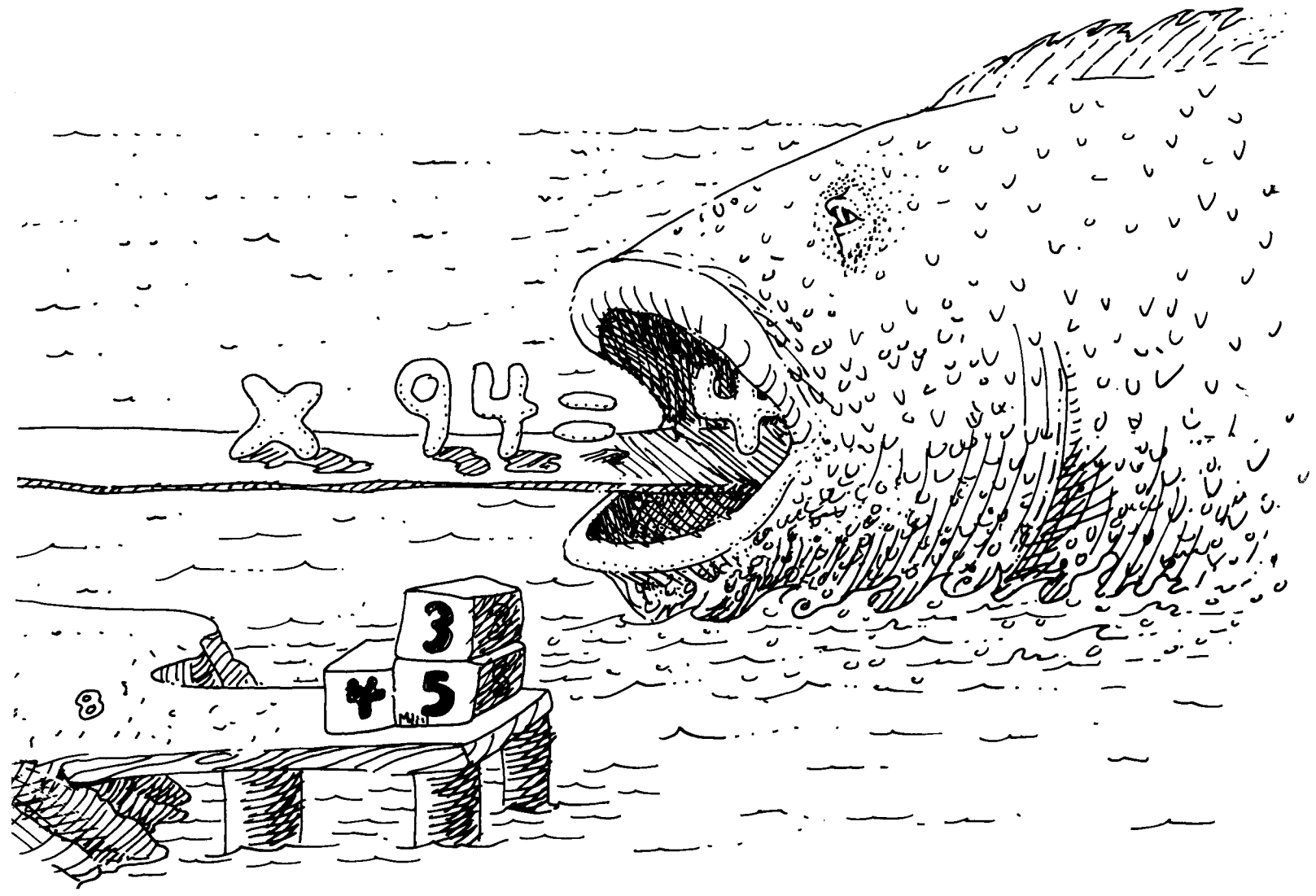
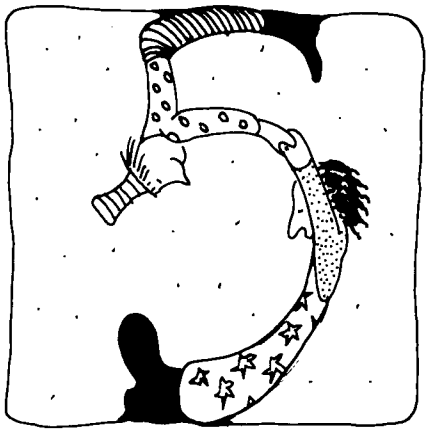
Chapter V

NUMBERS and OPERATIONS





TOOL KIT

Scratch paper
Construction paper of 5 to 8 different colors
Butcher paper or other long strips of paper
Pencils and pens
Scissors
Paste or tape
Dice
Play or real money (dimes and pennies)
A deck of cards
Graph paper (see page 79-82)
Tile squares (paper squares may be used)
Beans (Red beans, Lima beans, Black-eyed peas, or buttons or other objects to represent the beans)

NUMBERS AND OPERATIONS

Jamie goes to the hardware store and buys ten nails for a quarter. Later, she decides not to hammer, and she sells the nails to her friend Tim for two quarters. The next day, Jamie finds a project (putting up five posters) that requires nails. Tim, good friend that he is, sells the nails back to Jamie for three quarters. Before Jamie uses the nails, her friend Tommy comes over with a staple gun. They use staples instead of nails to secure the posters in their clubhouse. Fortunately for Jamie, the neighborhood carpenter, Sean, comes by to see if there are any nails left. Jamie sells Sean the ten nails for four quarters. What was the outcome of Jamie's transactions? Did she lose money, gain money, or break even?

Even though children can do all of the operations involved in this problem, they often don't have enough experience in reasoning through complex situations like this one. Instruction in numbers and operations should provide youngsters with the ability to use arithmetic to solve problems.

Simply teaching the "rules" for addition, subtraction, multiplication, and division, is not enough.

The view that mathematics is arithmetic and that arithmetic is a group of rules may have been a universally held belief at one time, but good math programs now include a much broader curriculum, with teaching for understanding instead of following rules. Even so, teachers of elementary school children often feel pressured to cover skills areas quickly, without enough time to allow children to experience arithmetic sufficiently. As a result, we have a nation of children who can compute the answers to arithmetic problems but are not capable of applying that computing power effectively.

Arithmetic should not be taught as a series of rules because:

Rules are easy to forget, especially if they are learned without an understanding of their applications. Children often use a combination of their own logic with a half-remembered rule: $1/2+1/4=2/6$; 10% of \$100.00 is \$1.00; $42-28=26$; or $\square-4=5$ means 1 goes into the $\square$. Each of the above errors has a logical basis and is the result of using "rules" without understanding their meaning.

Rules minimize thinking. Doing arithmetic solely by the rules enables a child to manipulate numbers symbolically without thinking about the values of the numbers, or what action is really happening. Ask the following question: If you cut ten feet of cloth into two-inch strips, how many strips will you have? A typical response is five.

Rules prevent visualizing interrelationships. Learning arithmetic by the rules makes it difficult to visualize interrelationships in mathematics; adding whole numbers is seen as something different from adding fractions. Fractions are seen as unrelated to decimals except for certain pages in the textbook where one has to change fractions to decimals and decimals to fractions according to a rule. Similarly, 2/4 can be reduced to 1/2 but often children are uncertain which is larger, 1/2 or 2/4, not realizing that 1/2=2/4.

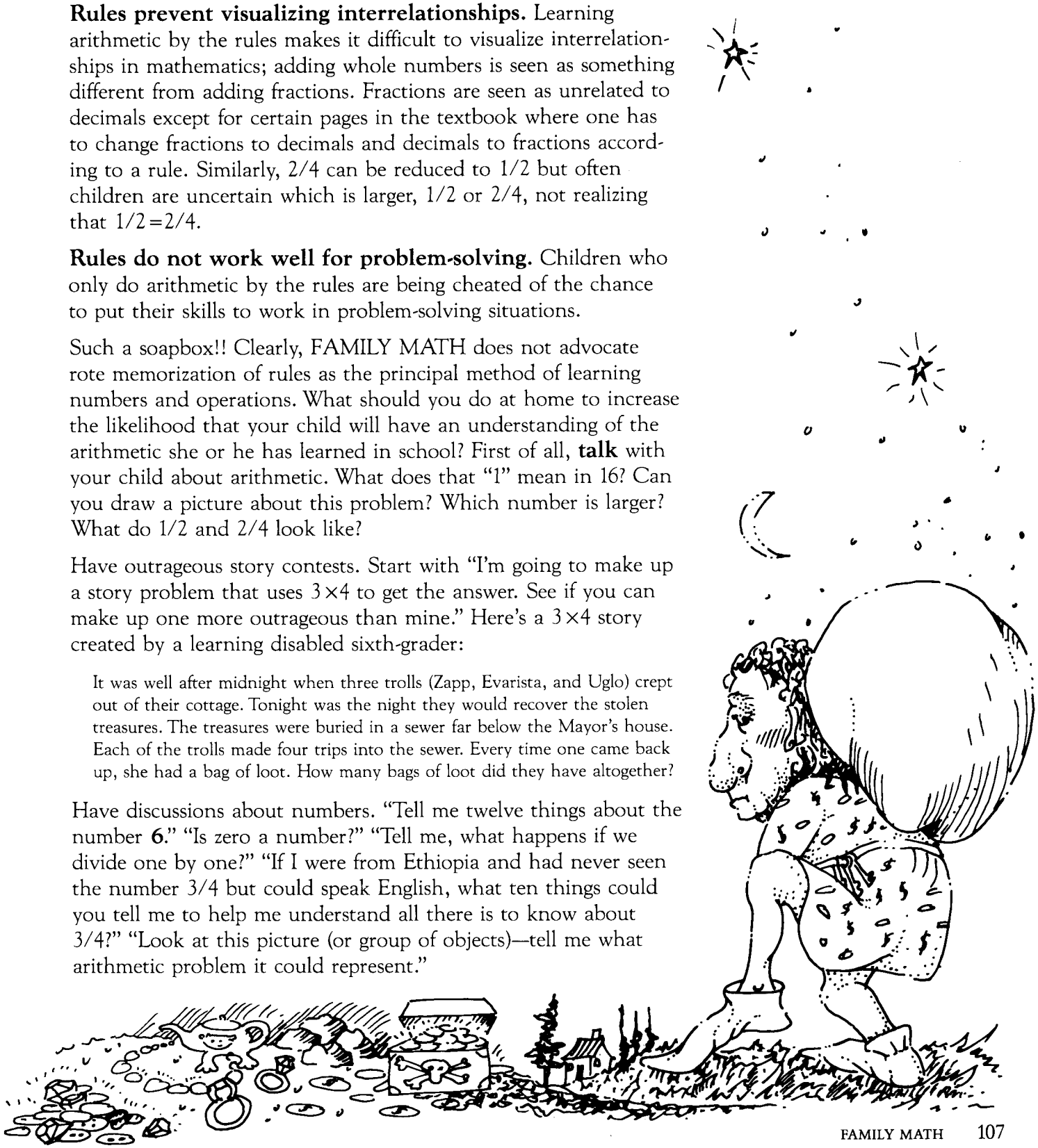
Rules do not work well for problem-solving. Children who only do arithmetic by the rules are being cheated of the chance to put their skills to work in problem-solving situations.

Such a soapbox!! Clearly, FAMILY MATH does not advocate rote memorization of rules as the principal method of learning numbers and operations. What should you do at home to increase the likelihood that your child will have an understanding of the arithmetic she or he has learned in school? First of all, **talk** with your child about arithmetic. What does that "1" mean in 16? Can you draw a picture about this problem? Which number is larger? What do 1/2 and 2/4 look like?

Have outrageous story contests. Start with "I'm going to make up a story problem that uses 3×4 to get the answer. See if you can make up one more outrageous than mine." Here's a 3×4 story created by a learning disabled sixth-grader:

> It was well after midnight when three trolls (Zapp, Evarista, and Uglo) crept out of their cottage. Tonight was the night they would recover the stolen treasures. The treasures were buried in a sewer far below the Mayor's house. Each of the trolls made four trips into the sewer. Every time one came back up, she had a bag of loot. How many bags of loot did they have altogether?

Have discussions about numbers. "Tell me twelve things about the number **6**." "Is zero a number?" "Tell me, what happens if we divide one by one?" "If I were from Ethiopia and had never seen the number 3/4 but could speak English, what ten things could you tell me to help me understand all there is to know about 3/4?" "Look at this picture (or group of objects)—tell me what arithmetic problem it could represent."



When you do the activities in this chapter, remember that the children often need concrete references for the symbols they manipulate. For "Double Digit," (page 111) for example, you may want your youngster to take a popsicle stick for each ten and a bean for each unit as they count to 100, instead of using only paper and pencil.

The bottom line in learning multiplication, subtraction, and addition facts is memorization. Even memorizing can be fun, and the process can be made much easier if a child sees patterns in the numbers and has an understanding of the operations.

We think arithmetic is full of wondrous and elegant notions. Besides learning to compute, children benefit from enjoying the computations, appreciating the beauty and structure of numbers. Try to keep or regain the natural exuberance most children have about numbers. Before these games become drudgery, or a discussion becomes a quiz session, relax and stop for a while. The activities should be used to enrich your relationship with your child, and your child's relationship with mathematics, not to create more stress.

Learning the Basic Facts

Why

To provide alternative methods of learning and practicing the basic arithmetic facts of addition, subtraction, multiplication, and division

► *Parents, teachers, and students themselves will usually identify "learning the basic facts" as one of the major steps in mathematics. Here are some ways to help people with this step. Try them all, to find out which has most appeal and success for your family.* ◄

Practice with just one number fact on a given day. For example, several times in the morning, repeat together "seven times eight is 56." Then suggest to your child that the same number sentence be repeated whenever possible all day long. Usually by the end of the day, that particular fact is well learned. You'll be surprised at how quickly the days will go by, and the facts all memorized.

Repeat the "fact of the day" in as many voices as possible —shout it, sing it, say it in a rumbly voice, use a piping voice, go