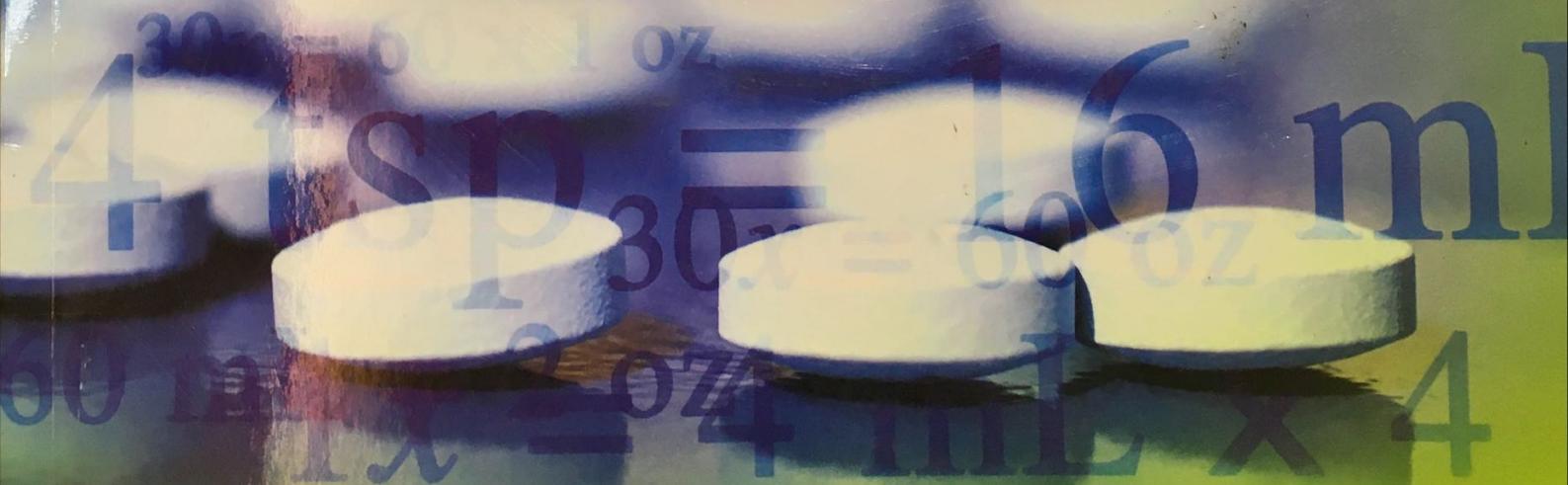


Math Calculations

for Pharmacy Technicians

A Worktext



Robert M. Fulcher
Eugenia M. Fulcher

**SECOND
EDITION**

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Abbreviations Commonly Used in Prescription Writing

Abbreviation	Meaning	Abbreviation	Meaning
i, 1	one	oint	ointment
ii, 11	two	O.S., OS	left eye
iii, 111	three	OTC	over-the-counter
v, 5	five	O.U., OU	both eyes
x, 10	ten	oz, 3	ounce
aa	of each	p	after
a.c.	before meals	pc	after meals
ad lib	as desired	per	by, with
agit	shake	pm	afternoon
am	morning	po	by mouth
aq	aqueous, water	prn, PRN	as needed
bid	twice a day	pt	pint
BSA	body surface area	Pt	patient
c	with	pulv	powder
cap(s)	capsule(s)	q	every
d	day	qam	every morning
dil	dilute	qh	every hour
dr, 3	dram	q2h	every 2 hours
Dr., MD	doctor	q4h	every 4 hours
D/W	dextrose in water	q6h	every 6 hours
Dx, dx	diagnosis	q12h	every 12 hours
EENT	eye, ear, nose, and throat	qid	four times a day
elix	elixir	qns	quantity not sufficient
emul	emulsion	qs	quantity sufficient
ext	extract	rep	repeat
f.fl	fluid	R, Rx	prescription
G	gauge	s	without
gal	gallon	Sig	directions, write on label
gm, g	gram	sol	solution
gr	grain	ss	one-half
gtt	drop(s)	stat, STAT	immediately, at once
H, hr, h	hour	subling, SL	sublingual, under tongue
IM	intramuscular	supp	suppository
inj	injection	S/W	saline in water
IV	intravenous	syr	syrup
K	potassium	tab	tablet
kg	kilogram	Tbsp, tbsp, T	tablespoon
L, #, lb	pound	tid	three times a day
liq	liquid	tinc, tr	tincture
m, m	minim	TO	telephone order
mcg	microgram	top	topically
mEq	milliequivalent	tsp, t	teaspoon
mg	milligram	ung	ointment
mL	milliliter	VO	verbal order
mm	millimeter	wt, Wt	weight
Na	sodium	x	times
noc	night	=	equal to
non rep	do not repeat	↑	increase
npo	nothing by mouth	↓	decrease
NS	normal saline		

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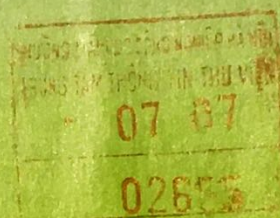


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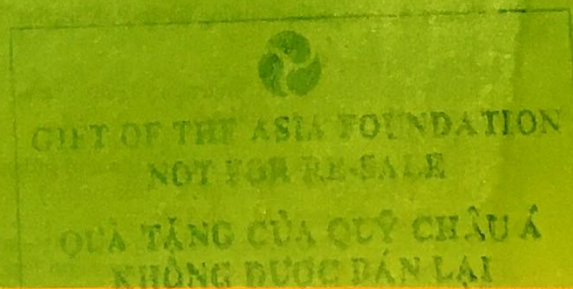
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SECOND EDITION

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Contributors and Reviewers

To our parents, Robert M. and Lucy F. Fulcher and Harold L. and Rosabel L. Mills, we give thanks for our genetic and educational backgrounds in all areas but especially in the math field. Their diligence to lovingly provide for us and give us roots and wings, love, and allow personal growth, ensured that we are who we are today with the abilities that we have. We only wish that they could enjoy this publication with us. We know they would be proud as both of our mothers were educators.

To our sons, Lee and Gene Fulcher, we wish for you the very best in the remainder of your lives. You are wonderful children and we are proud of your accomplishments. Lee, your inclusion of your business background in this text only strengthens the educational materials. Thanks.

To our grandchildren, Mac and Allie Fulcher, may your lives always be as fun and fruitful as ours have been and are. You are the apples of our eyes and we love both of you dearly. We wish you the best throughout your lives. May you grow into wonderful adults who know the firm foundation provided by our families.

All of you are so special in making us who we are, and we love you and are proud of your accomplishments.

To the students who will use this text, we wish you the best in your chosen careers. May you have a long professional life in the field of pharmacy or other health care fields. We have enjoyed our many years in the medical field and we wish you the best in the future.

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Preface

In our 50-plus years in the fields of pharmacy and nursing respectively, we have realized that patient safety depends on the ability of health care professionals, especially those responsible for the distribution of medication, to calculate medication dosages and doses. Pharmacy technicians must learn this skill early in their studies and use it continuously throughout their careers. This text, that meets the guidelines prepared by the American Society of Health-System Pharmacists (ASHP) for accredited pharmacy technician programs, is intended to provide the basic—and not so basic—mathematical concepts that are applied to pharmacy.

Our goal with *Math Calculations for Pharmacy Technicians: A Worktext* is to assist pharmacy technician students and other appropriate allied health students who need this background with mastering the mathematical calculations necessary when delivering medications safely. This text provides students with the knowledge to perform calculations for dispensing or administering medications in both ambulatory care and inpatient arenas as well as basic accounting procedures used in retail and some hospital pharmacy. Although some sections of the text are more related to ambulatory care and others are more relevant to hospital settings, both are necessary for the professional pharmacy technician.

As with most mathematical texts, this book includes the traditional methods of calculating medicinal dosages and doses: ratio/proportion, dimensional analysis, and formula method. Even though we show each method, we don't expect you to use all the methods with each problem. You should complete these exercises using the method that works best for you. We have also included other unique ways of obtaining correct calculations. Ultimately, we want to help you find the method that works best for you.

The book is organized from basic mathematical calculations (fractions, percentages) to basic medication calculations to more complicated dose and dosage calculations related to prescriptions and hospital orders. Each chapter builds on the previous knowledge base to ensure that information has been gleaned and processed for use in more exacting situations. For example, reading prescriptions is presented before using the prescription to count medications for dispensing to a patient.

A new chapter on business math presents the routine accounting procedures completed in retail pharmacy on a daily, monthly, or yearly basis with some concepts such as inventory also being used in inpatient pharmacy practice. Business calculations for reimbursement of prescriptions are included for practice prior to the actual need for these concepts. The new chapter provides a brief introduction to the calculations needed for business practices in the pharmacy field, especially in a retail setting, and provides a quick look into these practices for the student who decides to go into the nonhospital pharmacy option. It provides the basic skills for use in a community pharmacy. Inventory control and calculations for reimbursement for medications may be found in all areas of pharmacy and the basic business math concepts are needed to keep the pharmacy efficient.

Because adequate practice is so important, the text includes over 1300 practice problems that cover a wide range of concepts. The concepts of pharmaceutical mathematics build with each chapter, with reinforcement of previous materials throughout the text. The

worktext format allows students to work at a pace that is right for them and meet the needs of the instructor and course objectives. The time devoted to each chapter may vary depending on the student's mathematical level. For this reason, the student's prior mathematical competence is tested with each chapter. Be sure that the math calculations are shown with each problem; this allows the person to find where errors occurred so these errors are not carried forward without accomplishing the needed understanding of the math principle.

ORGANIZATION OF MATERIAL

The text is divided into five sections: Section I, Introduction and Basic Math Skills, which includes an assessment of math skills needed in this field, as well as a review of basic math skills; Section II, Measurements Used in Health Care and Conversions between Measurement Systems, which explores all aspects of the different measurement systems used in the pharmacy; Section III, Medication and Prescription Orders and Their Calculations, which focuses on the calculations needed to fill common prescriptions; Section IV, Special Medication Calculations, which covers special medications, diverse populations, and less commonly used pharmaceutical calculations; and Section V for Basic Business Mathematical Calculations.

CHAPTER FEATURES

Each chapter begins with a set of learning objectives and a list of key words.

OBJECTIVES

- Read labels of powders or crystals (lyophilized) medications to determine correct diluent and correct volume necessary to reconstitute powders
- Check labels for expiration dates and storage conditions before and after reconstitution of solid medication to a liquid form
- Understand the importance of labeling reconstituted medications with date, time, and initials of person performing the medication reconstitution
- Determine the appropriate amount of diluent necessary when using a single-dose container of a powder or crystals
- Determine the appropriate amount of diluent necessary when preparing a multidose container of a powder or crystals
- Determine the appropriate dilution concentration when more than one dosage strength in the multidose container is possible, and then determine amount of diluent necessary to meet desired concentration
- Calculate the amount of medication of a reconstituted medication to be dispensed to meet the physician's order

KEY WORDS

Diluent Agent that dilutes a substance; in pharmacology, the liquid added to a powder to change the powder to a liquid or the liquid used to dilute another liquid

Graduates Containers marked with progressive series of lines or markers, usually in the metric system, for measuring liquids or solids

Lyophilized Freeze dried

Powder displacement Amount of solute that causes displacement in the total volume of medication

Powder volume Space occupied by dry powder or freeze-dried (lyophilized or crystalline)

active ingredient related to total volume of medication following reconstitution with indicated diluent volume

Reconstitution Process of adding fluid, such as distilled water, sterile water for injection, or sterile saline, to a powdered or crystalline form of medication, making a specific liquid dosage strength

Vehicle Inert substance in which a medication is mixed for administration

Included in each chapter is a pretest that indicates the level of student understanding of the calculation principles to be presented.