

# MERCHANDISING MATHEMATICS

A MARKETING APPROACH

$\div$  %  $\times$  + = \$

ANDREA L. WEEKS  
MADELYN C. PERENCHIO  
VERONICA J. MILLER

EDITED BY DOROTHY A. METCALFE

# **MERCHANDISING MATHEMATICS**

---

## **A MARKETING APPROACH**

Andrea L. Weeks \* Madelyn C. Perenchio \* Veronica J. Miller

Edited by

Dorothy A. Metcalfe

All of The Fashion Institute of Design and Merchandising  
Los Angeles

**MERRILL PUBLISHING COMPANY**

A Bell & Howell Information Company  
Columbus \* Toronto \* London \* Melbourne

Published by Merrill Publishing Company  
A Bell & Howell Information Company  
Columbus, Ohio 43216

This book was set in Palatino

Administrative Editor: John Stout  
Production Coordinator: JoEllen Gohr  
Cover Designer: Russ Maselli

Copyright © 1990, by Merrill Publishing Company. All rights reserved. No part of this book may be reproduced in any form, electronic or mechanical, including photocopy, recording, or any information storage and retrieval system, without permission in writing from the publisher. "Merrill Publishing Company" and "Merrill" are registered trademarks of Merrill Publishing Company.

Library of Congress Catalog Card Number: 89-60668  
International Standard Book Number: 0-675-21065-8  
Printed in the United States of America  
1 2 3 4 5 6 7 8 9—93 92 91 90

## Dedication

*Merchandising Mathematics: A Marketing Approach* is dedicated to the students and faculty of The Fashion Institute of Design and Merchandising for their patience and input while this book was being created, and to our families and friends who believed in us and made sacrifices that allowed us to complete the project.

## Preface

The choice of a career in marketing, which encompasses the fields of buying, wholesaling, and manufacturing, is an affirmation of the desire to be involved with the world. Marketing is a universal tool by which needs and desires are fulfilled through producing, buying, and selling goods or services. However, to become successful in a marketing career, it is necessary to have a knowledge of some basic mathematics. *Mathematics is the controlling factor that allows a marketing strategy to be beneficial to the consumer, manufacturer, wholesaler, and retailer.* Mathematics is the key to marketing management and control. It is a planning and control device that allows the individual to develop objectives and, therefore, provides a concrete means of evaluating progress against the plan.

This book is divided into four parts: Basics, Pricing, Repricing and Inventory, and Profit. Each part contains chapters detailing information on these subjects that are so vital to success in the marketing world. Business concepts, chapter objectives, and key terms are explained in clear, concise language; formulas for computing problems are outlined step by step; finally, students are given sample and in-class problems with homework and special challengers to reinforce classroom learning. It is the objective of this book to provide readers with explanations and sufficient practice in order to develop their expertise in the basic concepts and mechanics of marketing and merchandising math, enabling them to acquire the basic knowledge needed to succeed in their chosen field of study.

## Acknowledgments

This book would not have been possible without the invaluable support of many individuals. Therefore, we want to thank the following authors: Gary Armstrong, M. Wayne Delozier, James F. Engel, Newton E. Godnick, Thomas C. Kinnear, Philip Koltler, and Martin R. Warshaw.

In addition, we wish to extend our appreciation for the support provided by the following staff and faculty members of The Fashion Institute of Design and Merchandising: Sharon Charles, Viki Deyoe, Suzanna Grueser, Patrice Hughes, Dan Jaffee, Gail Jenkins, Bill Lee, Michael Lindley, Dr. Norma Melone, Jim Nemmert, Debbie Reiner, Charlotte Rose, Susan Roy, Les Sechler, Rick Trotta, and Gail Williamson

The following reviewers were immensely helpful in their suggestions and general input and we gratefully acknowledge their contributions: Stan Adamski, Owens Technical College; Holly Bastow-Shoop, Ph. D., North Dakota State University; Louis D. Canale, Ph. D., Genesee Community College; Bernice Dandridge, Solano Community College; Gary M. Donnelly, Casper College; Louis Frank, Jr., Dundalk Community College; Laura Jolley, Oklahoma State University; Judy Kraft, Northeast Wisconsin Technical College; Roy O. Kruger, Warner Pacific College; Frank McDaniels, Delaware County Community College; Jack Porter, West Virginia University; Rebecca Shidel, Georgia Institute of Technology; Elizabeth Taylor, Art Institute of Atlanta; and Judy L. Witt, Waukesha County Technical Institute.

We would like to thank the editors and staff of Merrill Publishing Company for their insight, guidance, and belief in this book.

Lastly, we are indebted to our students, who provided questions and feedback in the teaching of this complex subject.

# CONTENTS

## PART 1: BASICS

Chapter 1:	Word Problem Guidelines/Rules of Rounding	1
	Work Unit	3
	Summary and Key Terms	11
Chapter 2:	Review of Percentage and Percentage Increase/Decrease Concept	13
	Work Unit	14
	Summary and Key Terms	27

## PART 2: PRICING

Chapter 3:	Pricing and Markup Concept	29
	Work Unit	32
	Summary and Key Terms	51
Chapter 4:	Markup of Groups Concept	53
	Work Unit	56
	Summary and Key Terms	88
Chapter 5:	Terms of the Sale Concept	89
	Work Unit	92
	Summary and Key Terms	107
Chapter 6:	Averaging of Markups Concept	109
	Work Unit	112
	Summary and Key Terms	148
Chapter 7:	Midterm Review	
	Problems	149
	Solutions	164

### **PART 3: REPRICING AND INVENTORY**

Chapter 8:	Repricing of Merchandise Concept	175
	Work Unit	180
	Summary and Key Terms	203
Chapter 9:	Closing Inventory Concept	205
	Work Unit	210
	Summary and Key Terms	223

### **PART 4: PROFIT**

Chapter 10:	Skeletal Profit and Loss Concept	225
	Work Unit	227
	Summary and Key Terms	243
Chapter 11:	Detailed Profit and Loss Concept	245
	Work Unit	248
	Summary and Key Terms	278
Chapter 12:	Final Review	
	Problems	279
	Solutions	300

# PART ONE: BASICS

## CHAPTER ONE

### Word Problem Guidelines and Rules of Rounding

#### OBJECTIVES

After completing this chapter, you should be able to:

- Successfully read and comprehend word problems.
- Correctly round a number using three different methods.
- Express numbers in the proper form as related to common business practice.
- Apply the principles learned to a business situation.

#### CONCEPT

This unit deals with the two areas that most often present a challenge to the student—word problems and rounding numbers. Although these concepts are elementary, word problems and rounding are used daily in business. Therefore, a simple review is in order to make sure that everyone starts from the same base of knowledge.

The first area discussed in this unit is **word problem solving**. Word problems are important because they are a verbal expression of a mathematical question. In the work environment, your supervisor will rarely write out a question for you. More often than not, communication will be verbal; e.g., while you are out on the selling floor, your boss asks you what percent of the stock you sold. This is a word problem. Your ability to answer questions like this will depend on how well you solve word problems. Following the ten-step procedure in this chapter will help you:

1. Develop the ability to recognize key words;
2. Delete extraneous material; and
3. Use the proper formulas correctly.

Once you have developed sufficient facility with word problems, the next major challenge is expressing the correct answer in the accepted form. This process involves the procedure known as **rounding**.

The concept of rounding is simple: It is a procedure that allows you to express the number in shortened form. However, since the introduction of computers to the business world, there are now three common ways of rounding used that apply to different business situations. These three methods are:

1. Rounding by looking to the number to the immediate right of the digit to be rounded (e.g., 54.445 is rounded to 54.4);



2. Rounding by truncating, or cutting off, the number at a certain point regardless of what the rest of the number is (e.g. 54.445 is rounded to 54.4); and
3. Rounding by looking at the number to the farthest right and rounding forward (to the left) up to the digit required (e.g., 54.445 is rounded to 54.5).

The last method of rounding, from the far right, is most often used when a buyer or wholesaler is trying to determine markup or profit of merchandise. Therefore, this is the method we will use in this book. The main point to remember in this procedure is not to round too far. Express the number in its proper form (i.e., units are expressed as whole numbers, dollars are usually expressed to an even cent, and percents are expressed to the first decimal).

#### DEFINITIONS OF TERMS USED IN THIS CHAPTER

**Rounding** — a procedure that results in expressing a number in a shortened form.

**Rounding—looking to the immediate right method** — procedure that shortens the number by checking one decimal place beyond the required form.

**Rounding—looking to the far right method** — procedure that shortens the number by starting at the far right and rounding decimal by decimal to the required form.

**Truncating method** — procedure that shortens the number by “cutting off” the number at the required decimal.

**Word problem** — a verbal expression of a mathematical question.

#### FORMULA: THE STEPS IN SOLVING WORD PROBLEMS

If you are careful to follow these ten steps, you should have no trouble.

1. Read the entire problem through once.
2. Stay calm.
3. Read the entire program through a second time, listing how many and what types of answers are needed.
4. Cross out all unnecessary words (story words).
5. Do not cross out key words: any numbers, any marketing terms (e.g., sales, cost, plan, amount spent, etc.).
6. Write down all formulas that seem to apply to the problem.
7. Convert all words to the arithmetic functions indicated. For example:

<i>of</i>	bottom of the fraction
<i>less</i>	subtraction
<i>missing</i>	subtraction
<i>was, is, are, were</i>	equals (top of the fraction)

<i>plan</i>	total
<i>increase</i>	addition
<i>more</i>	addition
<i>decrease</i>	subtraction
<i>has, have, had</i>	equals

8. Arrange problem **chronologically** (by time sequence); for example, you buy first, next sell some, then adjust retail price, sell some more, etc.
9. Work the problem in the chronological order established—solving for the unknown in the first action, then moving on to the next time sequence. Circle each answer as you find it and identify it.
10. Make sure all your answers reflect what you are dealing with (i.e., units of items are expressed as whole numbers; dollars are rounded off to even cents; percents are rounded off to the first decimal point, or tenths).

### SAMPLE PROBLEM

---

**Mary Jane has 15 apples. She gives Bob 20.0% of them. She then gives Suzie 50.0% of what she has left. How many did she give to Bob? Suzie? How many does she have left for herself?**

- STEP 1:** Read the problem through once.
- STEP 2:** Stay calm! Take a deep breath and get ready to read the problem again.
- STEP 3:** Read the problem through once again and list how many and what types of answers will be required to solve the problem completely.

Mary Jane has 15 apples. She gives Bob 20.0% of them. She then gives Suzie 50.0% of what she has left. *How many did she give to Bob? Suzie? How many does she have left for herself?*

Answers needed:

- A. How many apples did Mary give Bob?
- B. How many apples did Mary Jane give to Suzie?
- C. How many apples did Mary Jane have left for herself?

- STEP 4:** Cross out all unnecessary words in the problem when you read the problem through for the third time.

Mary Jane has 15 apples. ~~She gives Bob 20.0% of them. She then gives Suzie 50.0% of what she has left.~~ *How many did she give to Bob? Suzie? How many does she have left for herself?*

**STEP 5:** Arrange all the numbers in a chart or formula that applies to the situation.

number of apples given to Bob =  $x$   
 number of apples given to Suzie =  $y$   
 number of apples Mary Jane has left =  $15 - x - y$

$$\frac{\text{part}}{\text{whole}} = \% \text{ (key)}$$

*Formula to find the number of apples given to Bob:*

$$\frac{x}{15} = 20\%$$

*Formula to find the number of apples given to Suzie:*

$$\frac{y}{15 - x} = 50\%$$

*Formula to find the number of apples left for Mary Jane:*

$$15 - x - y = \text{number left}$$

**STEP 6:** Convert all words that indicate arithmetic functions to the correct sign.

Mary Jane *has* (=) 15 apples. ~~She gives~~ Bob 20.0% of (bottom of fraction) ~~them~~.  
~~She then gives~~ Suzie 50.0% of (bottom of fraction) ~~what she has left~~. How many ~~did~~  
~~she give~~ to Bob? Suzie? How many ~~does she have~~ left for herself?

**STEP 7:** Arrange all actions chronologically.

- A. Mary Jane has 15 apples.
- B. She gives Bob 20.0% of them.
- C. She gives Suzie 50.0% of what she has left.
- D. She keeps the remainder.

**STEP 8:** Work the problems in chronological order, solving for the unknown quantity in this time sequence.

- A. Mary Jane has 15 apples.

(There is nothing to solve here; it is merely a statement of fact.)

- B. She gives Bob 20.0% of them (use formula established in Step 7).

$$\frac{x}{15} = 20\% \text{ (key)}$$

Multiply:

$$15 \times 20 (\% \text{ key}) = 3$$

$$x = 3 \text{ (Bob was given 3 apples.)}$$

- C. She then gives Suzie 50.0% of what she has left (use formula established in Step 7).

$$\frac{y}{15 - x} = 50.0\%$$

or since  $x = 3$  established earlier

$$\frac{y}{15 - 3} = 50.0\%$$

or

$$\frac{y}{12} = 50.0\%$$

Multiply:

$$12 \times 50.0 (\% \text{ key}) = 6$$

$$y = 6 \text{ (Suzie was given 6 apples.)}$$

- D. Mary Jane keeps the rest (use formula established in Step 7).

$$15 - x - y = \text{number kept}$$

$$x = 3$$

$$y = 6$$

$$15 - 3 - 6 = 6$$

Mary Jane keeps 6 apples for herself.

*STEP 9:* Identify all answers.

Bob got 3 apples.

Suzie got 6 apples.

Mary Jane kept 6 apples.

*STEP 10:* Make sure all answers required to solve the problems are expressed in the correct form.

Since we are discussing apples in this problem, the correct form would be whole units. All our answers are in whole units and are therefore correct.

**RULES FOR ROUNDING NUMBERS**

1. All units are expressed as whole numbers (e.g., 1, 762, 565).
2. Money is usually expressed as dollars and even cents (e.g., \$15.35, \$1,284.72).
3. All percentages are expressed to the first decimal place, or tenths (e.g., 51.4%, 68.3%).
4. To round off a number on a calculator, make sure your calculator is set on a floating decimal point so that it shows as many decimal places as possible.
5. Next, starting at the farthest number to the right, round off one decimal place at a time.
6. Continue the procedure using this rule:  
**"If the number is 5 or greater, increase the next number to the left by one; if the number is 4 or less, leave it alone"** until you have expressed the number in the terms stated in Rules 1, 2, and 3.

**SAMPLE PROBLEMS**

---

- A. Round off the following number, which represents the units of stock planned as an increase of the sweater inventory in the Newcastle store: 576.85369.**

**STEP 1:** Determine the form in which the number should be expressed.

Units = a whole number

**STEP 2:** Start at the number to the extreme right and round using our "5 or greater rule = up one; 4 or less = leave alone."

Substep a. 576.85369

Substep b. 9 is greater than 5, so increase the next decimal to the left and drop the 9.

Result\*: c. 576.8537

\*Answer is not yet expressed as a whole unit.

**STEP 3:** Repeat the procedure using the new number.

Substep a. 576.8537

Substep b. 7 is greater than 5, so increase the next decimal to the left and drop the 7.

Result\*: c. 576.854

\*Answer is not yet expressed as a whole unit.

**STEP 4:** Repeat the procedure.

Substep a. 576.854

Substep b. 4 is less than 5, so leave the next decimal place to the left alone and drop the 4.

Result\*: c. 576.85

\*Answer is not yet expressed as a whole unit.

**STEP 5:** Repeat the procedure.

Substep a. 576.85

Substep b. 5 is equal to 5, so increase the next decimal place to the left and drop the 5.

Result\*: c. 576.9

\*Answer is not yet expressed as a whole unit.

**STEP 6:** Repeat the procedure.

Substep a. 576.9

Substep b. 9 is greater than 5, so increase the next decimal to the left and drop the 9.

Result\*: c. 577

\*Answer is now expressed as a whole unit.

**B. What is the correct rounded percentage of markup if your calculator reads 61.5796431%?**

**STEP 1:** Percentages are expressed to the first decimal place.

**STEP 2:** Start at the number to the right and round according to the rule.

Substep a. 61.5796431%

Substep b. 1 is less than 5, so leave the next decimal place alone and drop the 1.

Result\*: c. 61.579643%

\*Answer is not yet expressed as a rounded percentage.

STEP 3: Repeat the procedure.

Substep a. 61.579643%

Substep b. 3 is less than 5, so leave the next decimal place alone and drop the 3.

Result\*: c. 61.57964%

\*Answer is not yet expressed as a rounded percentage.

STEP 4: Repeat the procedure.

Substep a. 61.57964%

Substep b. 4 is less than 5, so leave the next decimal place alone and drop the 4.

Result\*: c. 61.5796%

\*Answer is not yet expressed as a rounded percentage.

STEP 5: Repeat the procedure.

Substep a. 61.5796%

Substep b. 6 is greater than 5, so increase the next decimal place and drop the 6.

Result\*: c. 61.580%

\*Answer is not expressed as a rounded percentage.

STEP 6: Repeat the procedure.

Substep a. 61.580%

Substep b. 0 is less than 5, so leave the next decimal alone and drop the 0.

Result\*: c. 61.58%

\*Answer is not expressed as a rounded percentage.

STEP 7: Repeat the procedure.

Substep a. 61.58%

Substep b. 8 is greater than 5, so increase the next decimal place and drop the 8.

Result\*: c. 61.6%

\*Answer is expressed to first decimal place.

**IN-CLASS PRACTICE PROBLEMS**

1. Round off to whole numbers.

- a. 653.459 \_\_\_\_\_
- b. 75.65454 \_\_\_\_\_
- c. 6.44445 \_\_\_\_\_
- d. 66677.2345 \_\_\_\_\_

2. Round off the following percentages to the correct decimal.

- a. 60.00023% \_\_\_\_\_
- b. 152.54546% \_\_\_\_\_
- c. 62.44445% \_\_\_\_\_
- d. 71.4743% \_\_\_\_\_

3. Round off the following dollar amounts to the correct cents.

- a. \$61.43217 \_\_\_\_\_
- b. \$81.4546 \_\_\_\_\_
- c. \$151,562.04679 \_\_\_\_\_

**HOMEWORK**

1. Round off the following numbers to whole numbers, percentages, and dollars.

- |              | Whole #'s | Percentages | \$    |
|--------------|-----------|-------------|-------|
| a. 64.321469 | _____     | _____       | _____ |
| b. 81.9432   | _____     | _____       | _____ |
| c. 1645.7326 | _____     | _____       | _____ |
| d. 581.9243  | _____     | _____       | _____ |



2. A manufacturer looks at her calculator and sees the numbers \$443.7496. If she is looking for the dollar price for a food processor, what is the correct price?
3. A divisional merchandise manager looks at her buyer's purchase order and sees the markup percentage written as 51.445%. What is the correct percentage?
4. A store manager is told to transfer 63.4% of his spark plugs to a new store. Since he has 1,046 units of spark plugs, his calculator shows he must transfer 663.164 units. Exactly how many spark plugs should he transfer?

## CHALLENGER

**A buyer must transfer 66 dresses from her stock of 862 units. What is the percentage of stock she is transferring?**