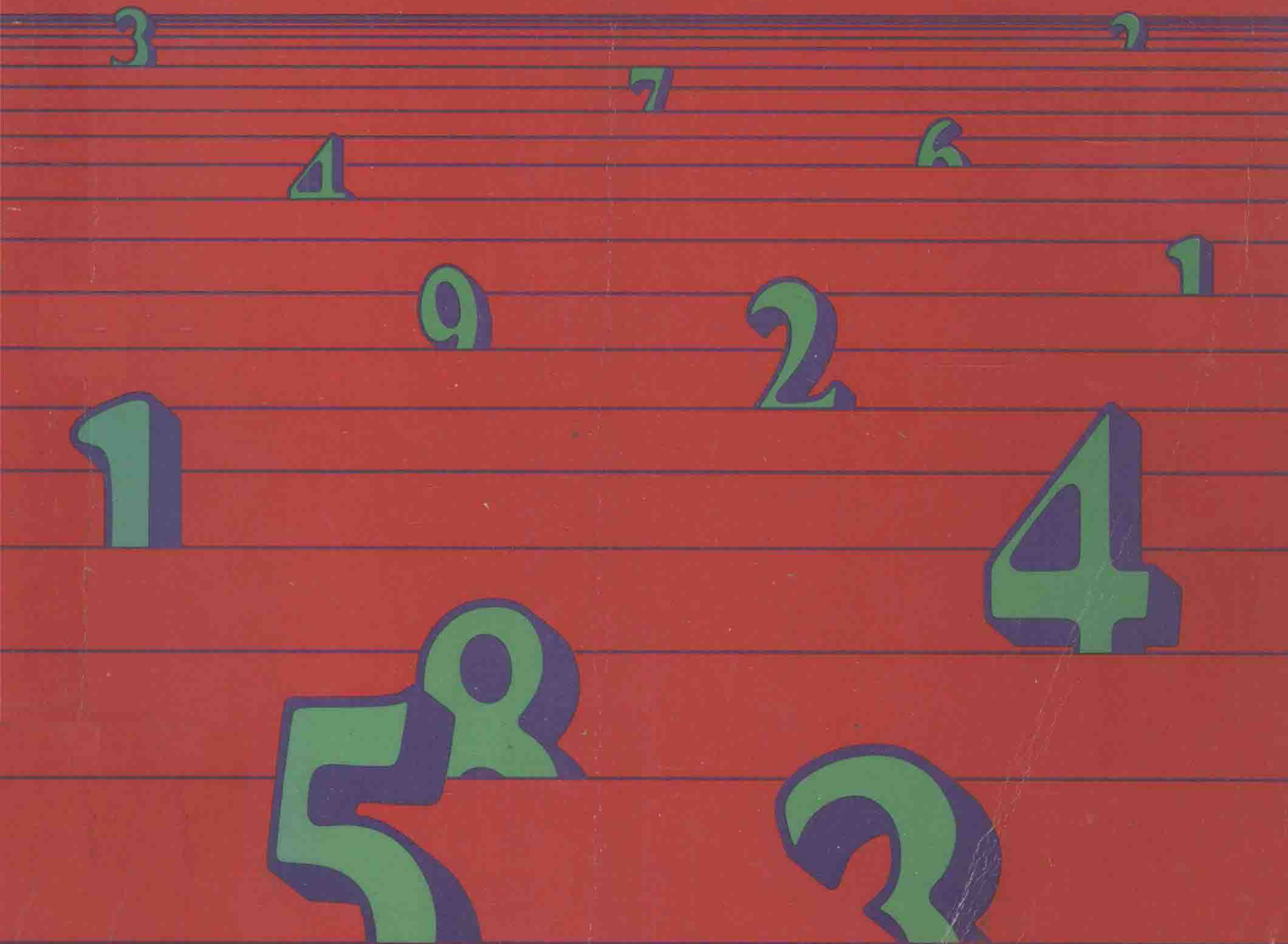
Workbook of Solutions and Dosage of Drugs

INCLUDING MATHEMATICS

TWELFTH EDITION

Vervoren · Oppeneer



Workbook of Solutions and Dosage of Drugs

INCLUDING MATHEMATICS

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TWELFTH EDITION

The C. V. Mosby Company

ST. LOUIS TORONTO 1983

MOSBY

A TRADITION OF PUBLISHING EXCELLENCE

Editor: Julie Cardamon
Assistant editor: Bess Arends
Manuscript editor: Patricia J. Milstein
Design: Suzanne Oberholtzer
Production: Judy Bamert

TWELFTH EDITION

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Previous editions copyrighted 1939, 1943, 1947, 1953, 1956, 1960, 1964, 1968, 1972, 1976, 1980

Printed in the United States of America

International Standard Book Number 0-8016-5228-6

The C.V. Mosby Company
11830 Westline Industrial Drive, St. Louis, Missouri 63146

TS/VH/VH 9 8 7 6 5 4 3 2 03/C/330

Preface

This workbook is primarily designed for students in nursing and is a useful resource for nurses returning to practice. Pharmacy students and pharmacy technicians will also find the workbook a valuable learning resource. The purpose of the book is to provide learning activities that will assist the student to develop knowledge and skills necessary to safely participate in components of patient care related to drug therapy.

The workbook has been developed to be used as a text for a course in drugs and solutions, as a supplement for a course in pharmacology, and as a self-study program for health care professionals. The objectives that precede each chapter, the practical problems related to current drug therapy, and the tests that can be self-administered make the book an adaptable resource.

The concise ''Review of Mathematics'' that precedes the sections related to pharmaceutical calculations can be completed independently and followed with the survey test. ''Systems of Measurement'' provides basic information on the apothecaries' and metric systems, conversion from one system to another, and the conversion of Celsius and Fahrenheit temperature measurement. ''Calculation of Dosage'' is based on practical drug problems encountered in clinical practice. All problems of external, oral, parenteral, and pediatric dosage calculations relate to actual health care situations. This approach assists the student to more readily relate theory to practice. Answers to problems and a comprehensive examination are located in the Appendix.

We express our appreciation to faculty and students for their suggestions that have been incorporated into this revision, and to Paula Meyer for typing the manuscript.

Thora M. Vervoren
Joan E. Oppeneer

To Students

This book is designed for guided or independent study. Objectives preceding each chapter will guide you in determining your achievements. Practical drug problems that follow each chapter may be worked in the spaces provided and may be used as a future reference. Answers to the drug problems are located in the Appendix and may be used in evaluating your work.

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Contents

PART 1

REVIEW OF MATHEMATICS

- Arabic and Roman Number Systems
- Fractions and Ratio
- Decimals
- Percentage and Proportion

CHAPTER 1

Arabic and Roman Number Systems

OBJECTIVES

At the completion of this chapter, the student will:

- differentiate the Arabic system from the Roman system of numbers
- convert Arabic numerals to Roman numerals
- convert Roman numerals to Arabic numerals

The history of the system of numbers is assumed to go back in time before recorded history. Each country had its own system, and as communications and exchange of goods between peoples increased, the need for a common system of numbers increased. The system of numbers with which we are familiar is derived from the early systems of the Arabians, Hindus, Babylonians, Assyrians, Egyptians, and tribes unnamed in history.

The early system of notation was largely a system of counting. This type of notation was similar to our whole number. In time another kind of notation made its appearance. It was used in designating a part of a whole and was called a broken number or fraction. Earliest history of a broken number or fraction comes from the Egyptians and Babylonians. As the system of notation developed, the Greeks followed the Egyptian system of fractions and the Romans the Babylonian system of fractions. By the end of the sixteenth century the surviving systems of numbers were the Arabic and Roman.

THE ARABIC SYSTEM OF NOTATION

Arabic numerals are 1, 2, 3, 4, 5, 6, 7, 8, 9, 0.

The Arabic system has surpassed and supplanted all other systems because it is simple and versatile. A numeral expresses a number and a combination of numerals expresses other numbers. Each numeral has a place value beginning from right to left. In a number such as 245, 5 is in the one's place expressing 5 ones; 4 is in the ten's place expressing 4 tens; 2 is in the hundred's place expressing 2 hundreds. Successive numerals occupy a place whose value is ten times as much as the preceding one.

Another advantage of the Arabic system is that it is readily adapted to use with broken numbers or fractions. This is indicated by the numerals to the right of one's place. The separation of whole numbers, a broken number, or fraction is indicated by a symbol. The most common is the decimal point.

The four basic processes of computation—addition, subtraction, multiplication, and division—can be carried out in the Arabic system.

THE ROMAN SYSTEM OF NOTATION

The Romans used letters to designate numbers. This restricts the system's usefulness, since there is no way to indicate processes in arithmetic such as division or multiplication. Roman numerals are sometimes used on dials of clocks and watches, for dates, especially on public buildings, and to head chapters in books. Roman numerals are used in the apothecaries' system of measures in writing prescriptions and dosage of drugs.

Basic Roman numerals are expressed by seven capital letters as follows:

Roman numeral	Arabic equivalent
I	1
V	5
X	10
L	50
C	100
D	500
M	1000

$\overline{\text{D}}$ = 5000, and $\overline{\text{M}}$ = 10,000, but these are seldom used.

Roman numerals also may be expressed in lower case letters.

When Roman numerals are used to write dosage of drugs and prescriptions, the numerals are expressed in lower case letters. The most commonly used lower case Roman numerals are as follows:

Roman numeral	Arabic equivalent
i	1
v	5
x	10
l	50

A combination of Roman numerals expresses other numbers.

Rule I—addition indicated

1. When a numeral of lesser value follows one of greater value.
2. When numerals of the same value are repeated in sequence. However, numerals are never repeated more than three times in a sequence.

EXAMPLES:

1. VI = 5 + 1, or 6
   XV = 10 + 5, or 15

2. II = 1 + 1, or 2
   III = 1 + 1 + 1, or 3
   XXX = 10 + 10 + 10, or 30

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Rule II—subtraction indicated

1. When a numeral of lesser value precedes one of greater value.

2. When a numeral of lesser value is placed between two of greater value, the numeral of lesser value is subtracted from the numeral following the one of lesser value.

EXAMPLES:

1. IV = 5 − 1, or 4
   IX = 10 − 1, or 9
   XL = 50 − 10, or 40

2. XIV = 10 + 5 − 1, or 14
   XXIX = 10 + 10 + 10 − 1, or 29
   MCMLXXXIII = 1000 + 1000 − 100 + 50 + 10 + 10 + 10 + 3 or 1983

PROBLEMS

Name ______________________

Date ______________________

ARABIC AND ROMAN NUMBER SYSTEMS

1. Write the following Arabic numerals as basic Roman numerals:

56	________	448	________
100	________	60	________
40	________	210	________
30	________	919	________
1550	________	27	________
656	________	85	________
504	________	99	________
1985	________	259	________

2. Write the following Roman numerals as Arabic numerals:

CCL	________	DCC	________
CDLV	________	DCL	________
MCMLXXV	________	DCX	________
XCIV	________	MM	________
CX	________	IV	________
XXIX	________	LVI	________
XVII	________	IX	________
XXXIII	________	XI	________
L	________	MXL	________
VC	________	LXXXIX	________

3. Write the following Arabic numerals as lower case Roman numerals:

6	________	3	________
14	________	51	________
22	________	7	________
19	________	18	________
1061	________	155	________

4. Write the following lower case Roman numerals in Arabic numerals:

ix	________	xl	________
xxiv	________	xii	________
lxv	________	xxix	________
iv	________	lxxi	________
cxli	________	xxxv	________

CHAPTER 2

Fractions and Ratio

OBJECTIVES

At the completion of this chapter, the student will:

- identify various kinds of fractions
- change the form of fractions
- compute fraction problems
- compute ratio problems

A fraction is a number that indicates division. In a simple form it expresses one or more parts into which a unit is divided.

EXAMPLES:

$1/3$ is one part of a unit that is divided into three equal parts.

$2/7$ is two parts of a unit that is divided into seven equal parts.

$3/8$ is three parts of a unit that is divided into eight equal parts.

The **numerator** is the dividend, or the number above the line. It tells how many parts of the divided unit are taken.

The **denominator** is the divisor, or number below the line. It tells into how many parts the unit is divided.

The numerator and denominator are called the **terms** of a fraction.

EXAMPLE: $\frac{2}{5}$ 2 is the numerator, 5 is the denominator. 2 and 5 are the terms.

As the denominator of a fraction increases, the value decreases if the numerator remains the same.

$$\frac{1}{2}, \frac{1}{3}, \frac{1}{5}, \frac{1}{10}, \frac{1}{20}$$

The fractions in this series are from greater to lesser value. It is possible to add, subtract, multiply, and divide fractions in the same manner as whole numbers.

KINDS OF FRACTIONS

1. A **proper fraction,** often called a simple or common fraction, is a fraction in which the numerator is smaller than the denominator. It is less than one unit.

EXAMPLES: $1/4$, $7/9$, $2/3$

2. An **improper fraction** is a fraction in which the numerator is equal to or greater than the denominator. It is equal to one unit or more than one unit.

EXAMPLES: $\frac{3}{2}$, $\frac{11}{3}$, $\frac{8}{8}$

3. A **mixed number** is a whole number and a fraction. Its value is always more than one unit.

EXAMPLES: $2\frac{1}{9}$, $8\frac{6}{7}$

4. A **complex fraction** is a fraction in which the numerator or the denominator is a fraction, or the numerator and denominator are both fractions.

EXAMPLES: $\dfrac{5}{\frac{1}{2}}, \dfrac{\frac{1}{2}}{5}, \dfrac{\frac{2}{3}}{\frac{5}{6}}$

In these fractions 5, $\frac{1}{2}$, and $\frac{2}{3}$ are the numerators; $\frac{1}{2}$, 5, and $\frac{5}{6}$ are the denominators.

LIKE AND UNLIKE FRACTIONS

Fractions whose denominators are alike, such as $\frac{2}{7}$, $\frac{3}{7}$, and $\frac{5}{7}$, are called **like fractions.**

Fractions whose denominators are unlike, such as $\frac{1}{3}$, $\frac{1}{4}$, and $\frac{2}{5}$, are called **unlike fractions.**

Like fractions can be added, subtracted, multiplied, and divided.

Unlike fractions can be multiplied and divided. Therefore when addition or subtraction of unlike fractions is indicated, it becomes necessary to change the unlike fractions to like fractions. The change results in a new fraction, different in form but equal to the original fraction, which is called an equivalent fraction.

EQUIVALENT FRACTIONS

The equivalency of fractions is based on a fundamental principle in computing with fractions: *Multiplying or dividing both terms of a fraction by the same number does not change its value.*

Computing with fractions depends on this principle. Multiplying or dividing both terms of a fraction by the same number results in another fraction of the same value and is called an **equivalent fraction.**

EXAMPLES:

1. Multiply both terms of $\frac{3}{4}$ by 2; by 4:

$$\frac{3 \times 2}{4 \times 2} = \frac{6}{8} \qquad \frac{3 \times 4}{4 \times 4} = \frac{12}{16}$$

The resulting fractions $\frac{6}{8}$ and $\frac{12}{16}$ are equal to $\frac{3}{4}$ and to each other.

When both terms of a fraction are multiplied by the same number, the terms of the new fraction are **larger** than the terms of the original fraction.

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