MATH YOU REALLY NEED

ROBERT GARDNER and EDWARD A. SHORE

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Introduction

Our goal in writing this book was to introduce a variety of real-world situations that would serve as a source of questions for students. We wanted to show how mathematics can be used to solve problems that students may or will encounter in their own lives.

At the same time, we were constantly guided by the standards recommended by the National Council of Teachers of Mathematics. As a result, you will find that much of the material in this book fosters the ideas and suggestions found in *Curriculum and Evaluation Standards for School Mathematics* (1989) recommended by the working groups of the Commission on Standards for School Mathematics of the National Council of Teachers of Mathematics (NCTM, 1906 Association Drive, Reston, VA, 22070). In particular, we have used "problem solving as a means as well as a goal of instruction," as recommended in the *Standards*. We have certainly tried to encourage the active involvement of students in making use of mathematics, we have suggested a variety of approaches ranging from individual investigations to whole-class activities where information is shared, we have encouraged students to communicate ideas through discussion and writing as well as by calculations, and we have assumed that students will make use of pocket calculators and perhaps have access to calculators or computers with graphing capabilities as well.

By choosing problems from a variety of sources, we believe students will recognize the connections between mathematics and other disciplines. Generally, students recognize that mathematics is a valuable tool for the scientist and engineer, but they may not be aware of the role of mathematics in sports, travel, music, art, money, household activities such as cooking and buying paint and lumber, making everyday estimates, and so on.

The questions throughout the book are designed to make use of real-world problems. We hope to motivate students to apply theory to concrete situations. Further motivation will come from doing the analyses required by the problems, comparing solutions, and questioning one another as to whether the answers seem reasonable.

As you can see from the Contents, we have chosen as our sources baseball, travel, the arts, activities related to the household, money, and a variety of other uses of mathematics in everyday life or in answering interesting questions. As former teachers, we know how difficult it is to find time to write questions or develop problem situations that will both challenge and motivate students. We hope you will find that many of these problems meet your needs, are appropriate for your students, and will help them to see that mathematics can play a significant role in their lives.

Additional Instructional Material

Although we recognize the value of unit analysis in problems that require conversion of units, the propitious use of scientific notation in dealing with large and small numbers, and the importance of the proper use of significant figures in calculations based on measurements, we believe that these ideas are best introduced when a need for them arises. Furthermore, we believe these ideas are best handled by the individual teacher who knows when his or her students are ready to deal with these useful concepts. We also realize that a busy teacher often does not have time to prepare questions that would give students practice in converting units, making use of scientific notation, or knowing how many significant figures are appropriate. Consequently, we have included the following "skill-builders" to provide support and practice problems for your students when and if you decide to introduce these concepts. You will find references to these skill-builders in the "To the Teacher" material at the beginning of each chapter.

Name _____ Date _____

16. Paying the Electric Bill

Here is a typical electricity bill received by a customer in Vermont.

Figure 4-1

ITEMIZATION OF YOUR STATEMENT

SERVICE PERIOD FROM MO	DAY	YR	TO MO	DAY	YR	NUMBER OF DAYS	METER READINGS PRESENT	PREVIOUS	METER CONST.	KILOWATT HOURS	DEMAND	RATE	EXPLANATION	AMOUNT
12	23	97	01	24	98	32	06295	5894	1	401		01	See below	40.76

Rate 01 calculation

Customer charge		6.20
VT/DPS	90 kwh × 0.05340 =	4.81
GMP	311 kwh × 0.09567 =	29.75
Total		40.76

Thank you for your payment of $34.74 made on 01/14/98
Payments received after 01/28/98 will be reflected on next month's bill

NEW BALANCE 40.76

COMPARE YOUR AVERAGE DAILY USE WITH LAST YEAR

	DAYS	KILOWATT HOUR USAGE MONTHLY USE	PER DAY	DEMAND	CURRENT MONTH AVERAGE COST PER KWH	PER DAY
January 1997	34	506	14.9			
January 1998	32	401	12.5		0.102	1.27

1. How many kilowatt-hours (kwh) of electrical energy did this customer use each day of the billing period?

2. Use the New Balance figure to find the cost per day.

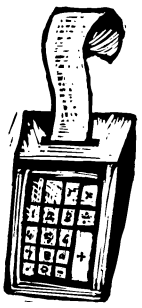
3. Does this answer agree with the cost per day stated on the bill?

4. VT/DPS refers to the up to 90 kwh that the state of Vermont sells to a customer each month. GMP refers to the remainder of the kwh sold to the customer by the billing company, Green Mountain Power. How do these rates differ percentage-wise?

5. Why is the average cost per kwh stated on the bill higher than either the cost per kwh for VT/DPS or GMP?

Name _____ Date _____

17. Budgets



Major budget figures for a small-town library are shown below. (To simplify matters, detailed line items are not included.) FY means fiscal year. Imagine that you are a library trustee. You and other trustees together with the librarian are negotiating with the town financial manager regarding the projected budget for the year 2002. The actual money budgeted and spent in FY 2001 is shown in the left column of figures.

	FY'01 (Actual)	**Projected for FY'02**
Salaries & Benefits	$77,467	$74,780
Cost of Services	$10,000	$14,800
Books, Mags, Subscr, etc.	$21,900	_____
Other	$100	$150
Total	$109,467	_____

1. The library is allowed to increase its budget by 2.5 percent. In fact, to qualify for state aid, it must increase its budget by this amount. Assuming the town would like to receive state aid, what then should be the minimum projected total budget for FY'02?

2. As a further requirement for state aid, the library's book budget, which includes magazines and other subscriptions, must be at least 20 percent of its total budget. The librarian and trustees feel they must budget at least $23,000 for books (Books, Mags, Subscr) in FY'96 to meet the needs of students, senior citizens, and other patrons. If that is to be 20 percent of the budget for FY'96, what would be the total budget figure for that year?

3. The town's financial manager refuses to allow the budget to grow by more than 2.5 percent. What might be done to resolve the matter?

4. What might have brought about the nearly $2,700 reduction in salaries shown in the projected budget figure for FY'02?