

To the Teacher

WHO IS THIS BOOK FOR?

This book is for students who have already had some exposure to fraction arithmetic and would benefit by a more *open-ended* and *creative* approach. It is intended to give students a greater fluency in the subject than can be achieved through the use of rule based learning. Though it is assumed that students are familiar with the basic vocabulary of fraction arithmetic, they are still reacquainted with the meaning of these words. The book can be used for any student at any level by selectively using an Activity or part of an Activity. It is my experience that the teacher is the best judge of a student's preparation for a particular topic. As such, this book is divided into nine Activities, any of which can stand alone depending upon the need and ability of the student. Reading and writing exercises are emphasized in all of the Activities. "Answers," are intended to be short responses, whereas, "explanations," are intended to be a sentence or more. Furthermore, explanations should not be of the form: "Because it is a rule." They should show a student's attempt to explore an idea in their own words.

If you do plan on using this book selectively, it would be a good idea to use Activity 1 as a pretest and as an introduction to the style of the book.

WHY THIS BOOK?

A few years ago I wrote a book called *Living With Math*. Before writing the book I asked 100 college graduates, ages 21-72, to take a basic math test. It turned out that close to 50% of this group could not do fraction arithmetic. College graduates who are unable to perform fraction arithmetic are a sad and telling indicator of the inadequacy of our educational system.

Where have we gone wrong? Part of the problem is that fraction arithmetic is, to put it simply, difficult. Whole number arithmetic, for most people, borders on being intuitive. Fraction arithmetic has never been intuitive for the vast majority of individuals. Historically, it is a subject that was cumbersome for every ancient civilization, often presenting some of the most tedious and difficult mathematics of the time. One needs a good notational system and the ability to abstract and visualize concepts. Fractions have a peculiar way of changing their context. A pie may be cut into six pieces and hence each piece is one-sixth of the pie, but to the person served

the piece of pie, it is thought of as one “whole” piece of pie. When dealing with fractions care must be taken to keep the basic unit—the particular whole which is referenced—in mind. Clearly it is true that one-half plus one-half is equal to one. But is it? In the real world, for example: sitting in a lawyer’s office and dividing up several pieces of property among relatives, may create a scenario wherein one-half plus one-half does not equal one. No more so than one-half of a 10 inch pizza plus one-half of a 16 inch pizza equals one pizza. The halves we deal with are not always referenced to the same unit. Yet most textbooks do not stress this simple and very practical idea. It is always taken for granted that the same unit is always in use. This can be very confusing for students who are asked to use fractions for problems that exist in the real world rather than in the textbook.

WHAT THIS BOOK WILL DO:

The goal of this book is to help students **understand** fraction mathematics rather than memorize rules. Not that memorizing rules in and of itself is a poor idea—it is at times expedient and very useful. But that which makes the rule reasonable is often not addressed. In this book, students are helped to discover why the rules governing fraction arithmetic are reasonable; first by visually considering what fractions are via the sections with “The Grid,” and later by using the more abstract techniques of mathematical manipulation. They are asked to write about mathematics from the point of view: What’s really going on here? This helps the student put mathematical concepts in perspective for themselves, and gives the teacher an opportunity to see how their students are thinking. It is important for students to familiarize themselves with mathematics through language and writing.

Such skills can help students to overcome their confusion with difficult concepts by challenging them to define, internally as well as externally, what is confusing. This is a skill that must be cultivated throughout the entire educational process. Learning how to reflect upon an idea is the beginning of true learning, rather than “knowing” a series of steps that are usually forgotten. It is the first step in claiming an idea for oneself and becoming intellectually empowered.

Oftentimes, when encountering Fractions or Algebra, students have serious problems. There is no doubt that if a student cannot do fraction arithmetic they will not be able to do Algebra. And usually those students who can master Fractions but not Algebra do not understand the logic behind Fractions, even if they do know how to find the answer. This is why learning fraction arithmetic is so critical. Without this knowledge students will never get beyond grade school mathematics.

A WORD ABOUT THE GRID:

The Grid is a purely visual method of doing any kind of fraction arithmetic. It can help those students who have difficulty developing a “feel” for fraction arithmetic. One can actually see the fractions in a problem and do fraction arithmetic using very few “rules.” Since it is visual, it is also more intuitive for most students. But like everything in life, it’s not for everyone. Those students who are good abstract thinkers may find using The Grid cumbersome. It is. But no more so than training wheels on a bicycle would be to one who can already ride.