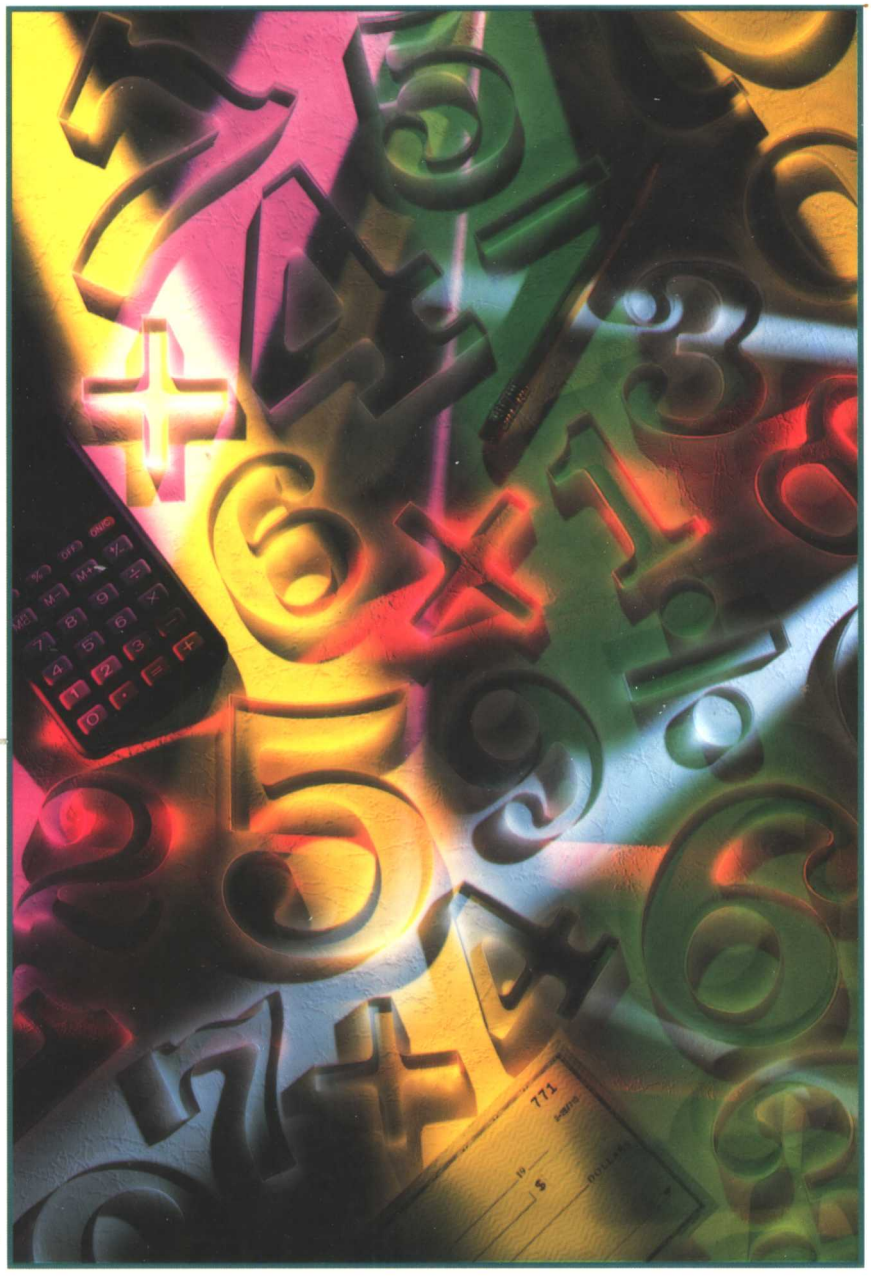
BUSINESS MATHEMATICS



ROBERT J. HUGHES

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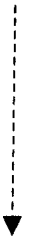

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PREFACE FOR THE STUDENT

"Math courses have always been difficult. The textbooks always seem to discuss abstract concepts and then apply those same concepts to apples and oranges."

—Jackie Marston
Math Student

Unfortunately, the feelings expressed by Jackie Marston are all too common today. Many students feel the same way when they walk into a math class. That's why it is important to begin this text with a basic idea: *Business Math Doesn't Have to Be Difficult.* In fact, we have done everything possible to eliminate the typical problems that students encounter in a business math class. Let's begin with an overview of how this text is organized.

ORGANIZATION OF THE TEXT

Take a moment and look at the Table of Contents on page XI. Notice that the first four chapters provide review material on our number system, addition, subtraction, multiplication, and division, fractions, and percentage. Even if you have never been successful in math, the material in these early chapters will help you build a foundation for the business applications that follow in Chapters 5 through 15.

CHAPTER FORMAT

All of the features in each chapter have been evaluated and recommended by instructors with years of teaching experience. In addition, business math students were asked to critique each chapter component. Based on this feedback, the following features are included in each chapter.

Chapter Preview

Each of the text's 15 chapters begins with a concise overview of the math topics that follow. You should look at the preview because it provides a capsule summary of each topic and the sequence in which topics are covered.

Math Today Opening Case

Chapter opening vignettes entitled "Math Today" introduce the content of the chapter through real-world situations. Take a moment and look at the opening case from Chapter One on page 1 that highlights how numbers can be used to describe Blockbuster Video. Other Math Today opening vignettes highlight Pepsi, Nike, Automated Data Processing (ADP), AT&T, The U.S. Government, and Ford.

Learning Units

The content in each chapter in *Business Mathematics* is broken down into smaller learning units. Generally, each learning unit covers a basic math concept and has the following components:

1. *Learning Objectives.* If you have a purpose for studying the material in each learning unit, you will learn more than if you just wander aimlessly through the text. Therefore, each learning unit in *Business Mathematics* contains clearly stated learning objectives that signal important concepts to be mastered.
2. *Clearly Written Explanations.* To help you understand the math concepts in this text, we have given special attention to word choice, sentence structure, and the presentation of business terms.
3. *Step-by-Step Instructions.* Every chapter in *Business Mathematics* contains numerous examples to illustrate important concepts. It is our belief that even the most difficult business application problems are easier to solve when a step-by-step approach is used. Take a moment and look at any learning unit in the text for examples of how this approach can help build success.
4. *End-of-Unit Problems.* As soon as a concept is presented, both drill and word problems are used to reinforce each concept. Special effort has been made to choose problems that allow you to apply concepts to real-world applications and lifelike situations. Answers for selected problems are located in Appendix D.
5. *Critical Thinking Problems.* The ability to think may be the most important skill that you can develop while in college. To develop this all-important skill, we have included a special group of problems that are called "Critical Thinking Problems." Take a moment and look at a typical Critical Thinking Problem on page 216. Although problems 19 and 20 require just calculations, you must summarize or apply your findings in two or three short sentences in order to answer question 21.
6. *Personal Math Problems.* "Personal Math Problems" are located in most chapters and involve a life situation where you must use math concepts to reach a decision. Look at the Personal Math Problem on page 386. Notice in this problem that questions 36 and 37 require calculations, but question 38 requires that you make a decision based on the facts and summarize your findings in two or three short sentences.

Instant Replay Summary

To help you review the material in each chapter, a concise outline called "Instant Replay" summarizes important concepts in each chapter. There is also an example or completed problem that illustrates each concept.

Mastery Quiz

Each Mastery Quiz contains 20 problems that can be used to test your comprehension of all the chapter concepts. Answers for Mastery Quiz problems are located in Appendix D.

Cumulative Review

At the end of Chapters 4, 8, 12, and 15, you can test your comprehension of chapter material by completing the cumulative review. Each cumulative review contains 20 problems and answers are located in Appendix D.

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A FINAL WORD

A text should always be evaluated by the students and instructors who use it. I will welcome and sincerely appreciate your comments and suggestions and will acknowledge your assistance in the next edition of *Business Mathematics.*

Bob Hughes
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CHAPTER 1

Number Values, Addition, and Subtraction

CHAPTER PREVIEW

In this chapter, we look at the basics that are necessary for working any mathematical problem. First we examine the number system used in business today. Next we discuss the rules for rounding numbers. Then our focus shifts to two operations—addition and subtraction—that are the basis for most business application problems.

MATH TODAY

BIG NUMBERS FOR BLOCKBUSTER VIDEO

Wow! What a difference. Those four words describe the 3,258 Blockbuster Video superstores in the United States, Great Britain, Canada, Chile, Austria, Mexico, and Japan. Each store is big, well-lit, and carries a comprehensive selection of between 5,000 and 6,000 recent motion picture titles. That's two to three times the number of titles that most independents—sometimes called mom-and-pop video stores—carry. Incidentally, the firm doesn't carry X-rated movies because sex videos go against Blockbuster's emphasis on family entertainment.

Blockbuster Video is the world's largest leading video retailer. In 1992, the last year for which complete financial results were available, the firm had sales revenues of over $1.2 billion. Net profits for 1992 were $142 million, which represents a 52 percent increase over 1991 profits. And at this writing, the first six months of 1993 were looking extremely promising with both revenues and profits expected to continue to improve over 1992 figures. Not bad for a company that had just over 200 stores back in 1987.

Although revenue growth and overall profits are expected to slow down in the video-rental industry between now and the year 2000, Blockbuster is taking steps to ensure that its own sales revenues and profits continue to increase for at least the next 10 years. With a corporate goal of 5,000 stores by 1995, Blockbuster continues to open new retail outlets in both the United States and abroad. Blockbuster has also diversified by purchasing over 200 Sound Warehouse stores and acquiring a 21 percent interest in a children's recreational fitness center called Discovery Zone. Finally, the firm plans to open a chain of virtual reality amusement parks throughout the United States.

Source: For more information, see Peter Katel, "New Kid on the Block, Buster," *Newsweek,* January 11, 1993, p. 48; *Moody's Handbook of Common Stocks* (New York, NY: Moody's Investors Service, Fall 1993); Gary Hoover, *Hoover's Handbook of American Business 1993* (Austin, TX: The Reference Press, 1992), p. 159; and Gail DeGeorge, "They Don't Call It Blockbuster for Nothing," *Business Week,* October 19, 1992, pp. 113–14.

UNIT 1 WHOLE NUMBERS

LEARNING OBJECTIVES *After completing this unit you will be able to:*

1. identify a specified place value within the decimal number system.
2. convert written whole numbers to numeral form.
3. change whole numbers in numeral form to written form.

3,258 Blockbuster Video superstores.
A selection of 5,000 to 6,000 motion picture titles.
Sales revenues of over $1.2 billion.
Net profits of $142 million.
Corporate goal of 5,000 stores by 1995.

All of the above numbers can be used to describe Blockbuster Video. These same numbers help management determine if the firm is meeting its goals and operating efficiently. And these numbers help lenders, suppliers, stockholders, and government agencies evaluate the firm. Finally, the above numbers underscore the importance of our number system in today's business world.

Let's begin by *examining* that number system. Our **number system** is based on ten individual digits: 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9. When digits are used to form a number, each digit stands for a specified value. For example, each digit in the number 5,683,427,891 represents a specific value as illustrated in Example 1.

EXAMPLE 1 Place Values for the Number 5,683,427,891

Billions Group		*Millions Group*				*Thousands Group*				*Units or Ones Group*		
5	,	6	8	3	,	4	2	7	,	8	9	1
Billions		Hundred millions	Ten millions	Millions		Hundred thousands	Ten thousands	Thousands		Hundreds	Tens	Units or ones

In this number, there are 5 billions, 6 hundred millions, 8 ten millions, 3 millions, 4 hundred thousands, 2 ten thousands, 7 thousands, 8 hundreds, 9 tens, and 1 unit. Let's look at another example.

EXAMPLE 2 Place Values for the Number 7,654,932

In the number 7,654,932, the value in the

units place is 2 (equal to 2).
tens place is 3 (equal to 30).
hundreds place is 9 (equal to 900).
thousands place is 4 (equal to 4,000).
ten thousands place is 5 (equal to 50,000).
hundred thousands place is 6 (equal to 600,000).
millions place is 7 (equal to $7,000,000).

Each group of three digits is separated by a comma. The commas help us read the number or write it in words. You read each group of three digits followed by the name of that specific group of numbers. For example, notice where the commas are placed in the above number 7,654,932. This same number is read aloud and written as "seven million, six hundred fifty-four thousand, nine hundred thirty-two." Also, note that a hyphen is used to separate compound numbers like fifty-four or thirty-two when expressed in written form. Finally, note that you do not use the word *and* when you read or write these numbers. The word *and* represents the decimal point and will be discussed in Unit 2.

Identify the Digit or Place Value in the Following Problems

1. In the number 32,649,108

a. the digit in the hundreds place is _____1_____.

b. the digit in the thousands place is 9.

c. the digit in the millions place is 2.

d. the digit in the units place is 8.

e. the digit in the ten millions place is 3.

2. In the number 2,456,138

a. the digit in the units place is 8.

b. the digit in the thousands place is 6.

c. the digit in the ten thousands place is 5.

d. the digit in the millions place is 2.

e. the digit in the tens place is 3.

Write the Following Whole Numbers in Numeral Form

3. a. One hundred ninety-three — 193

b. Seven thousand, four hundred fifteen — 7,415

c. Twelve thousand, two hundred forty-six — 12,246

d. Three million, two hundred thousand — 3,200,000

e. Two hundred sixty-nine thousand, seven hundred eighty-four — 269,784

f. Five hundred two — 502

g. Seventy thousand, four hundred thirty-three — 70,433

Write the Following Whole Numbers in Words

4. a. 147 one hundred forty-seven

b. 1,678 one thousand, six hundred seventy-eight

c. 14,569 fourteen thousand, five hundred sixty-nine

d. 723,659 seven hundred twenty-three thousand, six hundred fifty-nine

e. 65,432 sixty-five thousand, four hundred thirty-two

f. 3,459,700 three million, four hundred fifty-nine thousand, seven hundred

g. 444 four hundred forty-four

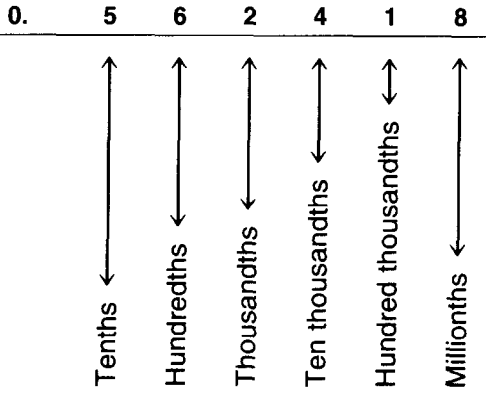
UNIT 2 DECIMAL NUMBERS

LEARNING OBJECTIVES *After completing this unit, you will be able to:*

1. identify decimal place values to the right of the decimal.
2. convert written numbers containing decimals to numeral form.
3. change numbers containing decimals in numeral form to written form.

The **decimal point** separates the whole number part of a number from the decimal part. Like whole numbers, decimal numbers also have assigned place values. Take, for example, the decimal number 0.562418.

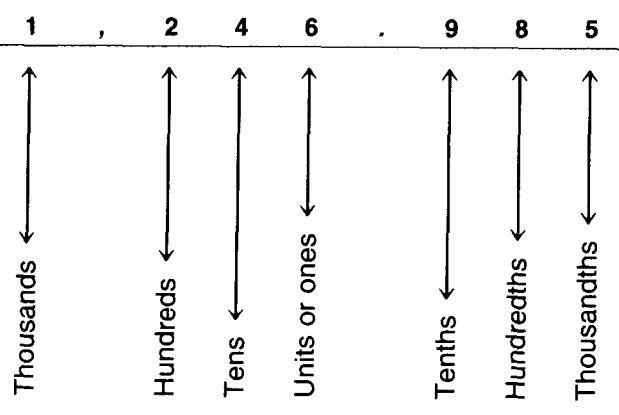
EXAMPLE 1 Place Values for the Decimal Number 0.562418



In this number, there are 5 tenths, 6 hundredths, 2 thousandths, 4 ten thousandths, 1 hundred thousandth, and 8 millionths. Notice that each of these place values ends with the letters "th(s)" to indicate that it is a decimal number that is less than one—not to be confused with a whole number.

When a number contains both whole numbers and decimal numbers, the whole number part is to the left of the decimal point, and the decimal part is to the right of the decimal point.

EXAMPLE 2 Place Values for the Number 1,246.985



When reading or writing numbers that contain decimals, extra care must be taken to make sure that other people who may hear or see the number understand that it contains a decimal value.

EXAMPLE 3 How to Read or Write Decimal Numbers

1. The number 0.4 is read or written as "four ten*ths*."
2. The number 0.35 is read or written as "thirty-five hundred*ths*."
3. The number 0.276 is read or written as "two hundred seventy-six thousand*ths*."

When the number contains a whole number and a decimal value, read the whole number first and then the decimal value. The word *and* is used to separate the whole number from the decimal value.

EXAMPLE 4 How to Read or Write Numbers That Contain Both Whole Numbers and Decimal Numbers

1. The number 23.6 is read or written as "twenty-three *and* six ten*ths*."
2. The number 125.68 is read or written as "one hundred twenty-five *and* sixty-eight hundred*ths*."

If the number represents dollars and cents, the words *dollars and* are inserted after the whole number and before the decimal value. The word *cents* is placed after the decimal value.

EXAMPLE 5 How to Read or Write Numbers That Represent Dollars and Cents

1. The number $129.87 is read or written as "one hundred twenty-nine *dollars and* eighty-seven *cents*."
2. The number $2,312.15 is read or written as "two thousand, three hundred twelve *dollars and* fifteen *cents*."

Identify the Digit or Place Value in the Following Problems

1. In the number 35.129
   - **a.** the digit in the thousandths place is 9.
   - **b.** the digit in the units place is 5.
   - **c.** the digit in the tens place is 3.
   - **d.** the digit in the hundredths place is 2.
2. In the number 2,478.1956
   - **a.** the digit in the ten thousandths place is 6.
   - **b.** the digit in the tenths place is 1.
   - **c.** the digit in the hundreds place is 4.
   - **d.** the digit in the thousandths place is 5.

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