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business mathematics

a consumer approach

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techniques. Some users may not agree with the early introduction of the calculator; however, its consideration can be deferred if that course of action appears desirable.

A second evidence of a contemporary point of view is the use of interest rates compatible with the real world. This has meant omitting certain traditional short-cut computational devices, but in doing so, the credibility of the work has been enhanced in the eyes of the reader. Awareness and relevance have been watchwords throughout the organization and writing of both the text and the problems.

The authors have been assisted in the preparation of *Business Mathematics—A Consumer Approach* by the thoughtful and helpful efforts of many people. Principal among these are Professors John R. Cleary of Youngstown University, Paul C. Eberhardt of Bryant and Stratton Business Institute, William W. Hartwell of St. Petersburg Junior College, and Mildred Polisky of Milwaukee Area Technical College, each of whom read the manuscript and contributed in significant ways to its improvement. Of the publisher's staff, two persons should be especially recognized: Burton C. Gabriel, who shared the authors' visions and encouraged the writing; and Ben Shriver, who graciously and patiently guided both the authors and the manuscript through the trauma of production. The manuscript was typed—and retyped—by Irene M. Woods, and Judith Ann Baldino assisted with the preparation of the teacher's edition.

The third unique feature of this book is the inclusion of a segmented master problem, or case, which permits the student to view important aspects of business operations from the perspective of a proprietor. The master problem requires the sequential consideration of the material in Chapters 4 through 12. Because of its segmented design, relevant sections of the case can be assigned as the course progresses, or alternatively, the entire problem can be assigned after the students complete Chapter 12. In either case the consumer orientation of the text and the proprietor orientation of the master problem will combine to give the student an opportunity to examine the arithmetic techniques from two different but equally important points of view.

The book is divided into fourteen chapters, and the chapters are organized in from three to six sections. Each section is followed by questions and exercises, and additional problem material is provided at the end of selected chapters. Although some purely mechanical exercises are included for purposes of drill and review, the emphasis of the exercises is on the solution of problems relevant to the related text material and the real world of business.

The first three chapters provide a review of fundamental arithmetic operations, and some users may choose to omit one or more of those units. If such an election is made, the remainder of the book will still present a unified whole. On the other hand, users who desire more extensive reviews of arithmetic than provided by Chapters 1–3 will find additional problems in the Appendix.

Chapters 4, 5, and 6 consider the mathematics applicable to the familiar areas of payroll, banking, and merchandising. The next two chapters, 7 and 8, deal with insurance and income tax matters. Chapters 9, 10, and 11 cover the related subjects of retirement plans, investments, and financial statement analysis, and these units are followed by an introduction to descriptive statistics in Chapter 12.

Chapter 13 considers four important but independent topics—the metric system, electronic data processing, employment tests, and compound interest. In order to accommodate the preferences of individual teachers, the sections treating the metric system, EDP, employment tests and compound interest have been designed so that they may be scheduled without regard to other sections of the book. Chapter 14 is the segmented master problem which considers the financial affairs of Benny Fishel.

Throughout the book, the authors have consciously strived to provide a vehicle appropriate to the times. Two comments in that regard will illustrate the point. First, it is clear that the pervasiveness of the hand calculator has made it an important tool of business. Its nominal cost has put the calculator in the hands of virtually every student, and we might as well admit that arithmetic can no longer be taught as it was in another time. In recognition of this, the authors introduce the calculator in Chapter 1, but at the same time they emphasize the value of understanding the manual

PREFACE

Business Mathematics—A Consumer Approach is a basic resource for all post-secondary students who have a need and/or a desire to gain a fundamental understanding of the relationship between business and mathematics.

Notwithstanding the fact that it is virtually impossible to survive in an advanced economy without frequently applying the mathematics of business, many students consider the organized study of business mathematics a distasteful or even unnecessary infringement on their time. The primary objective of *Business Mathematics—A Consumer Approach* is to provide a learning vehicle which will make that observation less applicable to the future than it has been to the recent past. Accordingly, the format of this book is intended to provide a pleasant and satisfying experience—for the teacher as well as the student.

The authors have approached their goal by incorporating in the presentation three pedagogical features not common to principal competing works. The first of these features is a consumer orientation in lieu of the traditional institutional perspective. For example, instead of telling the reader about retailing from the point of view of the merchant, the authors discuss the subject from the perspective of the student customer. This approach enables the student to identify immediately with the subject and thereby appreciate more fully the relevance of the mathematical techniques.

A second major feature of *Business Mathematics—A Consumer Approach* is the inclusion of non-numerical analytical questions in many sections. This material is introduced in an effort to impress upon the student the facts that in business as elsewhere, first, there are reasons for things being the way they are and, secondly, there is more to the economics of business than arithmetic. Students may be challenged beyond the scope of the text to answer the analytical questions fully, but the Teacher's Edition includes both comprehensive responses and suggestions for further discussion.

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part one

basic review

(at discretion of instructor)

- *fundamental processes*
- *fractions*
- *decimals and percentages*

1

FUNDAMENTAL CONCEPTS

It would be impossible in a civilized society to transact business without the aid of mathematics. Not so many years ago all mathematical computations had to be made manually. But today virtually all business mathematics is accomplished with the aid of some type of electronic assistance—the cash register, the computer, and the electronic calculator are the most common examples.

The wide use of electronic aids has not eliminated the need for hand computations, but it has reduced that need to a place of relatively minor importance. Accordingly, it is reasonable to think that an operational knowledge of electronically assisted methods is indispensable to the business practitioner. Because of its convenient size, its versatility, and its modest cost the hand calculator is probably the electronic tool that you will use most frequently.

Section 1—THE ELECTRONIC CALCULATOR

While there are many variations in the functions performed by various calculators, depending upon their intended use—technical, financial, general—certain standard operations are common to most of them. The following is a glossary

of the most common operations encountered in general-use electronic calculators. However, it is always advisable to study the instruction booklet provided with a particular machine for specific directions to operate *that* calculator.

Key	Function
On-Off	This switch is used to turn the calculator on and off. Usually all numbers stored in memory are cleared when the machine is turned off.
\boxed{C} Clear.....	Clears the machine of all previous calculations with the exception of memory storage. This key should be depressed before attempting a new problem.
\boxed{CE} Clear Entry	Erases or clears the number last entered into keyboard. Allows number incorrectly punched into keyboard to be erased without disturbing previous entries. This key is especially helpful for manipulation of lengthy problems.
$\boxed{0}$ through $\boxed{9}$ Numerals.....	These keys are used to enter numbers into the calculator.
$\boxed{\cdot}$ Decimal Point.....	Allows placement of decimal in entered number.
$\boxed{+}$ Addition	Activates addition command.
$\boxed{-}$ Subtraction	Activates subtraction command.
$\boxed{\times}$ Multiplication	Activates multiplication command.
$\boxed{\div}$ Division	Activates division command.
$\boxed{=}$ Equals	Commands the result of a previous sequence of operations; i.e., the <i>sum</i> , the <i>difference</i> , the <i>product</i> , or the <i>quotient</i> .
$\boxed{\%}$ Percentage	A time-saving feature which displays answers directly in percentage notation, eliminating the need to convert decimals to percentages by multiplying by 100.
\boxed{K} Constant	Time-saving device which allows for a constant multiplier (usually first entry) or a constant divisor (usually second entry).
$\boxed{M+}$ Memory Plus	Adds display number to the memory register.
$\boxed{M-}$ Memory Minus	Subtracts display number from memory register.
\boxed{MR} Memory Recall.....	Activates display of contents of memory register without clearing same.
\boxed{MC} Memory Clear	Serves to clear (erase) all contents of memory register.

Opportunities to test and perfect your knowledge of the electronic calculator will be provided throughout this book but especially in Sections 2

through 8. Of course, the exercises in those sections are also suitable for manual solution.

Section 2—ADDITION

Addition is the mathematical process of combining the values of a group of numbers into a total. The individual values in the addition process are called *addends* and the result of the completed operation is referred to as the *sum* or the *total*.

Example 1–1 Add the numbers 5, 12, 224, 7, and 36.

Solution:

$$\begin{array}{rcl}
 & 25 & \leftarrow \text{Addend} \\
 + & 12 & \leftarrow \text{Addend} \\
 + & 224 & \leftarrow \text{Addend} \\
 + & 7 & \leftarrow \text{Addend} \\
 + & \underline{36} & \leftarrow \text{Addend} \\
 \hline
 & 284 & \leftarrow \text{Sum}
 \end{array}$$

Notice that the solution to Example 1–1 involved the vertical alignment of digits within one addend with the corresponding digits of all other addends. Such alignment is necessary because numbers follow a hierarchy of values. That is, the first addend in Example 1–1 is 5, which is a “ones” digit. The second addend, 12, has two digits—a “ones” digit (the number 2), and a “tens” digit (the number 1). The third addend consists of a “ones” (4), a “tens” (2), and a “hundreds” (2) digit; other addends follow suit.

Manual addition of the numbers presented in Example 1–1 requires that the “ones” column be added first. Beginning at the top: $5 + 2 = 7$; $7 + 4 = 11$; $11 + 7 = 18$; $18 + 6 = 24$. The

number 4 is placed below the horizontal line in the “ones” place of the sum; the 2 (really 20 or 2 “tens”) is carried forward to the “tens” column and written above that column.

Beginning at the top of the “tens” column, then, $2 + 1 = 3$; $3 + 2 = 5$; $5 + 3 = 8$. The number 8 is placed below the line in the “tens” place of the sum. There is no need to carry anything forward to the “hundreds” column, because the total for the “tens” column does not exceed one digit. The final column to be added is the “hundreds” column. In this example there is only one digit—the number 2—to be considered. This number (2) is placed below the line in the “hundreds” place of the sum, and the entire sum may be read as “two hundred eighty-four.”

While vertical alignment of digits is necessary in manual calculations, whole numbers entered into the keyboard of an electronic calculator will be automatically aligned.

Accuracy Check Even with careful attention, errors do occur. The only way to be really sure that the sum calculated in Example 1–1 is correct is to double-check your work. In order to minimize the chance of making the same mistake twice through mindset, “prove” the accuracy of your answer by adding in the opposite direction from your original calculation; this time add bottom to top.

6 Fundamental Concepts

ASSIGNMENT 1

Add the following problems and "prove" the accuracy of your totals.

1. 64 <u>+39</u>	2. 666 <u>+212</u>	3. 963 <u>+3,625</u>	4. 1,878 <u>+23,235</u>	5. 257,069 <u>+ 72,844</u>
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6. 87 69 <u>+93</u>	7. 813 245 <u>+ 69</u>	8. 7,075 2,864 <u>+8,216</u>	9. 62,433 21,062 <u>+ 5,345</u>	10. 433,000 217,640 <u>+823,360</u>
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11. 89 62 74 <u>+96</u>	12. 117 650 240 <u>+333</u>	13. 9,647 6,635 6,330 <u>+2,040</u>	14. 18,647 21,800 57,639 <u>+41,727</u>	15. 850,450 217,635 209,717 <u>+727,000</u>
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16. 75 27 63 80 <u>+45</u>	17. 824 721 250 696 <u>+370</u>	18. 2,734 6,015 3,040 2,165 <u>+8,450</u>	19. 71,075 62,364 1,934 80,600 <u>+72,510</u>	20. 110,607 249,013 975,000 410,210 <u>+634,075</u>
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21. 67 33 94 87 9 <u>+19</u>	22. 175 329 606 373 641 <u>+321</u>	23. 1,749 2,893 4,690 2,345 3,468 <u>+2,050</u>	24. 14,733 69,324 17,297 40,050 82,421 <u>+63,759</u>	25. 107,000 256,500 91,410 111,111 204,303 <u>+189,889</u>
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THOUGHT PROBLEMS

- _____ 1. Dist Inc. purchased \$6,453 in raw materials in January. In February purchases increased by \$1,175 over January levels. Determine February purchases.
- _____ 2. Dr. Payne, a dentist, treated 5 patients this morning. He charged fees of \$19, \$16, \$25, \$39, and \$16 respectively. How much fee income did he receive?

- _____ 3. During 1979 the Lion's Den had liquor sales of \$38,765. It also had beer sales of \$72,615 and food sales of \$16,435. Determine total sales.
- _____ 4. Multy Corporation had sales of \$287,640 in April. May's sales were \$63,256 higher. Calculate May's sales.
- _____ 5. The Lucas Company owned 2,225 shares of XYZ Corporation's stock. During the year it acquired 260 additional shares in May and another 1,275 shares in October. Determine how many shares Lucas Company now owns.
- _____ 6. E-Z Fried Chicken has 225 franchises in the East, 1976 in the South, 79 in the Midwest, and 297 on the West Coast. Determine the total number of franchises operated by E-Z.
- _____ 7. Drexel Industries had sales of \$476,500 in 1978. In 1979 sales increased by \$152,000 over 1978 figures; in 1980 sales increased by another \$246,500. Calculate sales for 1980.

Section 3—SUBTRACTION

Subtraction is the mathematical process of deducting one number from another. The number to be deducted is called the *subtrahend*. The number from which the subtrahend is deducted is referred to as the *minuend*. The number which results when the subtrahend is deducted from the minuend is the *difference*.

Example 1-2 Subtract 311 from 684.

Solution:

$$\begin{array}{r} 684 \leftarrow \text{Minuend} \\ -311 \leftarrow \text{Subtrahend} \\ \hline 373 \leftarrow \text{Difference} \end{array}$$

In subtraction as well as in addition it is important to properly align digits—ones, tens,

hundreds, and so forth. Subtraction begins with the "ones" column. In Example 1-2, the difference between the minuend 4 and the subtrahend 1 is 3, which is recorded below the line. The difference in the "tens" column is 7, derived from subtracting 1 from 8. Finally, the "hundreds" column yields a difference of 3 when 3 is subtracted from 6. The process of subtracting 311 from 684 has resulted in a difference of 373.

Accuracy Check The accuracy of our answer is "proved" by adding the difference to the subtrahend:

$$\begin{array}{r} 311 \leftarrow \text{Subtrahend} \\ +373 \leftarrow \text{Difference} \\ \hline 684 \leftarrow \text{Minuend} \end{array}$$

ASSIGNMENT 2

Complete the following exercises by performing the subtractions and "proving" your answers.

$$\begin{array}{r} 1. \ 320 \\ -117 \\ \hline \end{array}$$

$$\begin{array}{r} 2. \ 625 \\ -194 \\ \hline \end{array}$$

$$\begin{array}{r} 3. \ 486 \\ -225 \\ \hline \end{array}$$

$$\begin{array}{r} 4. \ 757 \\ -109 \\ \hline \end{array}$$

$$\begin{array}{r} 5. \ 827 \\ -636 \\ \hline \end{array}$$

8 Fundamental Concepts

6. 6,363 <u>-3,726</u>	7. 9,745 <u>-2,893</u>	8. 2,175 <u>-1,976</u>	9. 9,989 <u>-2,999</u>	10. 4,240 <u>-3,759</u>
11. 99,350 <u>-82,675</u>	12. 37,869 <u>-17,421</u>	13. 87,523 <u>-38,632</u>	14. 90,500 <u>-30,410</u>	15. 48,640 <u>-33,865</u>
16. 895,000 <u>-640,000</u>	17. 747,750 <u>-625,650</u>	18. 115,425 <u>-76,535</u>	19. 810,605 <u>-204,705</u>	20. 247,000 <u>-113,255</u>
21. 652,359 <u>-346,643</u>	22. 850,909 <u>-206,871</u>	23. 659,958 <u>-320,660</u>	24. 389,647 <u>-298,476</u>	25. 810,642 <u>-232,159</u>

THOUGHT PROBLEMS

- _____ 1. Timeout Corporation produces watches. Production for the month of August was 14,707 units. In September 17,109 units were produced. How much did production increase for the month?
- _____ 2. Bravo Corporation purchased two machines this month. One cost \$17,635 and the other was \$2,454 less. Determine the cost of the second machine.
- _____ 3. Steady Distributors incurred \$42,560 in labor costs in 1978. In 1979 labor costs declined by \$3,790. Calculate 1979 costs.
- _____ 4. Ryan Shipping spent \$397 for supplies in May. The following month it spent only \$146. Calculate the difference between May's and June's supplies expenditures.
- _____ 5. Projected Sales in 1979 are \$65,325. If Actual Sales are \$3,750 less than Projected, determine Actual Sales.
- _____ 6. Randle Corporation employs 13,454 workers. At present 6,333 are on strike. How many are not on strike?
- _____ 7. If purchases declined from \$665,000 in 1979 to \$542,000 in 1980, determine the decrease in purchases.
- _____ 8. Sales for November at a local toy store were \$3,250. In December sales increased to \$8,450. Find the increase in sales.
- _____ 9. A certain new car has a sticker price of \$6,455. However, Murphy Auto will allow a \$750 discount. What is the purchase price if the car is bought at Murphy Auto?