

Contemporary Mathematics for Business and Consumers



8th Edition

Robert Brechner and George Bergeman

EIGHTH EDITION

Contemporary Mathematics for Business and Consumers

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Contemporary Mathematics, 8e

Real Business. Real Math. Real Life.

Contemporary Mathematics, 8e helps students overcome math anxiety and confidently master key business and mathematics concepts!

FROM MOTIVATION TO MASTERY

Brechner's **accessible and engaging style** begins with a business-oriented review of basic math operations, including whole numbers, fractions, and decimals. After students master these operations, they move to basic equations and their use in solving business problems. These tools form a strong foundation enabling students to succeed as they study the wide range of business math topics presented in subsequent chapters.

REFLECTING THE LATEST IN REAL BUSINESS

Brechner incorporates numerous **realistic** and **current** problems that are designed to develop problem-solving and critical thinking skills.

- Coverage of personal finances addresses the newest ways to manage finances, including online bills and banking, debit cards, and e-management of accounts.
- Realistic business and government forms, checks, bank statements, financial statements, credit card statements, and invoices are featured throughout.
- Stock, bond, and mutual fund tables are taken from *The Wall Street Journal Online*.

SECTION I **8** MARKUP BASED ON COST

cost of goods sold The cost of the merchandise sold during an operating period. One of two major expense categories of a business.

operating expenses, or overhead All business expenses, other than cost of merchandise, required to operate a business, such as payroll, rent, utilities, and insurance.

markup, markon, or margin The amount added to the cost of an item to cover the operating expenses and profit. It is the difference between the cost and the selling price.

Determining an appropriate selling price for a company's goods or services is an extremely important function in business. The price must be attractive to potential customers, yet sufficient to cover expenses and provide the company with a reasonable profit.

In business, expenses are separated into two major categories. The first is the **cost of goods sold**. To a manufacturer, this expense would be the cost of production; to a wholesaler or retailer, the expense is the price paid to a manufacturer or distributor for the merchandise. The second category includes all the other expenses required to operate the business, such as salaries, rent, utilities, taxes, insurance, advertising, and maintenance. These expenses are known as **operating expenses**, overhead expenses, or simply **overhead**.

The amount added to the cost of an item to cover the operating expenses and profit is known as the **markup, markon, or margin**. It is the difference between the cost and the selling price of an item. Markup is applied at all levels of the marketing channels of distribution. This chapter deals with the business math applications involved in the pricing of goods and services.

8-1 UNDERSTANDING AND USING THE RETAILING EQUATION TO FIND COST, AMOUNT OF MARKUP, AND SELLING PRICE OF AN ITEM

The fundamental principle on which business operates is to sell goods and services for a price high enough to cover all expenses and provide the owners with a reasonable profit. The formula that describes this principle is known as the **retailing equation**. The equation states that the selling price of an item is equal to the cost plus the markup.

retailing equation The selling price of an item is equal to the cost plus the markup.

Selling price = Cost + Markup

STEP INTO THE REAL BUSINESS WORLD

Brechner's unique modular approach **breaks each chapter into separate learning components**, allowing you to customize the material and order of coverage to meet the specific learning needs of your students.



ENHANCE STUDENT LEARNING

Delivering both assessment and instruction, **CengageNOW™** delivers robust course management along with powerful assessment and instructional components. These components include pre-tests which generate a personalized study plan complete with step-wise interactive guide problems and videos by author George Bergeman. Assessment and instruction is further facilitated by algorithmic review exercises, algorithmic problems tied to each objective (complete with step-by-step solutions), and a full-featured test bank.

Additional Features and Tools Further Prepare Students for the Real World

END-OF-CHAPTER FEATURES

- A **Chapter Summary Chart** provides a comprehensive review of each performance objective. The chart emphasizes important chapter concepts, steps, formulas, and illustrative examples with worked-out solutions.

CHAPTER SUMMARY		
Section I: Solving Basic Equations		
Topic	Important Concepts	Illustrative Examples
Solving Equations for the Unknown and Proving the Solution Performance Objective 5-2, Page 125	To solve equations, we must move or transpose all the unknowns to one side and isolate all the knowns on the other side. It is customary for the unknowns to be on the left side and the knowns to be on the right side, such as $X = 33$. To solve for the unknown value, apply an inverse, or opposite, operation to both sides of the equation. Operation—Opposite Addition \longleftrightarrow Subtraction Subtraction \longleftrightarrow Addition Multiplication \longleftrightarrow Division Division \longleftrightarrow Multiplication	Solve the equation $R + 7 = 12$ The equation indicates addition; therefore, use the opposite operation: subtract 7 from both sides: $R + 7 = 12$ $- 7 = - 7$ $R = 5$ $R = 5$ Solve the equation $W - 4 = 30$ The equation indicates subtraction; therefore, use the opposite operation: add 4 to both sides: $W - 4 = 30$ $+ 4 = + 4$ $W = 34$ $W = 34$ Solve the equation $3G = 18$ The equation indicates multiplication; therefore, use the opposite operation: divide both sides by 3: $\frac{3G}{3} = \frac{18}{3}$ $G = 6$ Solve the equation $\frac{T}{5} = 9$ The equation indicates division; therefore, use the opposite operation: multiply both sides by 5: $(5)\frac{T}{5} = 9(5)$ $T = 45$

CONCEPT REVIEW

- The retailing equation states that the selling price is equal to the _____ plus the _____. (8-1)
- In business, expenses are separated into two major categories. The cost of _____ sold and _____ expenses. (8-1)
- There are two ways of expressing markup as a percent: based on _____ and based on _____. (8-2)
- Write the formula for calculating the selling price when markup is based on cost. (8-3)
- To calculate cost, we divide the _____ price by 100% plus the percent markup based on cost. (8-4)
- The percent markup based on selling price is equal to the _____ divided by the selling price. (8-5)
- When markup is based on selling price, the _____ price is the base and represents _____ percent. (8-6)
- To convert percent markup based on cost to percent markup based on selling price, we divide percent markup based on cost by 100% _____ the percent markup based on cost. (8-8)
- To convert percent markup based on selling price to percent markup based on cost, we divide percent markup based on selling price by 100% _____ the percent markup based on selling price. (8-8)
- A price reduction from the original selling price of merchandise is called a(n) _____. (8-9)
- Write the formula for calculating the sale price after a markdown. (8-10)
- In calculating a series of markups and markdowns, each calculation is based on the previous _____ price. (8-11)
- Products that have a certain shelf life and then no value at all, such as fruit, vegetables, flowers, and dairy products, are known as _____. (8-12)

- Concept Review** fill-in questions test students' comprehension of the basic concepts and important vocabulary of each chapter.

Also at the end of each chapter...

- An **Assessment Test** includes exercises with multiple parts that build on previous answers and previously-learned material to encourage critical thinking and problem-solving.
- A **Collaborative Learning Activity** provides practice working in teams while enhancing students' comprehension of the chapter topics and their relevance in real-world scenarios.

SUPPLEMENTAL TOOLS FOR STUDENTS

- Jump Start Solutions** provide worked-out solutions to the first question in each new topic set in the section exercises.
- Excel® Templates** corresponding to problems in the text are presented at three levels of difficulty.
- An **Excel® Guide and Workbook** helps students learn spreadsheet basics.
- Author Videos** (new for this edition) by George Bergeman accompany each objective and walk students through detailed step-by-step solutions to sample problems.
- A **Financial Calculator Guide and Workbook** provides keystroke-by-keystroke instruction on using a business calculator.

Students access these tools by going to www.cengagebrain.com. Enter "Brechtner" in the search box and select the appropriate text. Click the "Free Materials" tab, and then click "Access Now."

Step into the Real Business World

Special features engage students and connect business math topics to issues and concerns encountered in everyday life as well as in business settings.



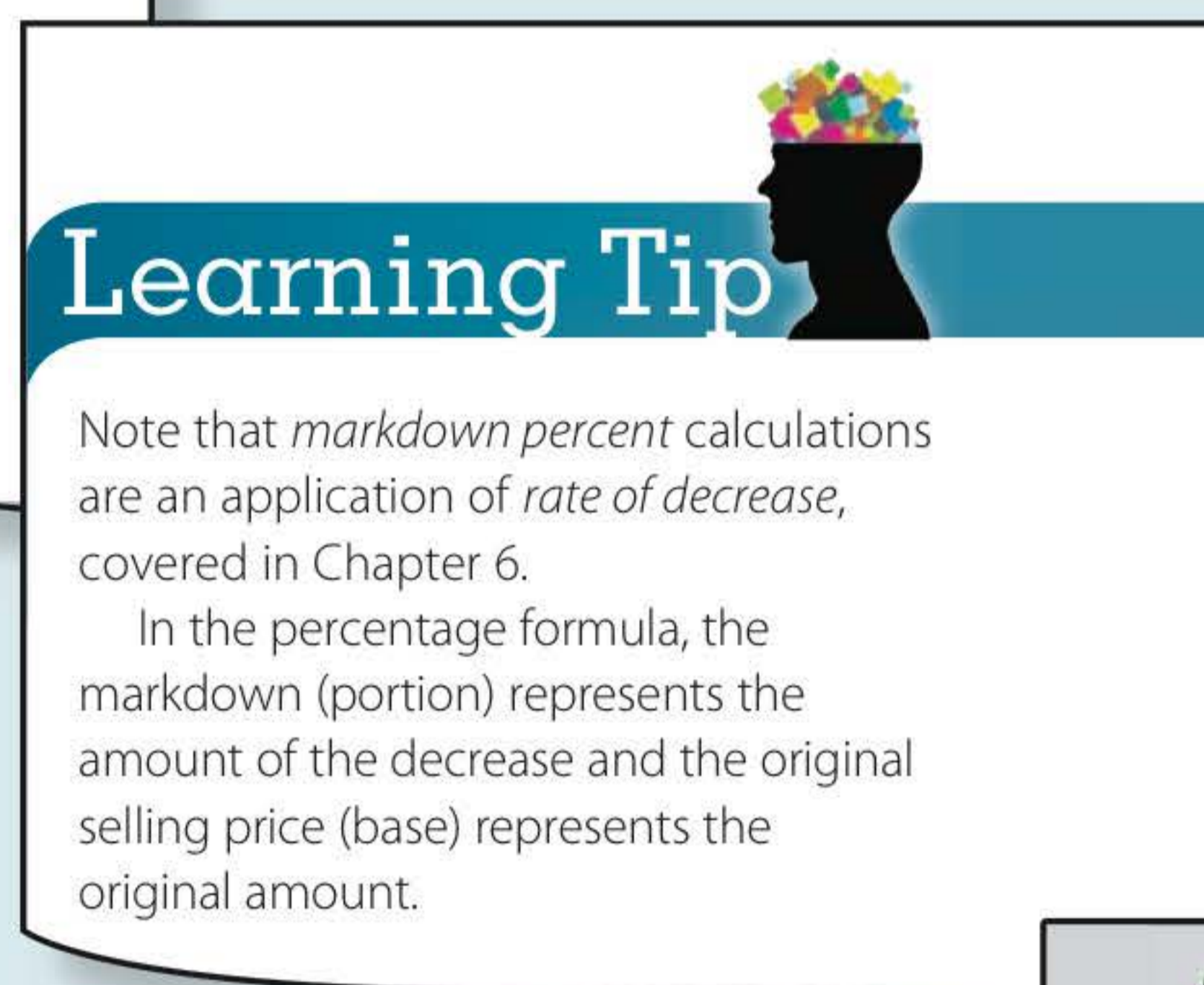
IN THE Business World

New Federal Debit Card – The U.S. Treasury now provides a debit card that people without traditional bank accounts can use to access federal benefits such as Social Security and disability payments.

Federal payments are credited to the cards each month, enabling users to make free withdrawals from ATMs in the government's Direct Express network.

IN THE BUSINESS WORLD

Useful and interesting notes provide connections to the real business world. Many have useful information to help students manage their own personal finance situations.



Learning Tip

Note that *markdown percent* calculations are an application of *rate of decrease*, covered in Chapter 6.

In the percentage formula, the markdown (portion) represents the amount of the decrease and the original selling price (base) represents the original amount.

LEARNING TIPS

Helpful mathematical hints, shortcuts, and reminders enhance students' understanding of the chapter material.

BUSINESS PROFILES

Accompanying selected exercises, photos and brief business-related profiles provide perspective, historical data, and other information to connect problems to the real world.

BUSINESS MATH JOURNAL

Appearing every three chapters, these pages provide current news items, cartoons, famous business and inspirational quotes, career information, and many other interesting facts and figures related to business topics.



Dollars AND Sense

Opportunity cost is the sacrifice of benefits from the next-best alternative when you make a financial or economic decision. To fully evaluate how much a checking account with a required minimum balance costs, calculate the opportunity cost.

Consider a bank that requires an average monthly balance of \$1,500. If you can earn 3% a year in interest on an investment maintaining this checking account means giving up \$45 in potential interest income.

DOLLARS AND SENSE

This feature stimulates student curiosity with current news items and statistics related to chapter topics. "Dollars and Sense" provides students with numerous personal finance and business money tips.

A Proven Step-by-step Learning System Powers Learning

Each chapter is broken into discrete performance objectives. For each objective, the text guides students to mastery by way of a carefully designed learning system that includes these components:

DETERMINING RATE OF INCREASE OR DECREASE

In calculating the rate of increase or decrease of something, we use the same percentage formula concepts as before. Rate of change means percent change; therefore, the *rate* is the unknown. Once again we use the formula $R = P \div B$. Rate of change situations contain an original amount of something, which either increases or decreases to a new amount.

In solving these problems, the original amount is always the base. The amount of change is the portion. The unknown, which describes the percent change between the two amounts, is the rate.

$$\text{Rate of change (Rate)} = \frac{\text{Amount of change (Portion)}}{\text{Original amount (Base)}}$$

STEPS FOR DETERMINING THE RATE OF INCREASE OR DECREASE

- STEP 1.** Identify the original and the new amounts and find the *difference* between them.
- STEP 2.** Using the rate formula $R = P \div B$, substitute the difference from Step 1 for the portion and the original amount for the base.
- STEP 3.** Solve the equation for R . Remember, your answer will be in decimal form, which must be converted to a percent.

An **EXPLANATION** of the topic

A **STEP BOX** clearly describing the solution steps

An **EXAMPLE** with a complete step-by-step solution

A **TRY-IT EXERCISE** with solution so students can immediately test their understanding

EXAMPLE 16 FINDING THE RATE OF CHANGE

Last year Iberia Furniture had a work force of 360 employees. This year there are 504 employees. What is the rate of change in the number of employees?

SOLUTION STRATEGY

The key to solving this problem is to properly identify the variables. The problem asks “what is the rate?”; therefore, the rate is the unknown. The original amount, 360 employees, is the base. The difference between the two amounts, $504 - 360 = 144$, is the portion. Now apply the rate formula.

$$R = \frac{P}{B} = \frac{144}{360} = .4 = 40\%$$

40% Increase in employees

TRY-IT EXERCISE 16

Solve the following problem for the rate of increase or decrease. Round to the nearest tenth of a percent when necessary.

When Mike Veteramo was promoted from supervisor to manager, he received a salary increase from \$450 to \$540 per week. What was the percent change in his salary?

CHECK YOUR ANSWER WITH THE SOLUTION ON PAGE 182.

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Bob Brechner worked tirelessly to develop the first six editions of this text, and he was both a good friend and an esteemed colleague. He is keenly missed, and I very much appreciate my good fortune in having had the opportunity to collaborate with him for more than sixteen years. I am also grateful to have the continuing support and friendship of Bob’s wife, Shari Brechner, who has positively impacted this text from its very first edition.

Finally, I wish to express my love and gratitude to my wife, Clarissa. She has provided encouragement and support over many years, and I offer her my heartfelt thanks.

George Bergeman
September, 2015

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Robert Brechner was Professor Emeritus, School of Business, at Miami Dade College. For 42 years he taught business math, principles of business, marketing, advertising, public relations, management, and personal finance. He was also Adjunct Professor at Florida Atlantic University, Boca Raton, International Fine Arts College, Miami, and Florida International University School of Journalism and Mass Communications.

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Bob and his wife, Shari, were avid travelers and enjoyed a wide range of activities together and in the company of friends. In many ways, both professional and otherwise, Bob's legacy remains an enduring inspiration for his colleagues, his friends, and his students.



Photo by Shari Brechner

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George Bergeman's teaching career of over twenty-five years began at a small college in West Africa as a Peace Corps Volunteer and continued at Northern Virginia Community College, one of the largest multi-campus colleges in the country. Teaching awards included Faculty Member of the Year honors at his campus.

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George lives with his wife, Clarissa, near Washington, D.C. Their daughter, Jessy, recently completed grad school in Colorado after previously working in San Francisco, Boston, and Brazil. In his free time, George enjoys accompanying his wife and their young corgi, Simon, on various adventures and on training sessions in preparation for dog shows. Other hobbies include photography and videography, and these activities frequently intersect with dog training and dog shows. Along those lines, George and his wife produced a dog-sport training video which has been distributed throughout the United States and several other countries.

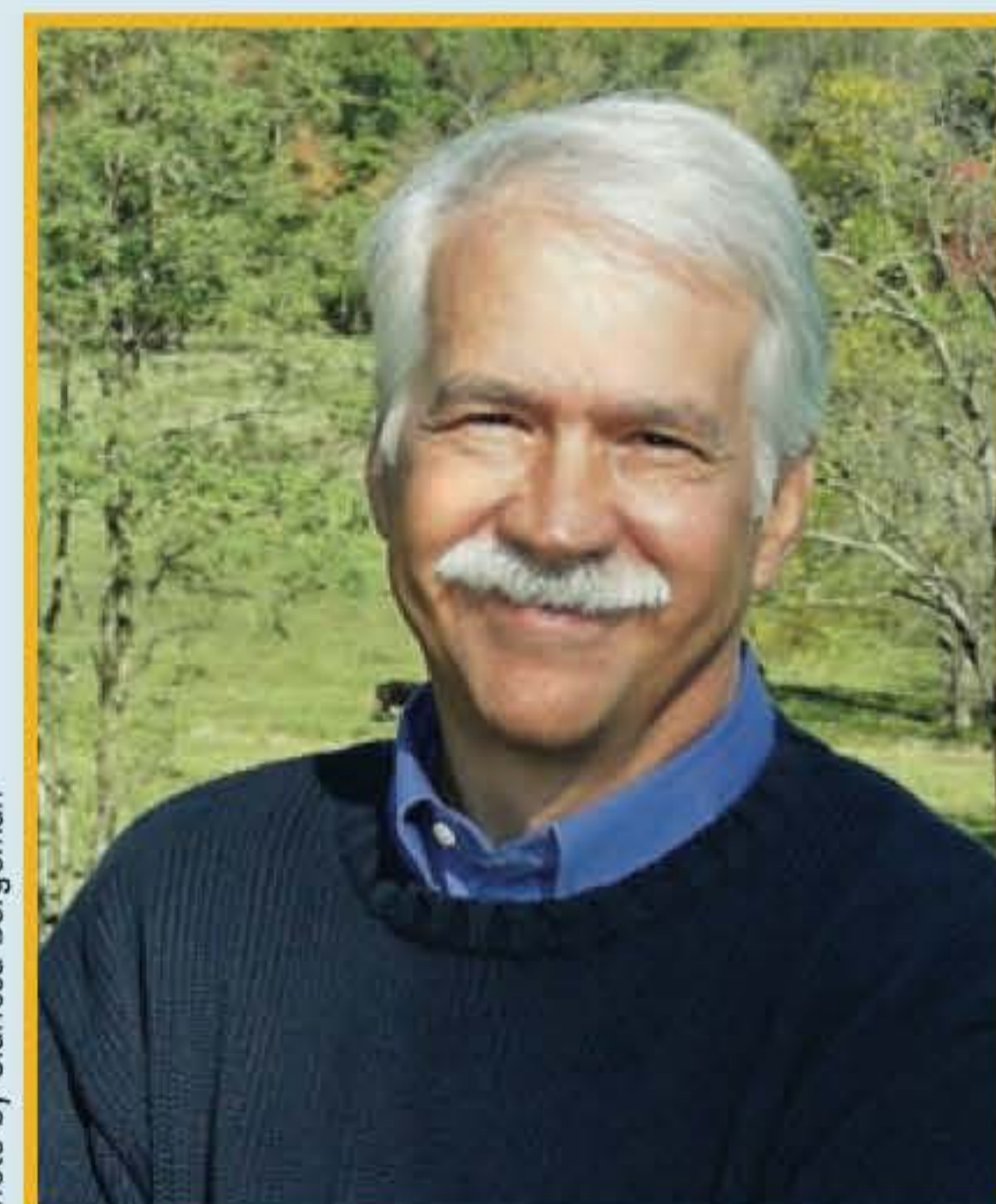


Photo by Clarissa Bergeman

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PERFORMANCE OBJECTIVES

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1-1: Reading and writing whole numbers
in numerical and word form (p. 2)

1-2: Rounding whole numbers
to a specified place value (p. 4)

SECTION II: Addition and Subtraction of Whole Numbers

1-3: Adding whole numbers
and verifying your answers (p. 7)

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and verifying your answers (p. 9)

SECTION III: Multiplication and Division of Whole Numbers

1-5: Multiplying whole numbers
and verifying your answers (p. 14)

1-6: Dividing whole numbers and
verifying your answers (p. 17)

SECTION I

1

THE DECIMAL NUMBER SYSTEM: WHOLE NUMBERS

Numbers are one of the primary tools used in business. The ability to read, comprehend, and manipulate numbers is an essential part of the everyday activity in today's complex business world. To be successful, business students should become competent and confident in dealing with numbers.

We will begin our study of business mathematics with whole numbers and their basic operations—addition, subtraction, multiplication, and division. The material in this chapter is based on the assumption that you have a basic working knowledge of these operations. Our goal is to review these fundamentals and build accuracy and speed. This arithmetic review will set the groundwork for our study of fractions, decimals, and percentages. Most business math applications involve calculations using these components.

1-1 READING AND WRITING WHOLE NUMBERS IN NUMERICAL AND WORD FORM

decimal number system A system using the 10 Hindu-Arabic symbols 0 through 9. In this place value system, the position of a digit to the left or right of the decimal point affects its value.

decimal point A dot written in a decimal number that separates the whole number part from the fractional part of the number.

whole numbers Any numbers 0 or greater that do not contain a decimal or fraction. Whole numbers are found to the left of the decimal point. Also known as an integer. For example, 6, 25, and 300 are whole numbers.

The number system most widely used in the world today is known as the Hindu-Arabic numeral system, or **decimal number system**. This system is far superior to any other for today's complex business calculations. It derives its name from the Latin words *decimus*, meaning 10th, and *decem*, meaning 10. The decimal system is based on 10s, with the starting point marked by a dot known as the **decimal point**. The decimal system uses the 10 familiar Hindu-Arabic symbols or digits:

0, 1, 2, 3, 4, 5, 6, 7, 8, 9

The major advantage of our decimal system over previous systems is that the position of a digit to the left or right of the decimal point affects its value. This enables us to write any number with only the 10 single-digit numbers, 0 through 9. For this reason, we have given names to the places or positions. In this chapter, we work with places to the left of the decimal point, **whole numbers**. The next two chapters are concerned with the places to the right of the decimal point, fractions, and decimals.

When whole numbers are written, a decimal point is understood to be located on the right of the number. For example, the number **27** is actually

27.

The decimal point is not displayed until we write a decimal number or dollars and cents, such as 27.25 inches or \$27.25.



Skills you acquire in this course will be applied frequently in your roles as a consumer and a businessperson.

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Exhibit 1-1 illustrates the first 15 places, and five groups, of the decimal number system. Note that our system is made up of groups of three places, separated by commas, each with its own name. Whole numbers start at the understood decimal point and increase in value from right to left. Each group contains the same three places: ones, tens, and hundreds. Note that each place increases by a factor of “times 10.” The group names are units, thousands, millions, billions, and trillions.

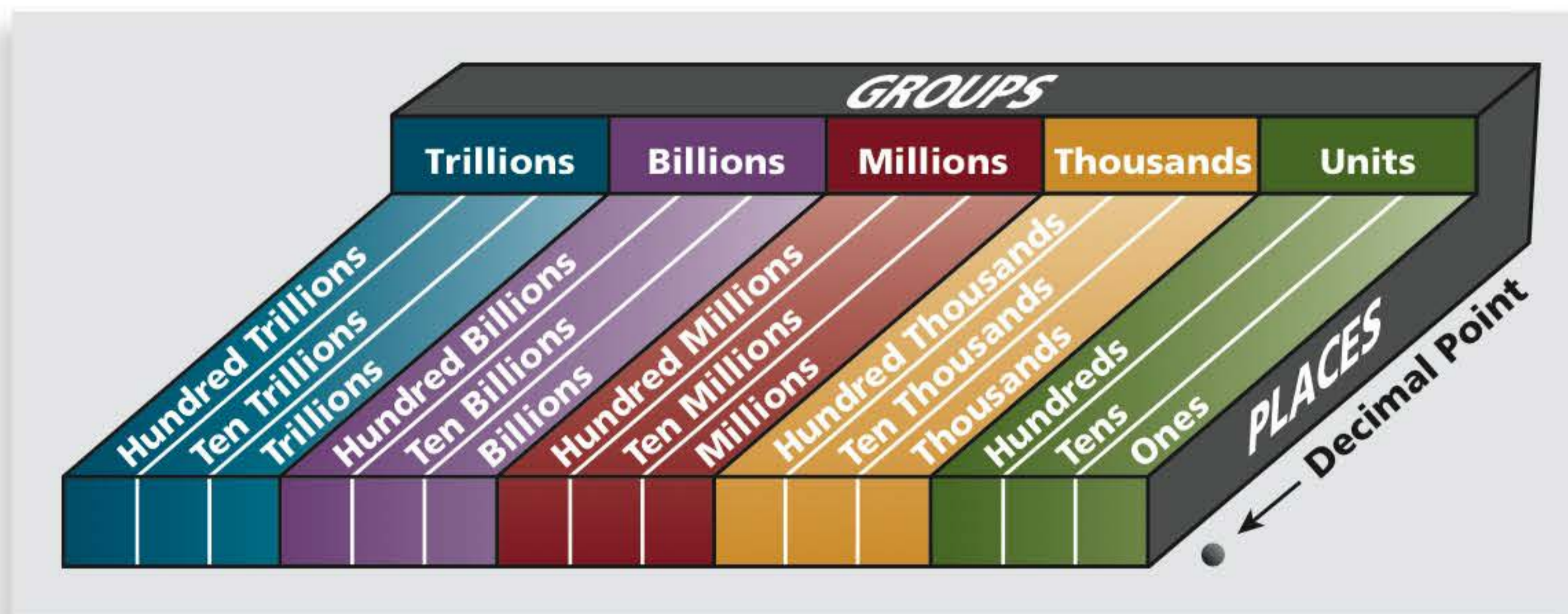


EXHIBIT 1-1

Whole Number Place Value Chart

STEPS FOR READING AND WRITING WHOLE NUMBERS

- STEP 1.** Beginning at the right side of the number, insert a comma after every three digits to mark the groups.
- STEP 2.** Beginning from left to right, name the digits and the groups. The units group and groups that have all zeros are not named.
- STEP 3.** When writing whole numbers in word form, the numbers from 21 to 99 are hyphenated, except for the decades (e.g., thirty). For example, 83 would be written as eighty-three.

Note: The word *and* should *not* be used in reading or writing whole numbers. It represents the decimal point and will be covered in Chapter 3.

Learning Tip

Whole numbers with four digits may be written with or without a comma. For example, 3,400 or 3400 are both correct.

EXAMPLE 1 READING AND WRITING WHOLE NUMBERS

Read and write the following whole numbers in numerical and word form.

- a. 14296 b. 560
c. 2294857 d. 184910
e. 3004959001 f. 24000064

SOLUTION STRATEGY

Following the steps above, we insert the commas to mark the groups, then read and write the numbers from left to right.

Number	Numerical Form	Word Form
a. 14296	14,296	fourteen thousand, two hundred ninety-six
b. 560	560	five hundred sixty
c. 2294857	2,294,857	two million, two hundred ninety-four thousand, eight hundred fifty-seven
d. 184910	184,910	one hundred eighty-four thousand, nine hundred ten
e. 3004959001	3,004,959,001	three billion, four million, nine hundred fifty-nine thousand, one
f. 24000064	24,000,064	twenty-four million, sixty-four

IN THE Business World

In text, large numbers, in the millions and greater, may be easier to read by writing the “zeros portion” in words. For example, 44,000,000,000,000 may be written as 44 trillion.

▶ TRY IT EXERCISE 1

Read and write the following whole numbers in numerical and word form.

- a. 49588 b. 804 c. 1928837
d. 900015 e. 6847365911 f. 2000300007

CHECK YOUR ANSWERS WITH THE SOLUTIONS ON PAGE 24.

1-2 ROUNDING WHOLE NUMBERS TO A SPECIFIED PLACE VALUE

rounded numbers Numbers that are approximations or estimates of exact numbers. For example, 50 is the rounded number of the exact number 49.

estimate To calculate approximately the amount or value of something. The number 50 is an estimate of 49.

rounding all the way A process of rounding numbers to the first (i.e., the leftmost) digit. Used to prework a problem to an estimated answer. For example, 2,865 rounded all the way is 3,000.

In many business applications, the use of an approximation of an exact number may be more desirable than using the number itself. Approximations, or **rounded numbers**, are easier to refer to and remember. For example, if a grocery store carries 9,858 items on its shelves, you would probably say that it carries 10,000 items. If you drive 1,593 miles, you would say that the trip is 1,600 miles. Another rounding application in business involves money. If your company has profits of \$1,302,201, you might refer to this exact amount by the rounded number \$1,300,000. Money amounts are usually rounded to the nearest cent, although they could also be rounded to the nearest dollar.

Rounded numbers are frequently used to **estimate** an answer to a problem before that problem is worked. Estimation approximates the exact answer. By knowing an estimate of an answer in advance, you will be able to catch many math errors. When using estimation to prework a problem, you can generally round off to the first (i.e., the leftmost) digit, which is called **rounding all the way**.

Once you have rounded to the first digit, perform the indicated math procedure. This can often be done quickly and will give you a ballpark or general idea of the actual answer. In the example below, the estimated answer of 26,000 is a good indicator of the “reasonableness” of the actual answer.

Original Calculation	Estimated Solution (rounding all the way)	Actual Solution
$\begin{array}{r} 19,549 \\ + 6,489 \\ \hline \end{array}$	$\begin{array}{r} 20,000 \\ + 6,000 \\ \hline 26,000 \end{array}$	$\begin{array}{r} 19,549 \\ + 6,489 \\ \hline 26,038 \end{array}$

If, for example, you had mistakenly added for a total of 23,038 instead of 26,038, your estimate would have immediately indicated that something was wrong.

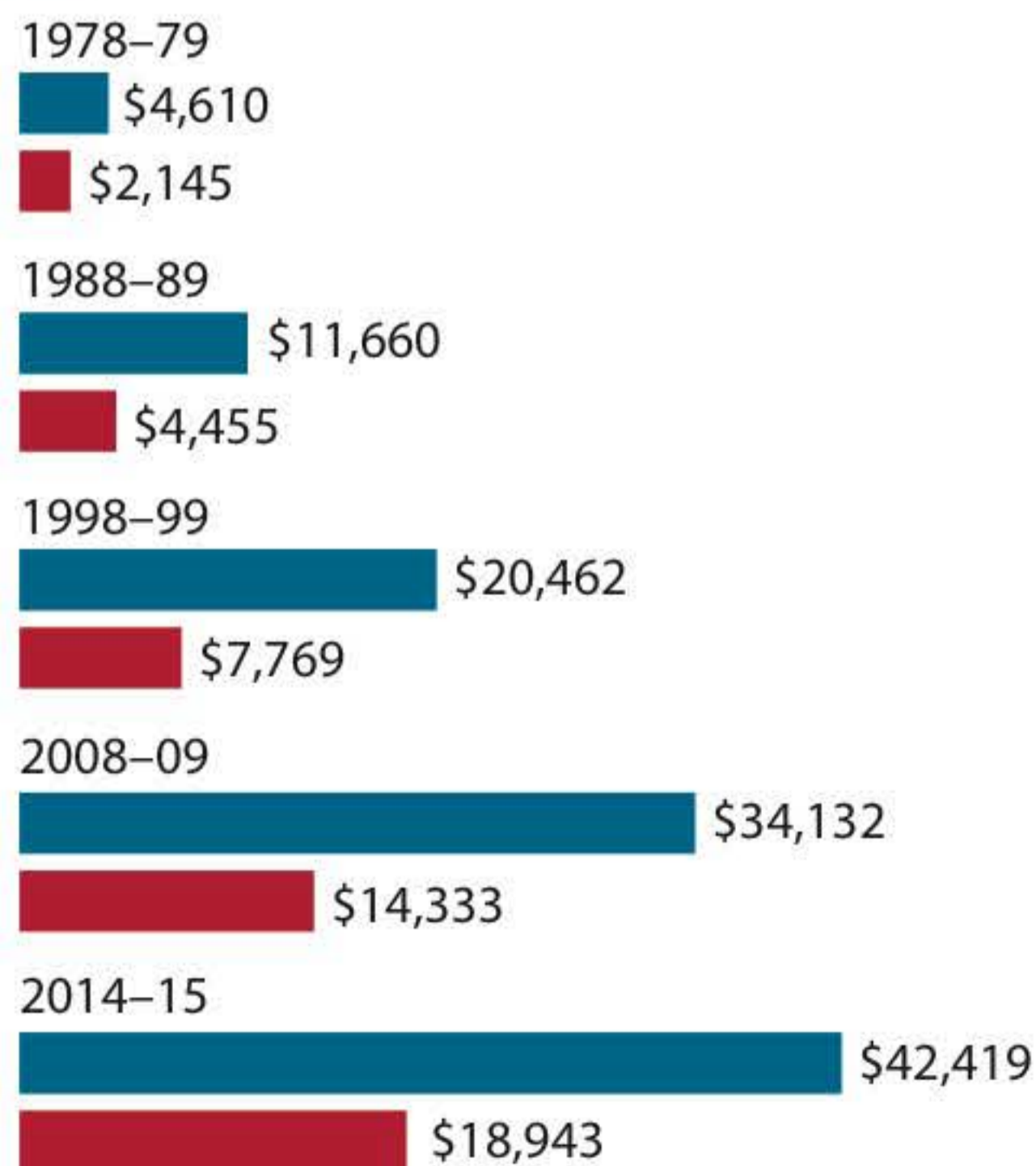


Dollars AND Sense

Pricey Diplomas

In the past three decades, college costs¹ have increased more than sevenfold at private schools and sixfold at public ones.

- Private four-year
- Public (in-state) four-year



1. Figures include tuition, fees, and room and board and are not adjusted for inflation.

Source: The College Board

STEPS FOR ROUNDING WHOLE NUMBERS TO A SPECIFIED PLACE VALUE

- STEP 1.** Determine the place to which the number is to be rounded.
- STEP 2a.** If the digit to the right of the place being rounded is 5 or more, increase the digit in that place by 1.
- STEP 2b.** If the digit to the right of the place being rounded is 4 or less, do not change the digit in the place being rounded.
- STEP 3.** Change all digits to the right of the place being rounded to zeros.



Write the following whole numbers in numerical form.

- | | |
|--|---------|
| 7. One hundred eighty-three thousand, six hundred twenty-two | 183,622 |
| 8. Seven million, sixty-one thousand, ten | _____ |
| 9. According to Globo's G1 website, expenses in preparation for the 2014 World Cup in Brazil reached forty billion dollars. Write this number in numerical form. | _____ |



Match the following numbers in word form with the numbers in numerical form.

- | | | |
|--|---|------------|
| 10. One hundred two thousand, four hundred seventy _____ | b | a. 12,743 |
| 11. One hundred twelve thousand, seven hundred forty-three _____ | | b. 102,470 |
| 12. Twelve thousand, seven hundred forty-three _____ | | c. 11,270 |
| 13. Eleven thousand, two hundred seventy _____ | | d. 112,743 |
| 14. According to NCR Corporation, retailers in America generate 228,700,000 pounds of paper receipts per year. Write this number in word form. | | |



Round the following numbers to the indicated place.

- | | |
|---|-------|
| 15. 1,757 to tens | 1,760 |
| 16. 32,475 to thousands | _____ |
| 17. 812,461 to hundreds | _____ |
| 18. 559,443 to ten thousands | _____ |
| 19. 25,812,922 to millions | _____ |
| 20. 45,699 all the way | _____ |
| 21. 1,325,669,226 to hundred millions | _____ |
| 22. 23,755 all the way | _____ |
| 23. According to the American Wind Energy Association, Texas has the highest operating wind capacity, 8,797 megawatts. Iowa is second with 3,053 megawatts capacity. | |
| a. Write each of these numbers in word form. | |
| b. Round each of these numbers to the nearest hundred. | |
| 24. According to the <i>Financial Times</i> , in a recent recession, outstanding consumer credit in the United States fell to \$2,460,000,000,000—the seventh straight monthly decline. Most of the drop came as a result of consumers paying down revolving debt such as credit cards. | |
| a. Write this number in word form. | |
| b. Round this number to the nearest hundred billion. | |

BUSINESS DECISION: UP OR DOWN?

25. You are responsible for writing a monthly stockholders' report about your company. Your boss has given you the flexibility to round the numbers to tens, hundreds, thousands, and so on, or not at all, depending on which is most beneficial for the company's image. For each of the following monthly figures, make a rounding choice and explain your reasoning.

- a. 74,469—number of items manufactured _____
- b. \$244,833—your department's net sales for the month _____
- c. 5,648—defective items manufactured _____
- d. \$649,341—total company profit _____
- e. 149 new customers _____

ADDITION AND SUBTRACTION OF WHOLE NUMBERS**1****SECTION II**

Addition and subtraction are the most basic mathematical operations. They are used in almost all business calculations. In business, amounts of things or dollars are often combined or added to determine the total. Likewise, subtraction is frequently used to determine an amount of something after it has been reduced in quantity.

ADDING WHOLE NUMBERS AND VERIFYING YOUR ANSWERS

Addition is the mathematical process of computing sets of numbers to find their sum, or total. The numbers being added are known as **addends**, and the result or answer of the addition is known as the **sum**, **total**, or **amount**. The “+” symbol represents addition and is called the **plus sign**.

$$\begin{array}{r} 1,932 \text{ addend} \\ 2,928 \text{ addend} \\ + 6,857 \text{ addend} \\ \hline 11,717 \text{ total} \end{array}$$

**STEPS FOR ADDING WHOLE NUMBERS**

- STEP 1.** Write the whole numbers in columns so that you line up the place values—units, tens, hundreds, thousands, and so on.
- STEP 2.** Add the digits in each column, starting on the right with the units column.
- STEP 3.** When the total in a column is greater than nine, write the units digit and carry the tens digit to the top of the next column to the left.

VERIFYING ADDITION

Generally, when adding the digits in each column, we add from top to bottom. An easy and commonly used method of verifying your addition is to add the numbers again, but this time from bottom to top. By adding the digits in the *reverse* order, you will reduce the chance of making the same error twice.

For illustrative purposes, addition verification will be rewritten in reverse. In actuality, you do not have to rewrite the numbers; just add them from bottom to top. As mentioned earlier, you will achieve speed and accuracy with practice.

1-3

addition The mathematical process of computing sets of numbers to find their sum, or total.

addends Any of a set of numbers being added in an addition problem. For example, 4 and 1 are the addends of the addition problem $4 + 1 = 5$.

sum, total, or amount The result or answer of an addition problem. The number 5 is the sum, or total, of $4 + 1 = 5$.

plus sign The symbol “+” representing addition.

Learning Tip

Once you become proficient at verifying addition, you can speed up your addition by recognizing and combining two numbers that add up to 10, such as $1 + 9$, $2 + 8$, $6 + 4$, and $5 + 5$. After you have mastered combining two numbers, try combining three numbers that add up to 10, such as $3 + 3 + 4$, $2 + 5 + 3$, and $4 + 4 + 2$.

Addition

$$\begin{array}{r} 8 \\ 3 \\ + 6 \\ \hline 17 \end{array}$$

Verification

$$\begin{array}{r} 6 \\ 3 \\ + 8 \\ \hline 17 \end{array}$$

A WORD ABOUT WORD PROBLEMS

In business math, calculations are only a part of the story! Most importantly, business math requires the ability to (1) understand and analyze the facts of business situations, (2) determine what information is given and what is missing, (3) decide what strategy and procedure is required to solve for an answer, and (4) verify your answer. Business application word problems are an important part of each chapter's subject matter. As you progress through the course, your ability to analyze and solve these business situations will improve. Now start slowly and relax!

EXAMPLE 3**ADDING WHOLE NUMBERS**

Add the following sets of whole numbers. Verify your answers by adding in reverse.

a.
$$\begin{array}{r} 40,562 \\ 29,381 \\ + 60,095 \\ \hline \end{array}$$

b. $2,293 + 121 + 7,706 + 20 + 57,293 + 4$

- c. Galaxy Industries, a furniture manufacturing company, has 229 employees in the design and cutting department, 439 employees in the assembly department, and 360 employees in the finishing department. There are 57 warehouse workers, 23 salespeople, 4 bookkeepers, 12 secretaries, and 5 executives. How many people work for this company?

SOLUTION STRATEGY

a.

Step 1. Write the numbers in columns so that the place values line up. In this example, they are already lined up.

$$\begin{array}{r} 40,562 \\ 29,381 \\ + 60,095 \\ \hline 130,038 \end{array}$$

Verification:

$$\begin{array}{r} 60,095 \\ 29,381 \\ + 40,562 \\ \hline 130,038 \end{array}$$

Step 2. Add the digits in each column, starting with the units column.

Units column: $2 + 1 + 5 = 8$ Enter the 8 under the units column.

Tens column: $6 + 8 + 9 = 23$ Enter the 3 under the tens column and carry the 2 to the hundreds column.

Hundreds column: $2 + 5 + 3 + 0 = 10$ Enter the 0 under the hundreds column and carry the 1 to the thousands column.

Thousands column: $1 + 0 + 9 + 0 = 10$ Enter the 0 under the thousands column and carry the 1 to the ten thousands column.

Ten thousands column: $1 + 4 + 2 + 6 = 13$ Enter the 3 under the ten thousands column and the 1 under the hundred thousands column.

b. Addition

Verification

$$\begin{array}{r} 2,293 \\ 121 \\ 7,706 \\ 20 \\ 57,293 \\ + 4 \\ \hline 67,437 \end{array}$$

$$\begin{array}{r} 4 \\ 57,293 \\ 20 \\ 7,706 \\ 121 \\ + 2,293 \\ \hline 67,437 \end{array}$$

c. Addition

Verification

$$\begin{array}{r} 229 \\ 439 \\ 360 \\ 57 \\ 23 \\ 4 \\ 12 \\ + 5 \\ \hline 1,129 \end{array}$$

$$\begin{array}{r} 5 \\ 12 \\ 23 \\ 360 \\ 439 \\ + 229 \\ \hline 1,129 \end{array}$$



IN THE Business World

Basic math proficiency without calculators is important. Calculators are not permitted on most employment tests and Civil Service exams.

▶ TRY IT EXERCISE 3

Add the following sets of whole numbers and verify your answers.

a.
$$\begin{array}{r} 39,481 \\ 5,594 \\ + 11,029 \\ \hline \end{array}$$

b. $6,948 + 330 + 7,946 + 89 + 5,583,991 + 7 + 18,606$

- c. Anthony's Italian Restaurant served 183 meals on Monday, 228 meals on Tuesday, 281 meals on Wednesday, 545 meals on Thursday, and 438 meals on Friday. On the weekend, it served 1,157 meals. How many total meals were served that week?

CHECK YOUR ANSWERS WITH THE SOLUTIONS ON PAGE 24.

SUBTRACTING WHOLE NUMBERS AND VERIFYING YOUR ANSWERS

Subtraction is the mathematical computation of taking away, or deducting, an amount from a given number. Subtraction is the opposite of addition. The original or top number is the **minuend**; the amount we are subtracting from the original number is the **subtrahend**; and the answer is the **difference** (sometimes called the “remainder” although “difference” is preferred). The “−” symbol represents subtraction and is called the **minus sign**.

$$\begin{array}{r} 2,495 \text{ minuend} \\ - 320 \text{ subtrahend} \\ \hline 2,175 \text{ difference} \end{array}$$

STEPS FOR SUBTRACTING WHOLE NUMBERS

- STEP 1.** Write the whole numbers in columns so that the place values line up.
STEP 2. Starting with the units column, subtract the digits.
STEP 3. When a column cannot be subtracted, you must “borrow” a digit from the column to the left of the one you are working in.

VERIFYING SUBTRACTION

An easy and well-known method of verifying subtraction is to add the difference and the subtrahend. If you subtracted correctly, this total will equal the minuend.

Subtraction	Verification
200 minuend	150 difference
− 50 subtrahend	+ 50 subtrahend
150 difference	200 minuend

EXAMPLE 4 SUBTRACTING WHOLE NUMBERS

Subtract the following whole numbers and verify your answers.

a.
$$\begin{array}{r} 4,968 \\ - 192 \\ \hline \end{array}$$

b. $189,440 - 1,347$

- c. On Monday morning, Appliance Depot had 165 microwave ovens in inventory. During the week, the store had a clearance sale and sold 71 of the ovens. How many ovens remain in stock for next week?

1-4

subtraction The mathematical process of taking away, or deducting, an amount from a given number.

minuend In subtraction, the original number. The amount from which another number, the subtrahend, is subtracted. For example, 5 is the minuend of the subtraction problem $5 - 1 = 4$.

subtrahend The amount being taken or subtracted from the minuend. For example, 1 is the subtrahend of $5 - 1 = 4$.

difference The number obtained when one number is subtracted from another. The answer or result of subtraction. For example, 4 is the difference of $5 - 1 = 4$.

minus sign The symbol “−” representing subtraction.



Learning Tip

Because each place value increases by a factor of 10 as we move from right to left (units, tens, hundreds, etc.), when we borrow a digit, we can think of it as borrowing a 10.

SOLUTION STRATEGY

- a.
$$\begin{array}{r} 4,968 \\ - 192 \\ \hline 4,776 \end{array}$$
- Verification:*
- $$\begin{array}{r} 4,776 \\ + 192 \\ \hline 4,968 \end{array}$$
- Write the numbers in columns so that the place values are lined up. In this problem, they are already lined up.
Starting with the units column, subtract the digits.
Units column: $8 - 2 = 6$. Enter the 6 under the units column.
Tens column: $6 - 9$ can't be subtracted, so we must borrow a digit, 10, from the hundreds column of the minuend. This reduces the 9 to an 8 and gives us a 10 to add to the 6, making it 16.
Now we can subtract 9 from 16 to get 7. Enter the 7 under the tens column.
Hundreds column: $8 - 1 = 7$. Enter the 7 under the hundreds column.
Thousands column: This column has no subtrahend, so just bring down the 4 from the minuend to the answer line.

- b. **Subtraction** **Verification**
- $$\begin{array}{r} 189,440 \\ - 1,347 \\ \hline 188,093 \end{array}$$
- $$\begin{array}{r} 188,093 \\ + 1,347 \\ \hline 189,440 \end{array}$$
- c. **Subtraction** **Verification**
- $$\begin{array}{r} 165 \\ - 71 \\ \hline 94 \end{array}$$
- $$\begin{array}{r} 94 \\ + 71 \\ \hline 165 \end{array}$$

TRY IT EXERCISE 4

Subtract the following whole numbers and verify your answers.

- a.
$$\begin{array}{r} 98,117 \\ - 7,682 \\ \hline \end{array}$$
- b. $12,395 - 5,589$
- c. Joe Montgomery has \$4,589 in his checking account. If he writes a check for \$344, how much will be left in the account?

CHECK YOUR ANSWERS WITH THE SOLUTIONS ON PAGE 24.

SECTION II

1

REVIEW EXERCISES



Add the following numbers.

$$\begin{array}{r} 1. \quad 45 \\ \quad 27 \\ + 19 \\ \hline 91 \end{array}$$

$$\begin{array}{r} 2. \quad 548 \\ \quad 229 \\ \quad 4,600 \\ + 62,660 \\ \hline \end{array}$$

$$\begin{array}{r} 3. \quad 339 \\ \quad 1,236 \\ \quad 5,981 \\ \quad 3,597 \\ + 8,790 \\ \hline \end{array}$$

$$\begin{array}{r} 4. \quad 2,359 \\ \quad 8,511 \\ + 14,006 \\ \hline \end{array}$$

$$\begin{array}{r} 5. \quad 733 \\ \quad 401 \\ \quad 1,808 \\ \quad 24,111 \\ + 10,595 \\ \hline \end{array}$$

6. $2,339 + 118 + 3,650 + 8,770 + 81 + 6 = \underline{\hspace{2cm}}$



7. $12,554 + 22,606 + 11,460 + 20,005 + 4,303 = \underline{\hspace{2cm}}$

Estimate the following by rounding each number all the way; then add to find the exact answer.

	<u>Estimate</u>	<u>Rounded Estimate</u>	<u>Exact Answer</u>
8.	288	300	6,800
	512	500	6,694
	3,950	4,000	
	+ 1,944	+ 2,000	
	<u>6,694</u>	<u>6,800</u>	



9.	27,712	_____	_____
	5,281		
	+ 368		
10.	318,459	_____	_____
	+ 283,405		

11. City traffic engineers in Canmore are doing an intersection traffic survey. On Tuesday, a counter placed at the intersection of Armstrong Place and Three Sisters Blvd. registered the following counts: morning, 2,594; afternoon, 2,478; and evening, 1,863.

a. Round each number to the nearest hundred and add to get an *estimate* of the traffic count for the day.

b. What was the *exact* amount of traffic for the day?

12. While shopping, Tyler Hammond purchases items for \$3, \$24, \$13, \$2, and \$175. How much did he spend?



13. The following chart shows the April, May, and June sales figures by service categories for Pandora's Beauty Salon. Total each row to get the category totals. Total each column to get the monthly totals. Calculate the grand total for the three-month period.

Pandora's Beauty Salon				
<u>Service Category</u>	<u>April</u>	<u>May</u>	<u>June</u>	<u>Category Totals</u>
Cutting, Styling, Coloring	\$13,515	\$12,350	\$14,920	_____
Manicure, Pedicure, Waxing	5,418	7,640	5,756	_____
Facials and Makeup	4,251	6,125	6,740	_____
Beauty Supplies	8,690	7,254	10,346	_____
Monthly Totals	_____	_____	_____	Grand Total



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Service Sector According to the *CIA World Factbook*, service sector businesses such as beauty salons and dry cleaners account for 79.6% of the U.S. economy's gross domestic product. Other sectors include industrial at 19.2% and agriculture at 1.2%.

14. At Cherry Valley Farms, a farmer plants 350 acres of soybeans, 288 acres of corn, 590 acres of wheat, and 43 acres of assorted vegetables. In addition, the farm has 9 acres for grazing and 4 acres for the barnyard and farmhouse. What is the total acreage of the farm?
15. Service Masters Carpet Cleaners pays its sales staff a salary of \$575 per month, plus commissions. Last month Alex Acosta earned commissions of \$129, \$216, \$126, \$353, and \$228. What was Alex's total income for the month?



Subtract the following numbers.

16. $\begin{array}{r} 354 \\ - 48 \\ \hline 306 \end{array}$	17. $\begin{array}{r} 5,596 \\ - 967 \\ \hline \end{array}$	18. $\begin{array}{r} 95,490 \\ - 73,500 \\ \hline \end{array}$	19. $\begin{array}{r} 339,002 \\ - 60,911 \\ \hline \end{array}$	20. $\begin{array}{r} 2,000,077 \\ - 87,801 \\ \hline \end{array}$
--	---	---	--	--

21. \$206 minus \$58 22. 67,800 – 9,835 23. \$127 less \$33

24. Subtract 5,868 from 10,918 25. Subtract 8,906,000 from 12,396,700



26. The beginning inventory of the Designer Shoe Salon for August was 850 pairs of shoes. On the 9th, it received a shipment from the factory of 297 pairs. On the 23rd, another shipment of 188 pairs arrived. When inventory was taken at the end of the month, there were 754 pairs left. How many pairs of shoes were sold that month?

27. An electrician, Sparky Wilson, starts the day with 650 feet of wire on his truck. In the morning, he cuts off pieces 26, 78, 45, and 89 feet long. During lunch, he goes to an electrical supply warehouse and buys another 250 feet of wire. In the afternoon, he uses lengths of 75, 89, and 120 feet. How many feet of wire are still on the truck at the end of the day?

28. Use the U.S. Postal Service Mail Volume graph on the next page to answer the following questions.
a. How many pieces were delivered in 2005 and 2006 combined?



Dollars AND Sense

The American Association of Retired Persons offers financial advice targeted at those in their 20s and 30s at www.aarp.org/money. The site contains tips from financial experts as well as calculators to help you budget and determine ways to reduce debt.