Mathematics of Business

JAY DIAMOND

GERALD PINTEL

THIRD EDITION

Mathematics of Business

JAY DIAMOND
Professor
Marketing-Retailing Department
Nassau Community College

GERALD PINTEL, Ph.D.
Professor
Business Administration Department
Nassau Community College

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Preface

As was the case in the two previous editions of *Mathematics of Business,* this edition has been written expressly for the purpose of reviewing arithmetic procedures and applying them to specific business functions.

Each unit in every chapter is presented in the most fundamental terms, is followed by an illustrative problem and a solution that have a better graphical design than in the earlier editions, and is concluded with a series of problems that are designed to reinforce learning. This technique enables the student to master easily each arithmetic topic before proceeding to the next one.

Extensive use of practical business applications makes the drill work more palatable as well as meaningful. Since the text is introductory, and is directed toward business students and others interested in the workings and involvements of business, meaningful terminology and definitions are extensively used.

In recognizing that the book might be too comprehensive for completion in one semester, the material has been organized into nine separate parts. It is recommended that all students study the first three parts, which are general in nature, and select those remaining that are most appropriate for their specialized courses of study.

Significant among the many new features of the third edition are the following:

1. All illustrative problems and solutions have been graphically redesigned to permit easier and quicker locating.
2. A greater variety of interest rates have been incorporated to make the problems more meaningful in today's economy.
3. In addition to chapter review problems for the text, the same feature has been added to every chapter in the accompanying workbook.
4. New topics such as sales tax, checking accounts, converting markups, discount versus borrowing, distribution of expenses, bad debts, and zero bracket income tax deductions have been added.

5. Coverage of the metric system has been expanded.
6. Charts, graphs, and illustrations have been completely updated.

In addition to the text and the workbook, an instructor's manual, complete with solutions, is available as is a prognostic examination and tests, with solutions for each unit.

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Fundamental Operations and the Metric System

1. **ADDITION**
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   b. Position
   c. Combinations of 10
   d. Proving addition
   e. Breaking columns
   f. Horizontal addition
2. **SUBTRACTION**
   a. Definitions
   b. Position
   c. Proving subtraction
   d. Horizontal subtraction
   e. Mental subtraction
3. **MULTIPLICATION**
   a. Definitions
   b. Operation: mental multiplication
   c. Operation: long multiplication
   d. Multiplication by 10 or powers of 10
   e. Multiplication when one numeral ends in zero
   f. Multiplication when zeros appear within a numeral
   g. Multiplication with decimals
   h. Proving multiplication

4. DIVISION
a. Definitions
b. Operation: mental division
c. Operation: long division
d. Division by 10 or powers of 10
e. Division when the divisor ends in zero
f. Division when there are decimals in the divisor
g. Division to prove multiplication
h. Proving division
5. ROUNDING OFF
6. ESTIMATING
7. THE METRIC SYSTEM
a. Linear measurement
b. Weight
c. Volume

1. ADDITION

Addition is the most common of the fundamental operations. Adding with speed and accuracy is required of business people. This can be achieved only through practice. The following brief review and drill will improve your addition skills.

a. Definitions

The numbers to be added are called the addends. The result of the addition is called the sum or total. Thus,

$$\left.\begin{matrix}6\\7\\8\end{matrix}\right\}\ \text{Addends}$$
$$21 \quad \text{Sum or total}$$

b. Position

Our numbering system is positional: that is, the value of a digit depends upon the position it is in as well as upon the value of the digit itself. For example, the numeral 4 in the rightmost column equals the number 4, while the numeral 4 in second rightmost column equals 40. Therefore, when adding, it is necessary to arrange the numbers so that similar positional values fall in the same column.

Illustrative Problem

Find the sum of 127 + 3,746 + 12 + 923.

Solution.

$$\begin{array}{r} 127 \\ 3{,}746 \\ 12 \\ \underline{923} \\ 4{,}808 \end{array}$$ Sum

1.1 SOLVE THESE PROBLEMS: Add.

1.
$$\begin{array}{r} 3{,}666 \\ 81 \\ 9 \\ 7{,}842 \\ 3 \\ 27 \\ 688 \\ 38{,}476 \\ \underline{927} \end{array}$$

2.
$$\begin{array}{r} 17 \\ 37 \\ 72 \\ 36{,}289 \\ 898 \\ 466 \\ 1 \\ 378 \\ 9 \\ \underline{76} \end{array}$$

3.
$$\begin{array}{r} 86 \\ 127 \\ 9 \\ 637 \\ 276 \\ 86 \\ 164 \\ 97 \\ \underline{472} \end{array}$$

In the case of numerals containing decimals, the addends must be positioned so that the decimals all appear in the same column.

Illustrative Problem

Find the sum of 1.27 + 36 + 33.684 + 778.2632.

Solution.

$$\begin{array}{r} 1.27 \\ 36. \\ 33.684 \\ \underline{778.2632} \\ 849.2172 \end{array}$$ Sum

1.2 SOLVE THESE PROBLEMS: Add.

1.
$$\begin{array}{r} .3784 \\ 27.1 \\ 3.63 \\ 278 \\ .14 \\ 3.6 \\ 78 \\ 9 \\ \underline{\quad} \end{array}$$

2.
$$\begin{array}{r} 1.2 \\ .374 \\ 12 \\ 46 \\ 9.268 \\ 8.3 \\ 492 \\ 36.9 \\ \underline{.1274} \end{array}$$

3.
$$\begin{array}{r} 1.678 \\ 71.4 \\ .29 \\ 36 \\ 4.72 \\ .129 \\ .8 \\ 3729 \\ \underline{.410} \end{array}$$

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1.3 SOLVE THESE PROBLEMS

1. The inventory of Bennincasa and Sons revealed the following: Style 608—46 pieces of green, 139 pieces of red, 2,746 pieces of blue, and 3,684 pieces of beige. Calculate the total pieces.
2. The Krinsk Building has the following space available for rent: 627 square feet, 3,780 square feet, 912 square feet, 96 square feet, 2,570 square feet, and 736 square feet. Calculate the total vacant space.
3. Tom held five jobs during the year. His earnings statements revealed that he had earned the following salaries: $628.40, $3,780.12, $68.00, $746.18, and $2,764.15. Determine his total annual earnings.
4. The assets of the Right-Way Corp. consist of the following: cash in bank, $12,678.40; cash on hand, $125.00; receivables, $6,788.19; merchandise inventory, $7,663.47; delivery equipment, $4,627.14; supplies, $683.64; and prepaid insurance, $1,263.00. What are the total assets of the corporation?
5. Calculate the total weekly sales of Parker, Inc., if the daily sales are as follows: Monday, $463.14; Tuesday, $788.41; Wednesday, $636.00; Thursday, $568.94; Friday, $13,688.19; and Saturday, $19,273.47.
6. The monthly payrolls of the Ryan Corp. were as follows: $3,748.12, $6,347.18, $2,147.22, $7,866.14, $9,268.72, $8,846.14, $2,789.41, $8,896.12, $3,368.31, $746.77, $126.70, and $3,688.14. Calculate the annual payroll.

c. *Combinations of 10*

Most competent arithmeticians do not add a column in a number-by-number fashion. Instead, they pick out combinations of 10 which they recognize instantly. The following are the two-number combinations of 10 that you should memorize. These should not require you to think 6 + 4 = 10, but the numbers 6 and 4 should be thought of as 10 with no intermediate calculations.

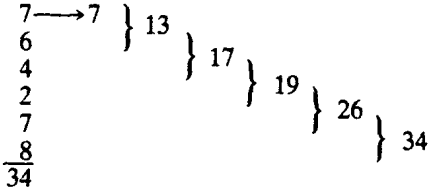
1	2	3	4	5	or	9	8	7	6	5
9	8	7	6	5		1	2	3	4	5

Illustrative Problem

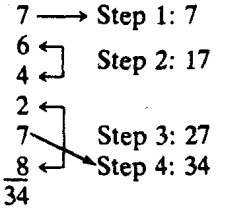
Add.

$$\begin{array}{r} 7 \\ 6 \\ 4 \\ 2 \\ 7 \\ \underline{8} \end{array}$$

Solution. Without using combinations totaling 10, you would normally think 7, 13, 17, 19, 26, 34.



But by grouping into combinations totaling 10, you would think 7, 17, 27, 34. In other words, the steps in the addition would be numbered as shown here:



Although this method may be cumbersome at first, it is worthwhile to develop. The authors estimate that 90% of all accountants add by using combinations of 10.

There are also many three-digit combinations totaling 10 that should be instantly recognized. Some of these are

1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4
1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
8	7	6	5	7	6	5	4	6	5	4	3	5	4	3	2

1.4 SOLVE THESE PROBLEMS: Add, using combinations of 10.

1. 6	**2.** 2	**3.** 5	**4.** 7	**5.** 9	**6.** 4	**7.** 3
7	8	6	8	8	2	9
3	4	5	3	1	8	7
8. 16	**9.** 81	**10.** 16	**11.** 77	**12.** 94	**13.** 14	**14.** 39
37	77	37	83	26	26	28
24	99	74	34	83	37	11
73	35	28	56	12	83	72
15. 312	**16.** 416	**17.** 126	**18.** 984	**19.** 827	**20.** 297	**21.** 632
463	379	368	126	363	603	387
738	694	984	378	289	816	723
267	386	742	188	466	204	466
849	724	866	732	634	497	643

22. 4,783	**23.** 3,762	**24.** 4,636	**25.** 5,277	**26.** 3,788
3,629	2,328	2,472	1,833	1,422
6,317	7,649	8,968	4,164	7,366
5,618	3,618	2,743	2,946	2,734
4,492	8,492	6,357	7,365	9,648
27. 1,642	**28.** 3,822	**29.** 28,364	**30.** 27,362	**31.** 96,427
2,438	1,487	12,447	36,187	34,182
9,960	7,203	80,793	83,943	13,673
8,134	8,678	26,319	72,473	42,781
7,676	2,690	94,601	26,377	68,309
		72,688	38,637	12,784
32. 12,796	**33.** 27,988	**34.** 97,233	**35.** 79,006	
37,314	14,129	33,844	37,118	
27,728	83,001	10,166	31,894	
12,939	97,273	28,733	61,902	
14,382	12,469	71,378	87,377	
98,071	12,837	82,002	14,736	

1.5 SOLVE THESE PROBLEMS: Use combinations of 10.

1. Payroll checks for one week were $127.63, $78.15, $229.17, $164.29, and $46.18. How much cash will be required to meet the payroll?
2. Calculate the total cash value of goods received if the individual bills were $126.80, $782.19, $384.20, $1,308.91, $2,746.50, and $7,354.50.
3. The monthly rents of a small office building are $325.12, $168.98, $685.60, $429.40, $1,237.80, and $423.28. Calculate the monthly rent roll.
4. Determine the amount of cash needed to cover checks written in the amounts: $97.26, $4.68, $13.74, $3.00, $626.41, $2,484.62, and $47.88.
5. Tom Johnson is paid according to the number of pieces he produces. His production for 1 week was Monday, 3,762 pieces; Tuesday, 2,648 pieces; Wednesday, 8,421 pieces; Thursday, 6,812 pieces; and Friday, 7,288 pieces. What was Tom's total production for the week?
6. Calculate the total kilowatt usage from the following weekly totals: 27,626, 33,980, 80,404, 62,163, 38,942, and 76,308.

d. Proving Addition

Of the several ways of proving addition, reading in the opposite direction is by far the most common. If the original total was arrived at by adding the column from the top down, the proof would be accomplished by getting the same total by beginning at the bottom of the column and adding up.

Another method of proving addition is by adding the columns, writing the total of each column separately, and indenting one place left, then adding the column totals (partial sums).

Illustrative Problem

Add and prove.

Solution.

$$\begin{array}{r} 1{,}527 \\ 6{,}376 \\ 1{,}429 \\ 2{,}638 \\ 1{,}726 \\ 1{,}837 \\ 2{,}618 \\ \underline{2{,}638} \\ 20{,}789 \end{array}$$

Proof. Add each column separately.

$$\begin{array}{rl} 1{,}527 & \\ 6{,}376 & \\ 1{,}429 & \\ 2{,}638 & \\ 1{,}726 & \\ 1{,}837 & \\ 2{,}618 & \\ \underline{2{,}638} & \\ 59 & (7 + 6 + 9 + 8 + 6 + 7 + 8 + 8) \\ 23 & (2 + 7 + 2 + 3 + 2 + 3 + 1 + 3) \\ 45 & (5 + 3 + 4 + 6 + 7 + 8 + 6 + 6) \\ 16 & (1 + 6 + 1 + 2 + 1 + 1 + 2 + 2) \\ \hline 20{,}789 & \end{array}$$

Note that each partial sum is indented one column.

1.6 SOLVE THESE PROBLEMS: Add and prove.

1.
$$\begin{array}{r} 3{,}728 \\ 1{,}463 \\ 5{,}936 \\ 2{,}844 \\ 1{,}526 \\ \underline{3{,}799} \end{array}$$

2.
$$\begin{array}{r} 16{,}327 \\ 57{,}286 \\ 38{,}194 \\ 21{,}412 \\ 67{,}808 \\ \underline{84{,}273} \end{array}$$

3.
$$\begin{array}{r} 63{,}808 \\ 18{,}275 \\ 28{,}998 \\ 37{,}228 \\ 16{,}189 \\ \underline{94{,}379} \end{array}$$

4.	5.	6.
289,736	327,188	975,263
374,263	187,989	236,632
185,317	963,274	178,188
263,362	147,741	169,961
203,848	208,343	907,163
278,417	369,774	187,521

e. *Breaking Columns*

It is frequently helpful in adding long columns of numbers to separate them into several parts, arrive at subtotals, and then add the subtotals. This method may also be used as a proof.

Illustrative Problem

Add by dividing into subtotals.

3,726
4,816
2,978
1,523
3,729
1,866
4,637
2,619

Solution.

3,726		
4,816		
2,978		
1,523	13,043	Subtotal
3,729		
1,866		
4,637		
2,619	12,851	Subtotal
	25,894	Total

1.7 SOLVE THESE PROBLEMS: Add by finding the subtotals where indicated and adding the subtotals. Prove.

1.	2.
1,273	3,896
4,868	2,769
3,729	3,728
1,633	9,429
2,788	3,768
1,577	1,427
Total	Total

3. 1,627
7,836
1,568
9,561
3,768
9,248
Total

4. 1,877
1,926
3,747
1,268
3,926
1,877
4,236
7,233
5,726
Total

5. 3,726
5,698
7,378
7,561
1,627
2,478
5,733
3,899
9,421
Total

6. 37,263
54,379
73,187
14,269
93,776
29,367
34,429
14,477
26,376
Total

f. Horizontal Addition

Frequently business forms present numbers to be added in horizontal rather than in vertical form. To save the time required to relist these numbers vertically, business people often add horizontally.

Illustrative Problem

$$127 + 638 + 476 + 788 + 372 = 2{,}401$$

Solution. This problem is solved in the same manner as vertical addition; that is,

1. Starting with the rightmost digits, add $7 + 8 + 6 + 8 + 2 = 31$. Write the 1 and carry 3 to the second column ___1
2. Then add the second rightmost digits, $3 + 2 + 3 + 7 + 8 + 7 = 30$. Write the 0 and carry 3 to the third column, __01
3. Then add the third rightmost digits, $3 + 1 + 6 + 4 + 7 + 3 = 24$. Sum = 2401

1.8 SOLVE THESE PROBLEMS:

1. $786 + 375 + 682 + 747 =$
2. $376 + 147 + 966 + 525 =$
3. $472 + 638 + 395 + 716 =$

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