mean that the list continues on and on and that there is no largest natural number. The natural numbers are also called the **counting numbers**.

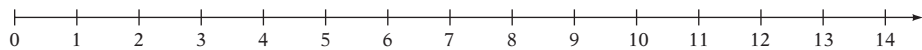


## Point of Interest

Among the slang words for zero are *zilch*, *zip*, and *goose egg*. The word *love* for zero in scoring a tennis game comes from the French for “the egg”: *l’oeuf*.

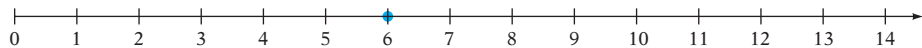
The **whole numbers** are 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, . . . . Note that the whole numbers include the natural numbers and zero.

Just as distances are associated with markings on the edge of a ruler, the whole numbers can be associated with points on a line. This line is called the **number line** and is shown below.



The arrowhead at the right indicates that the number line continues to the right.

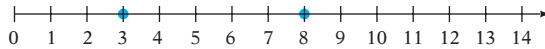
The **graph** of a whole number is shown by placing a heavy dot on the number line directly above the number. Shown below is the graph of 6 on the number line.



On the number line, the numbers get larger as we move from left to right. The numbers get smaller as we move from right to left. Therefore, the number line can be used to visualize the order relation between two whole numbers.

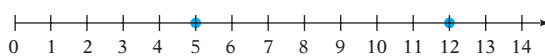
A number that appears to the right of a given number is **greater than** the given number. The symbol for *is greater than* is  $>$ .

8 is to the right of 3.  
8 is greater than 3.  
 $8 > 3$



A number that appears to the left of a given number is **less than** the given number. The symbol for *is less than* is  $<$ .

5 is to the left of 12.  
5 is less than 12.  
 $5 < 12$



## Take Note

An inequality symbol,  $<$  or  $>$ , points to the smaller number. The symbol opens toward the larger number.

An **inequality** expresses the relative order of two mathematical expressions.  $8 > 3$  and  $5 < 12$  are inequalities.

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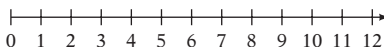
**EXAMPLE 1**

Graph 4 on the number line.

**Solution** 


**YOU TRY IT 1**

Graph 9 on the number line.

**Your solution** 

**EXAMPLE 2**

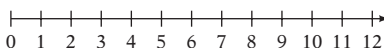
On the number line, what number is 3 units to the right of 4?

**Solution** 

7 is 3 units to the right of 4.

**YOU TRY IT 2**

On the number line, what number is 4 units to the left of 11?

**Your solution** 

**EXAMPLE 3**

Place the correct symbol,  $<$  or  $>$ , between the two numbers.

a. 38 23      b. 0 54

**Solution**

a.  $38 > 23$       b.  $0 < 54$

**YOU TRY IT 3**

Place the correct symbol,  $<$  or  $>$ , between the two numbers.

a. 47 19      b. 26 0

**Your solution**

**EXAMPLE 4**

Write the given numbers in order from smallest to largest.

16, 5, 47, 0, 83, 29

**Solution**

0, 5, 16, 29, 47, 83

**YOU TRY IT 4**

Write the given numbers in order from smallest to largest.

52, 17, 68, 0, 94, 3

**Your solution**

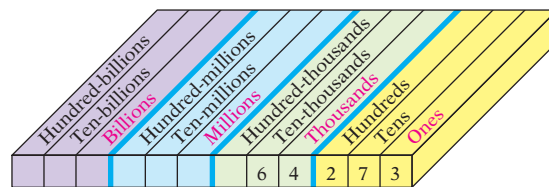
*Solutions on p. S1*

**OBJECTIVE B**

*To write whole numbers in words, in standard form, and in expanded form*

When a whole number is written using the digits 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9, it is said to be in **standard form**. The position of each digit in the number determines the digit's **place value**. The diagram below shows a **place-value chart** naming the first twelve place values. The number **64,273** is in standard form and has been entered in the chart.

In the number **64,273**, the position of the digit **6** determines that its place value is ten-thousands.



When a number is written in standard form, each group of digits separated by a comma is called a **period**. The number **5,316,709,842** has four periods. The period names are shown in red in the place-value chart above.

**Point of Interest**

The Romans represented numbers using M for 1000, D for 500, C for 100, L for 50, X for 10, V for 5, and I for 1. For example, MMDCCCLXXVI represented 2876. The Romans could represent any number up to the largest they would need for their everyday life, except zero.

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**Point of Interest**

George Washington used a code to communicate with his men. He had a book in which each word or phrase was represented by a three-digit number. The numbers were arbitrarily assigned to each entry. Messages appeared as a string of numbers and thus could not be decoded by the enemy.

To write a number in words, start from the left. Name the number in each period. Then write the period name in place of the comma.

5,316,709,842 is read “five billion three hundred sixteen million seven hundred nine thousand eight hundred forty-two.”

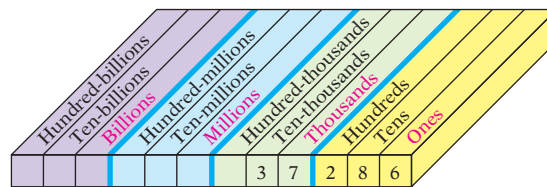
To write a whole number in standard form, write the number named in each period, and replace each period name with a comma.

Six million fifty-one thousand eight hundred seventy-four is written 6,051,874. The zero is used as a place holder for the hundred-thousands place.

The whole number 37,286 can be written in **expanded form** as

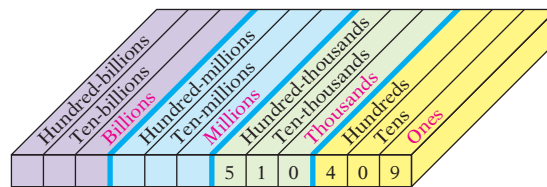
$$30,000 + 7000 + 200 + 80 + 6$$

The place-value chart can be used to find the expanded form of a number.



3		7		2		8		6
Ten-thousands	+	Thousands	+	Hundreds	+	Tens	+	Ones
30,000	+	7000	+	200	+	80	+	6

Write the number 510,409 in expanded form.



5		1		0		4		0		9
Hundred-thousands	+	Ten-thousand	+	Thousands	+	Hundreds	+	Tens	+	Ones
500,000	+	10,000	+	0	+	400	+	0	+	9
= 500,000 + 10,000 + 400 + 9										

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**EXAMPLE 5**

Write 82,593,071 in words.

**Solution**

eighty-two million five hundred ninety-three thousand seventy-one

**YOU TRY IT 5**

Write 46,032,715 in words.

**Your solution****EXAMPLE 6**

Write four hundred six thousand nine in standard form.

**Solution**

406,009

**YOU TRY IT 6**

Write nine hundred twenty thousand eight in standard form.

**Your solution****EXAMPLE 7**

Write 32,598 in expanded form.

**Solution**

$30,000 + 2000 + 500 + 90 + 8$

**YOU TRY IT 7**

Write 76,245 in expanded form.

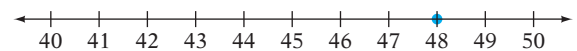
**Your solution**

*Solutions on p. S1*

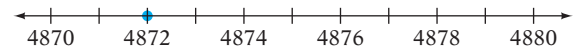
**OBJECTIVE C****To round a whole number to a given place value**

When the distance to the sun is given as 93,000,000 mi, the number represents an approximation to the true distance. Giving an approximate value for an exact number is called **rounding**. A number is rounded to a given place value.

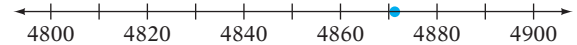
48 is closer to 50 than it is to 40.  
48 rounded to the nearest ten is 50.



4872 rounded to the nearest ten is 4870.



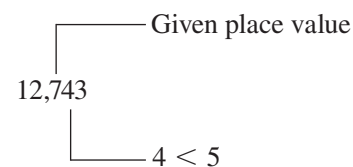
4872 rounded to the nearest hundred is 4900.



We can round a number to a given place value without using the number line by looking at the first digit to the right of the given place value.

**If the digit to the right of the given place value is less than 5, replace that digit and all digits to the right of it by zeros.**

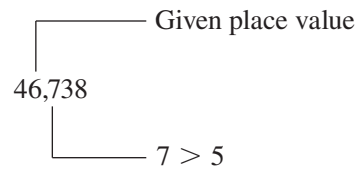
Round 12,743 to the nearest hundred.



12,743 rounded to the nearest hundred is 12,700.

If the digit to the right of the given place value is greater than or equal to 5, increase the digit in the given place value by 1, and replace all other digits to the right by zeros.

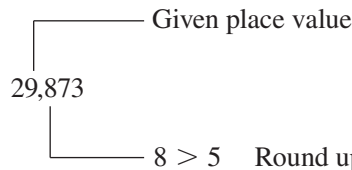
Round 46,738 to the nearest thousand.



46,738 rounded to the nearest thousand is 47,000.

#### HOW TO 1

Round 29,873 to the nearest thousand.



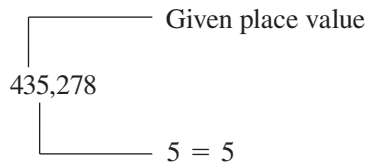
Round up by adding 1 to the 9 ( $9 + 1 = 10$ ).  
Carry the 1 to the ten-thousands place ( $2 + 1 = 3$ ).

29,873 rounded to the nearest thousand is 30,000.

#### EXAMPLE 8

Round 435,278 to the nearest ten-thousand.

#### Solution



435,278 rounded to the nearest ten-thousand is 440,000.

#### YOU TRY IT 8

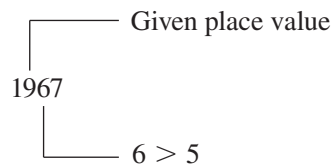
Round 529,374 to the nearest ten-thousand.

#### Your solution

#### EXAMPLE 9

Round 1967 to the nearest hundred.

#### Solution



1967 rounded to the nearest hundred is 2000.

#### YOU TRY IT 9

Round 7985 to the nearest hundred.

#### Your solution

Solutions on p. S1

**OBJECTIVE D***To solve application problems and use statistical graphs*

Graphs are displays that provide a pictorial representation of data. The advantage of graphs is that they present information in a way that is easily read.

A **pictograph** uses symbols to represent information. The symbol chosen usually has a connection to the data it represents.



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Bill Gates

Figure 1.1 represents the net worth of America's richest billionaires. Each symbol represents 10 billion dollars.

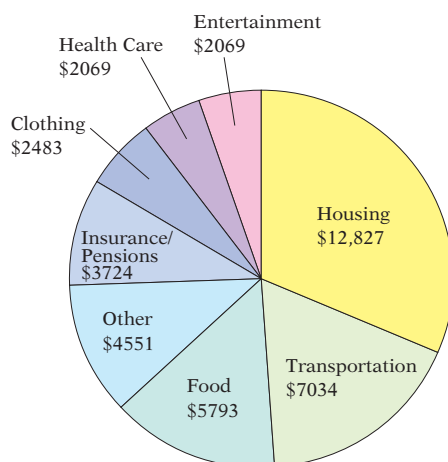
	Net Worth (in tens of billions of dollars)
Bill Gates	\$ \$ \$ \$ \$ \$ \$
Warren Buffett	\$ \$ \$ \$ \$
Larry Ellison	\$ \$ \$ \$
Christy Walton	\$ \$ \$
Sheldon Adelson	\$ \$

**Figure 1.1** Net Worth of America's Richest Billionaires

Source: www.Forbes.com

From the pictograph, we can see that **Bill Gates has the greatest net worth. Warren Buffett's net worth is \$10 billion more than Larry Ellison's net worth.**

A typical household in the United States has an average after-tax income of \$40,550. The **circle graph** in Figure 1.2 represents how this annual income is spent. The complete circle represents the total amount, \$40,550. Each sector of the circle represents the amount spent on a particular expense.



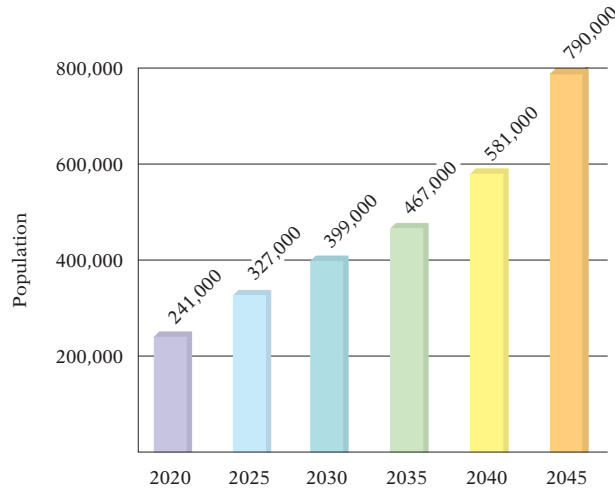
From the circle graph, we can see that **the largest amount is spent on housing. We can see that the amount spent on food (\$5,793) is less than the amount spent on transportation (\$7,034).**

**Figure 1.2** Average Annual Expenses in a U.S. Household

Source: American Demographics

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The **bar graph** in Figure 1.3 shows the expected U.S. population aged 100 and over for various years.



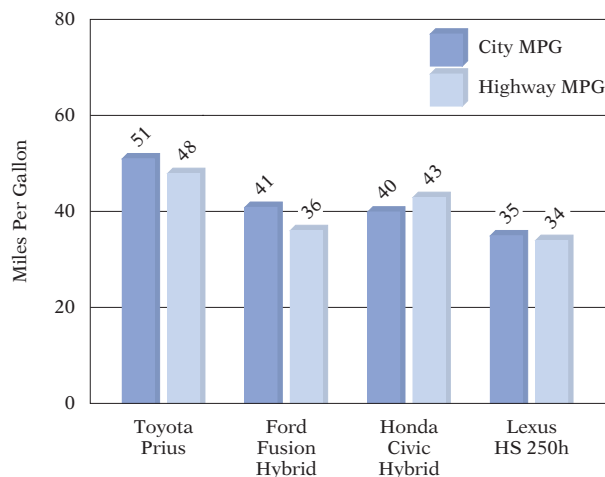
**Figure 1.3** Expected U.S. Population Aged 100 and Over

Source: Census Bureau

In this bar graph, the horizontal axis is labeled with the year (2020, 2025, 2030, etc.) and the vertical axis is labeled with the population. For each year, the height of the bar indicates the population for that year. For example, we can see that **the expected population aged 100 and over in the year 2030 is 399,000**. The graph indicates that **the number of people aged 100 and over is expected to increase steadily**.

A **double-bar graph** is used to display data for the purposes of comparison.

The double-bar graph in Figure 1.4 shows the fuel efficiency of four vehicles, as rated by the Environmental Protection Agency. These are among the most fuel-efficient 2011-model-year cars for city and highway mileage.

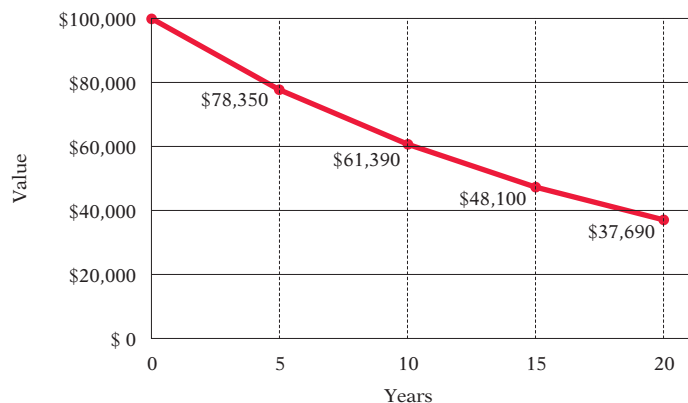


**Figure 1.4** EPA Fuel Efficiency Ratings

From the graph, we can see that **the fuel efficiency of the Ford Fusion Hybrid is less on the highway (36 mpg) than it is for city driving (41 mpg)**.

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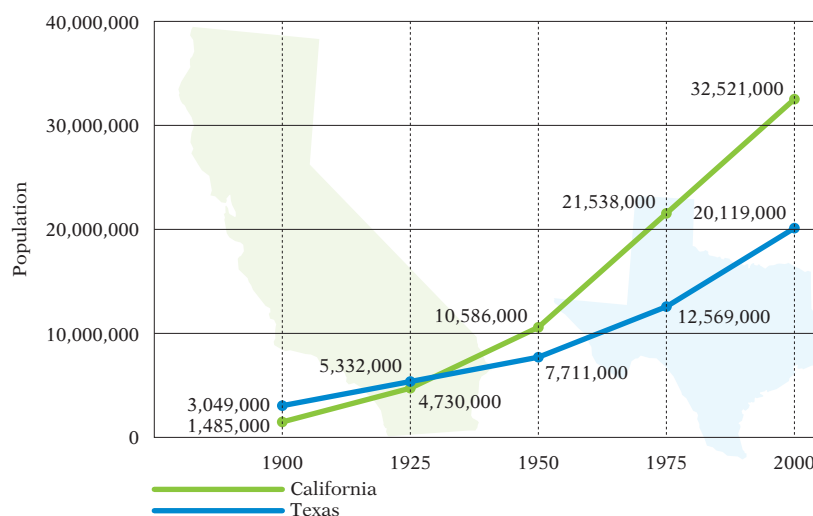
The **broken-line graph** in Figure 1.5 shows the effect of inflation on the value of a \$100,000 life insurance policy. (An inflation rate of 5 percent is used here.)



**Figure 1.5** Effect of Inflation on the Value of a \$100,000 Life Insurance Policy

According to the line graph, after five years the purchasing power of the \$100,000 policy has decreased to \$78,350. We can see that the value of the \$100,000 policy keeps decreasing over the 20-year period.

Two broken-line graphs can be used to compare data. Figure 1.6 shows the populations of California and Texas. The figures are those of the U.S. Census for the years 1900, 1925, 1950, 1975, and 2000. The numbers are rounded to the nearest thousand.



**Figure 1.6** Populations of California and Texas

From the graph, we can see that the population was greater in Texas in 1900 and 1925, while the population was greater in California in 1950, 1975, and 2000.