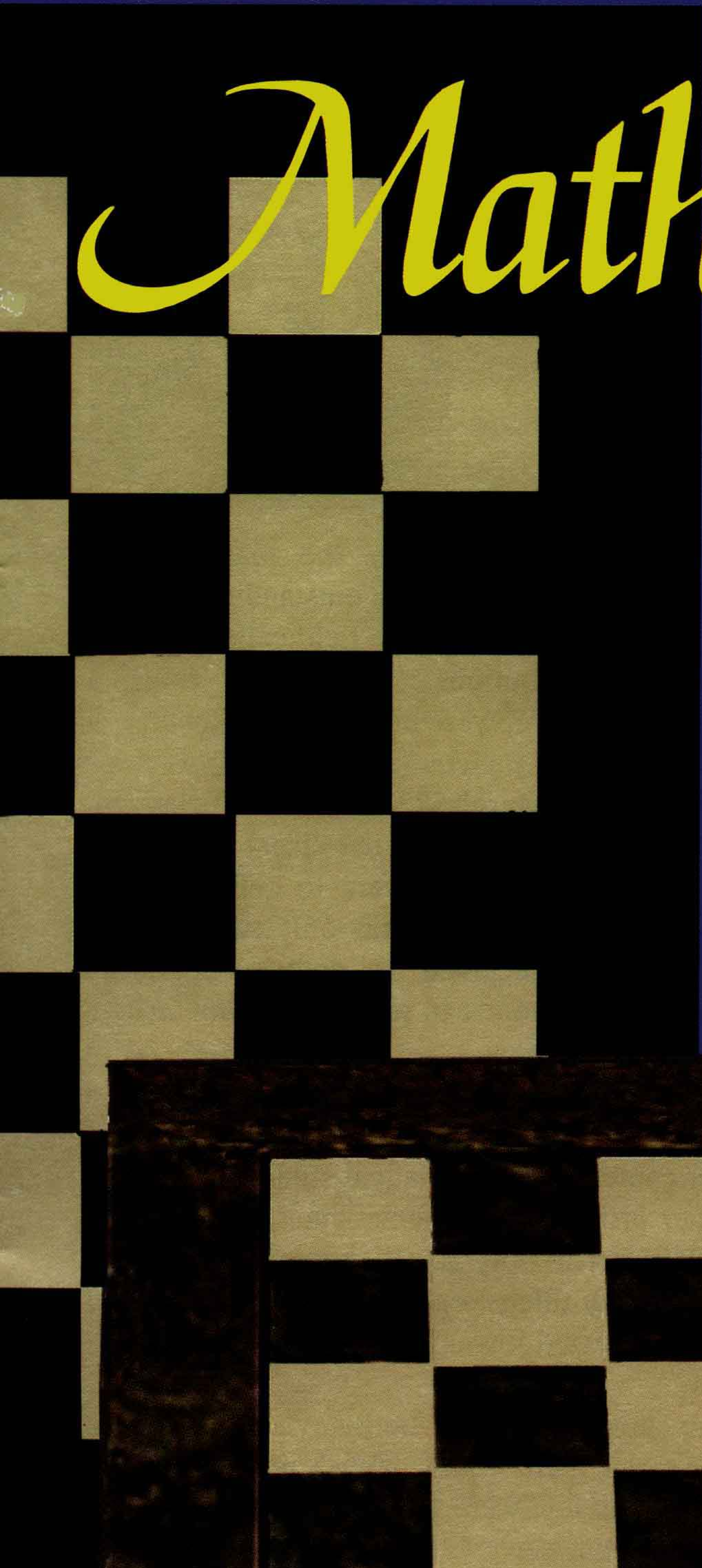
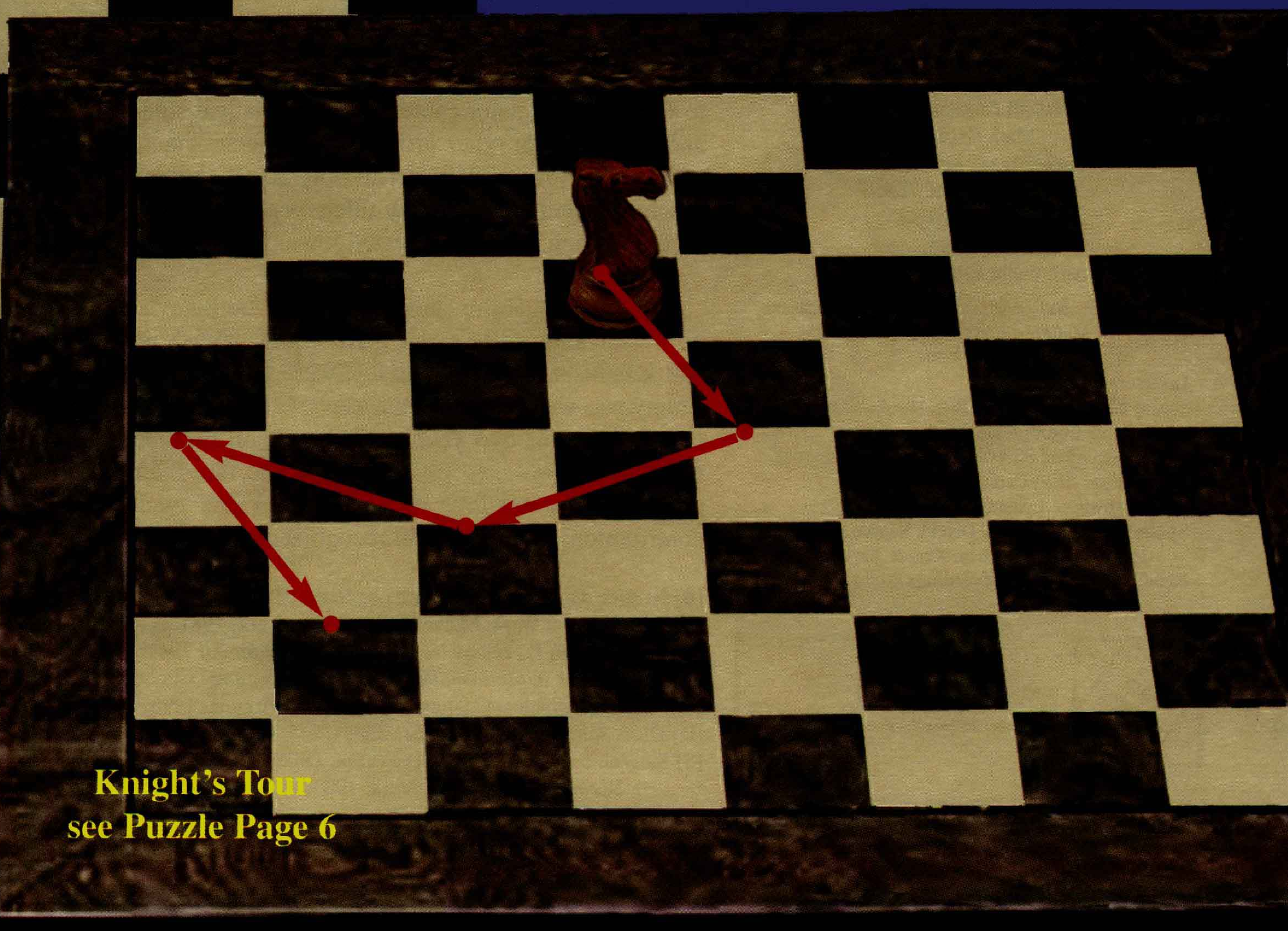
Math Explorer

Volume 1 • Number 5
April 1999





Knight's Tour
see Puzzle Page 6

Math Explorer

Contents

Math Reader (elementary) and *Math Explorer* (intermediate) are published 8 times a year by the Southwest Texas State University Math Institute for Talented Youth (MITY). An annual subscription is $8.00 for individuals, $6.00 for group purchases of 25 or more, and $4.00 for school purchases of 100 or more. See the back cover for an order form or contact *Math Explorer* at the address or phone below.

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Emmy Noether

by Hiroko Warshauer
Hiroko Warshauer teaches mathematics at Southwest Texas State University. She enjoys music and the arts, as well as working with students on math puzzles, problems, and activities.

Emmy Noether is recognized by the mathematical community as a great mathematician and an outstanding teacher. Her main interest in mathematics was in the field called algebra, where she made many contributions. "Noetherian" rings, a special kind of algebraic structure, were named in her honor.

Emmy was born on March 23, 1882 in Erlangen, Germany. She was the only daughter and the eldest of the five children of Ida and Max Noether. She went to college at the University of Erlangen. Out of 986 students only two students were women. In 1908 Emmy received her doctoral degree in mathematics, the highest degree one can receive at a university.

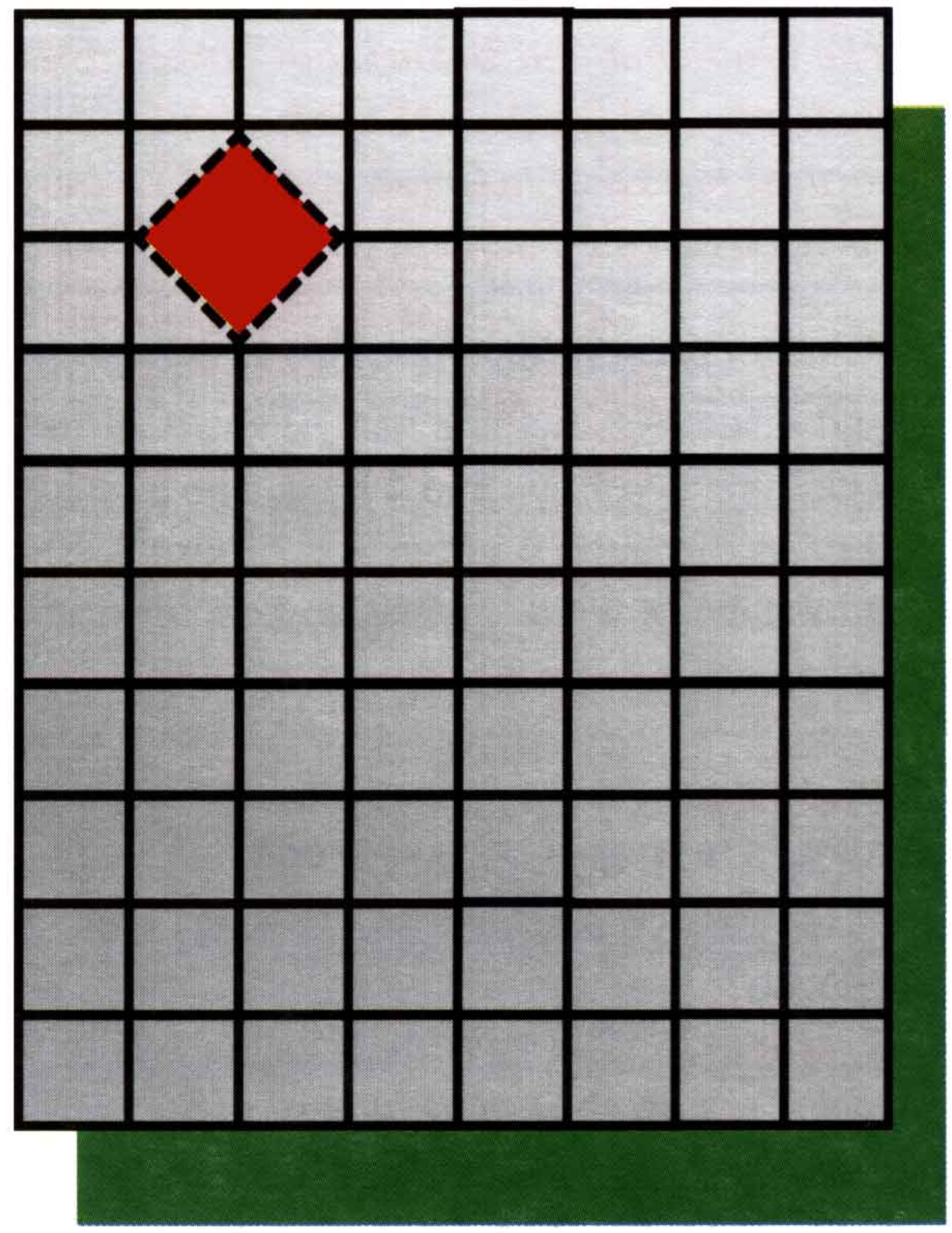
With her excellent credentials one might think getting a job would be fairly simple. This was not the case. Emmy moved to Gottingen, a major center for mathematical studies in Europe, and worked with other prominent mathematicians, but couldn't get a paying job until 1918. The story goes that Emmy did not pay much attention to day to day things, only buying new articles of clothing when friends suggested it was time.

In 1933, Hitler came to power in Germany, and Jews were no longer allowed to teach there. Many Jewish mathematicians and scientists, including Emmy, were forced to leave Germany. Emmy was welcomed to Bryn Mawr College in Pennsylvania and taught there for two years until her death in 1935. Despite the many difficulties and obstacles that she faced, Emmy Noether pursued her great love of mathematics and made outstanding contributions which are still recognized today.

[B] Brewer, James W., and Martha K. Smith. *Emmy Noether: A Tribute to Her Life and Work*. Marcel Dekker, New York, 1981.
[C] Clark, Susan E., *Emmy Noether- Algebraist for All Times in Celebrating Women in Mathematics and Science*. National Council of Teachers of Mathematics, Cooney Miriam P. ed. Virginia, 1996.
[D] Dick, August. *Emmy Noether 1882-1935*, Birkhauser, Boston, 1981.
[S] Sally, Judith, and Bhama Srinivasan. *Emmy Noether in Bryn Mawr*, Springer-Verlag, New York, 1983.

PROBLEMS OF THE MONTH

Send your solutions to *Math Explorer*! We will publish the best solutions each month and send a free *Math Explorer* pen to you and your math teacher if we print your solution.



1. Use the grid to the right (or your own larger grid) to draw a square with an area of 8 square units. Draw squares with areas 18, 5, 7 and 13 square units. What is the area of the shaded square?

2. How many ways can nine people sit around a circular table?

3. Juan and Melissa go to a coffee shop which serves 7 kinds of coffee and 5 kinds of cookies. Juan wants either a cup of coffee or a cookie. How many ways can he make his order? Melissa wants a cup of coffee and a cookie. How many ways can she make her order?

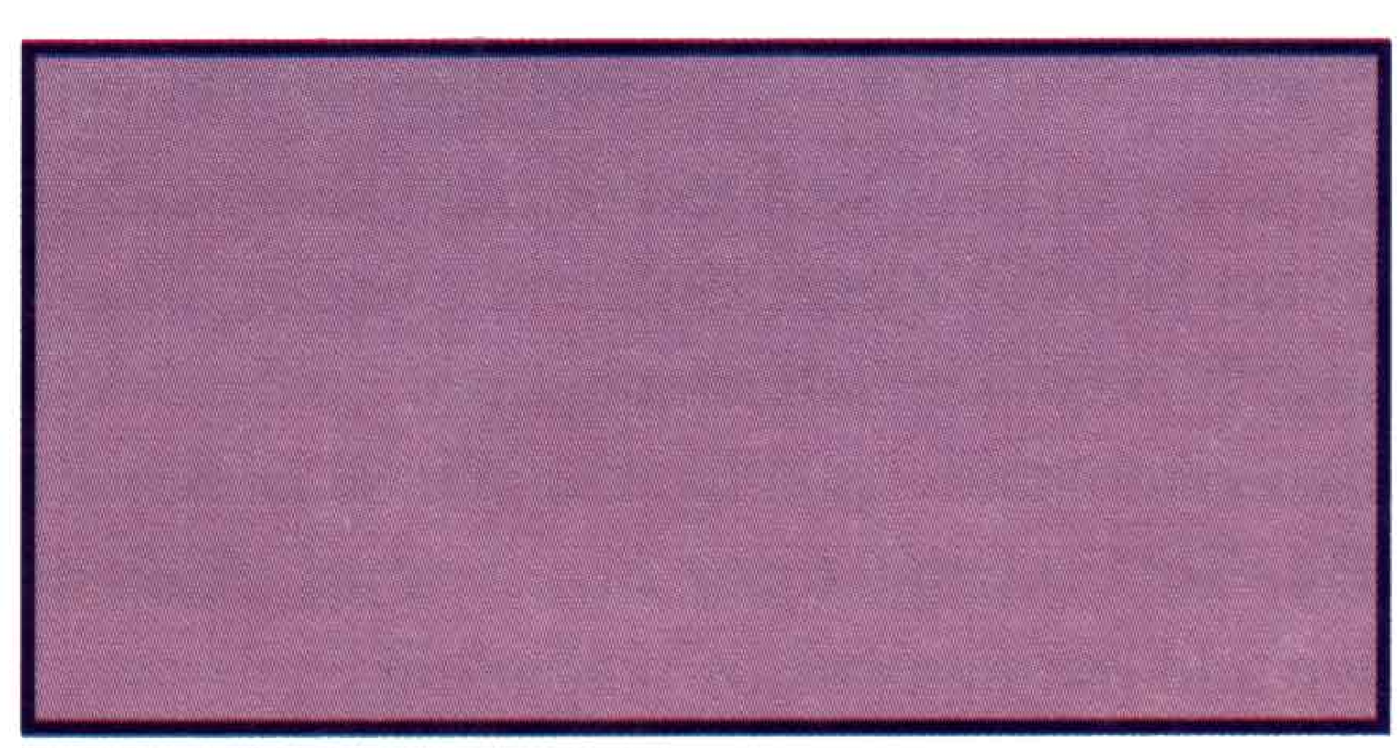
4. A cafe offers 3 kinds of soup, 2 kinds of salad, and 5 kinds of hamburgers. If you want to start with a soup or salad and then eat a hamburger, how many possible orders can you make?

5. Suppose you buy 2 cubic feet of sand and it is delivered in a perfectly cubic box. Assuming the sand completely fills the box, what is the length of each side of the box? You may need to estimate this number.

6. Mrs. Ramirez's class has 5 girls and Mr. Brown's class has 6 boys. How many ways are there for each class to choose one representative for a math contest?

7. How many ways are there for the above two classes to choose one representative from either Mrs. Ramirez's class or Mr. Brown's class?

8. What is the angle between the two hands of an analog watch at 6:30? at 6:45?



9. Ingenuity A rectangle is twice as long as it is wide. Cut this rectangle into pieces so that you can rearrange the pieces into a square.

Making Choices

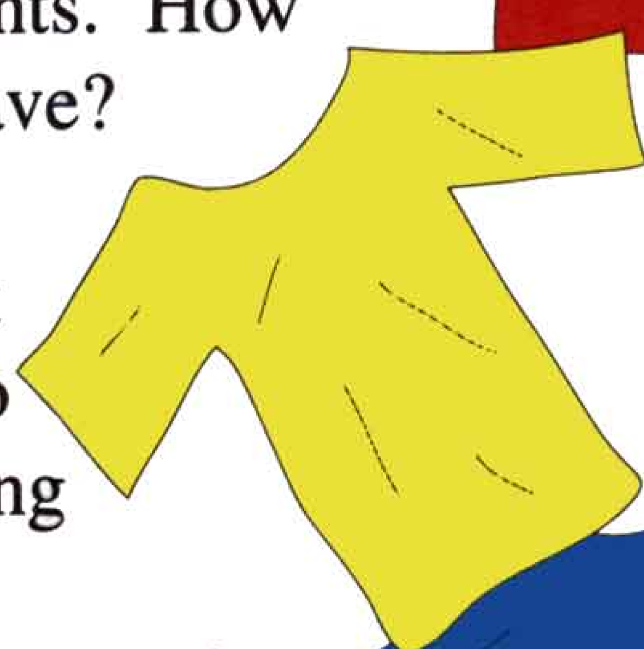
by Janet Chen and Max Warshauer

The Mathematical BrainTrain Society (MBTS) was created by the late Doyle Coats, highly-successful teacher and coach of the A & M Consolidated High School math teams. Knowing that he was dying of cancer, Doyle formed MBTS to help talented math students develop their interest in mathematics. This article is one of a series written by student members of MBTS. Janet is an undergraduate at Stanford University.

One day, Jackie looks in her closet and discovers that she has 10 shirts: 3 red, 1 orange, 2 yellow, and 4 blue. She also has 9 pairs of pants: 4 green and 5 purple. She thinks about what to wear and decides on her favorite pair of purple pants.

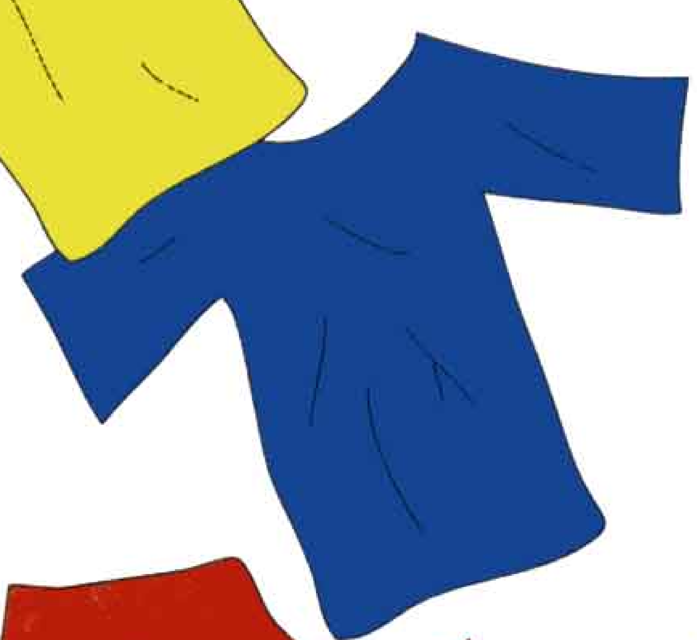
Problem 1: To match, she wants to wear a red or blue shirt with it. How many different shirts can she choose?

Problem 2: The next day, Jackie wants to wear a red shirt and green pants. How many possible outfits does she have?

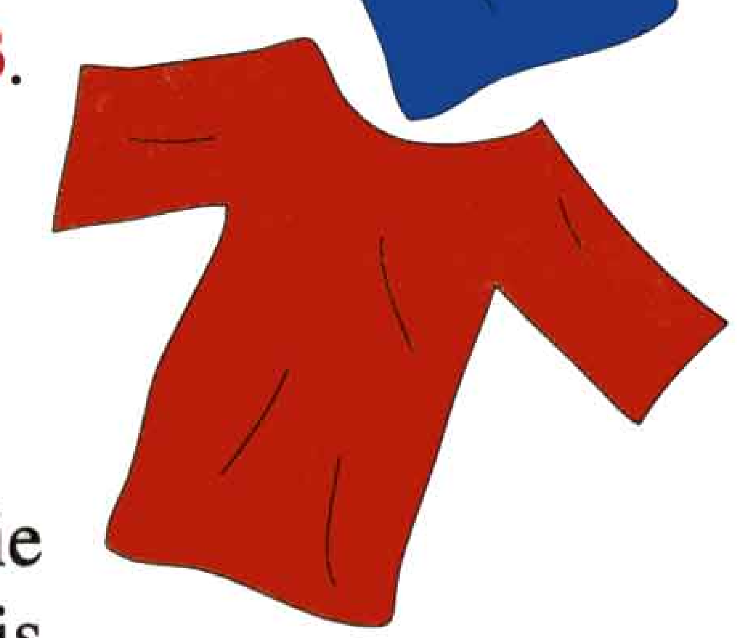


Problem 1: What is different about the way you solve these two problems? Let's begin by analyzing the first problem carefully.

Let event E(1) be the event that Jackie chooses a red shirt. There are 3 ways this event can occur since Jackie owns 3 red shirts. We label these **R1**, **R2**, and **R3**.



Let event E(2) be the event that Jackie chooses a blue shirt. There are 4 ways this event can occur since Jackie owns 4 blue shirts. We label these **B1**, **B2**, **B3**, and **B4**.



In order to choose a red or blue shirt, either event E(1) **or** event E(2) must occur. There are 7 possible different shirts that Jackie can choose--**R1, R2, R3, B1, B2, B3,** or **B4**. To find the **total number of choices** we add the number of ways that each event

can occur. We can state this as a mathematical principle:

The Rule of Sum: If one event E(1) can be done in r ways, and another event E(2) can be done in s ways, then there are (r+s) ways to do either event E(1) **or** event E(2).

Problem 2: To analyze problem 2, we again define two events. Let event E(1) be the event that Jackie chooses a red shirt. Again, there 3 ways for event E(1) to occur since Jackie owns 3 red shirts which we label as **R1, R2,** and **R3**.

Let event E(2) be the event that Jackie chooses a pair of green pants. There are 4 ways that event E(2) can occur since Jackie owns 4 green pants which we label as **G1, G2, G3,** and **G4**.

Both event E(1) **and** event E(2) must occur for Jackie to make one of the desired outfits. We can make a table of the different outfits using a red shirt and a green pants:

R1, G1	**R2, G1**	**R3, G1**
R1, G2	**R2, G2**	**R3, G2**
R1, G3	**R2, G3**	**R3, G3**
R1, G4	**R2, G4**	**R3, G4**

In this case, we multiply to find the total number of outfits. Do you see why? There are $3 \times 4 = 12$ possible outfits for Jackie to choose. We have our second important rule:

The Rule of Product: If event E(1) can be done in r ways and event E(2) can be done in s ways, then there are $(r \times s)$ ways for events E(1) **and** E(2) to occur in succession.

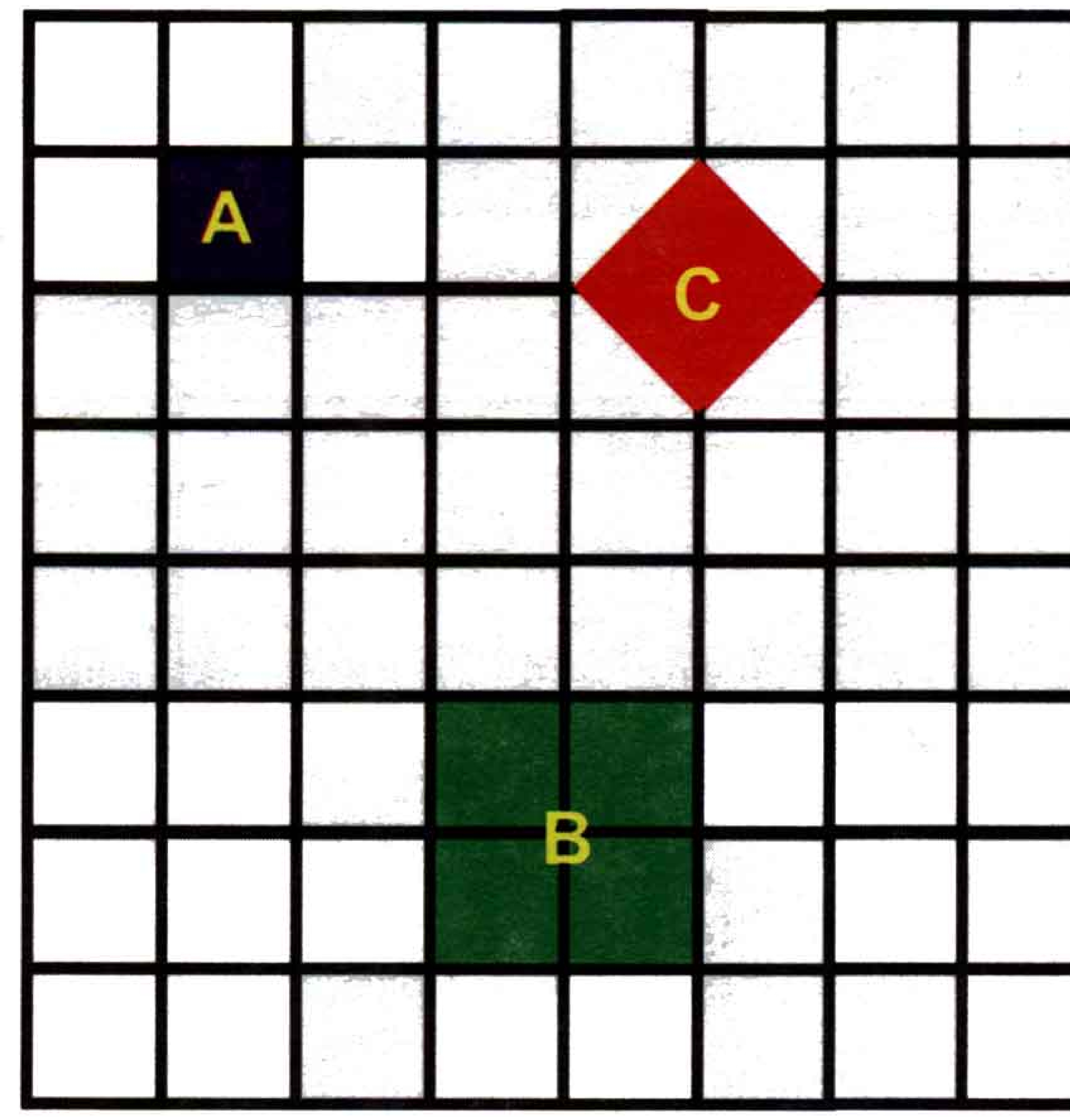
Look at the Problems of the Month for more problems where you can use the Rule of Sum or the Rule of Product!

How Long Is That Side?

by Terry McCabe

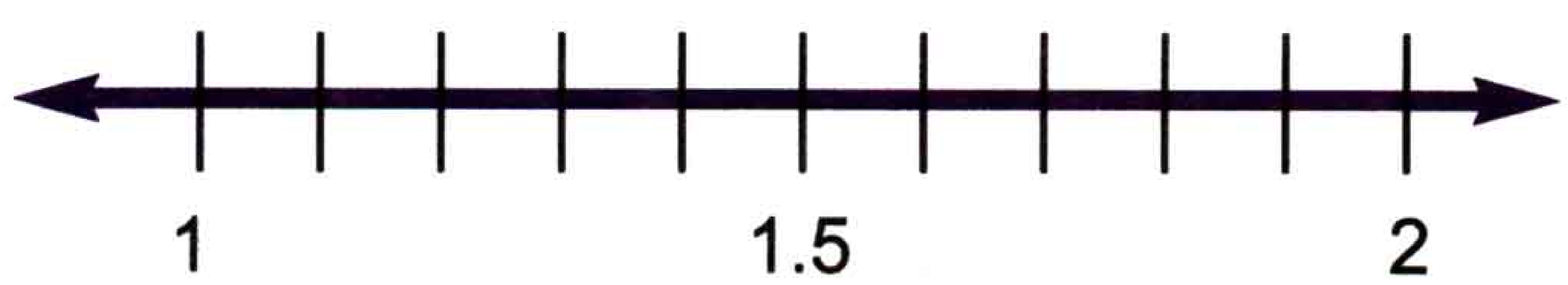
Terry McCabe teaches in the Math Department at Southwest Texas State University. He enjoys working with students and finding simple ways to explain ideas that seem complicated.

Look at the squares on the grid to the right. **Square A** is a 1 by 1 rectangle with area 1 square unit. **Square B** is a 2 by 2 rectangle with area 4 square units. What is the area of **Square C**? Let L be the length of one side of C. How long is side L?



By now you probably know that the area of C is 2 square units. Explain your answer. To calculate the area of a rectangle, you multiply its length times its width. So, the area of C is (L)(L). Let's try to guess what the number L might be. If we try L = 1, then (1)(1) = 1 square unit, which is not enough area. So L must be greater than 1. Next we try L = 2. But, (2)(2) = 4, which is too much area. So L must less than 2. Therefore L must be between 1 and 2.

We can use the number line below to track down the correct value of L. The number line has been labeled with the numbers between 1 and 2 with a spacing of one tenth between each. Label each mark on the number line.



Can we figure out where L is located on this part of the number line? Take some of these numbers as lengths of sides of squares and calculate their areas.

$(1.2)^2 =$ ________ $(1.3)^2 =$ ________

$(1.4)^2 =$ ________ $(1.5)^2 =$ ________

From your calculations, how can you estimate the value of L? Using your calculations and pictures, you can see that L is between 1.4 and 1.5. To which of these two numbers is L closer? We now will take the part of the number line between 1.4 and 1.5 and zoom in on it. Label the marks on this part of the number line,

remembering that 1.4 is 1.40 and 1.5 is 1.50. Then repeat the process, using these numbers as lengths to calculate the area for each square.

Continue this process of getting closer and closer to L. We have been "approximating the value of L." You can compute L to an approximation of 3, 4, 5, or even 6 decimal places. Let me give you a hint: this process does not stop. You cannot find the exact value of L with just a finite number of decimal places. This means a calculator cannot display the entire value of L.

Another interesting fact about L is that there is no repeating pattern in its decimal form. Do you know what kind of numbers have a decimal form with a repeating pattern?

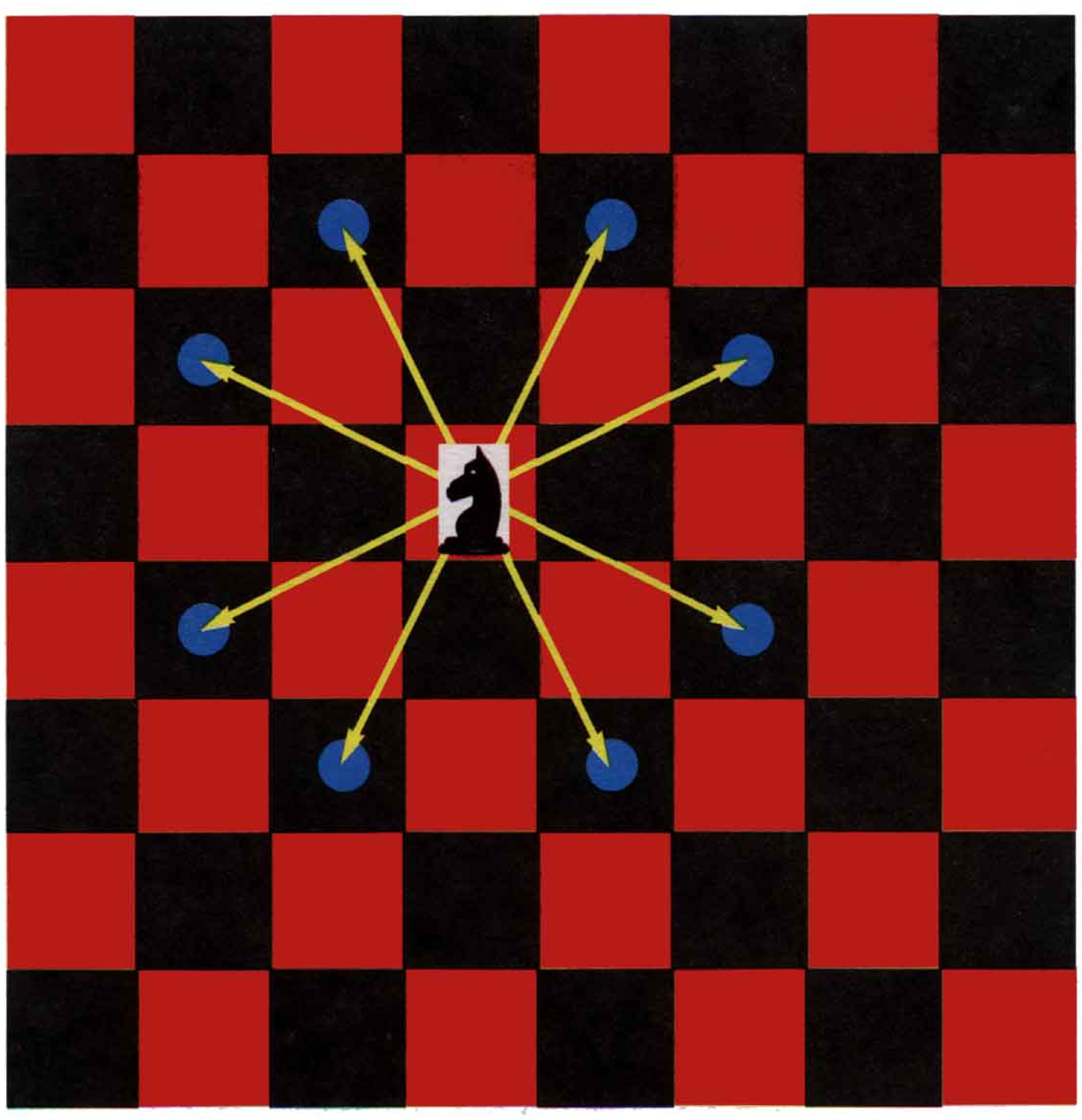
The number L has a famous name. It is called the square root of 2. The symbol for L is $\sqrt{2}$. Try to find out why it has this name. Look in the problem section for some problems that are related.

Math Explorers,

We want to print your work! Send us your own math games, puzzles, problems, and activities. If we print them, we'll send you and your math teacher free *Math Explorer* pens.

The Knight's Tour

A knight in chess moves by going two spaces horizontally and one vertically, or two spaces vertically and one space horizontally. All the squares to which a knight can move from its initial position are shown below. Can you find a sequence of moves that takes the knight to every square on the chessboard, without landing on any square twice? Such a sequence is called a "knight's tour!" Try beginning your knight's tour from one of the corners.



FOUR 4'S

Use the operations

$+ \quad - \quad \times \quad \div$

and parentheses to combine the four 4's and make each equation below true. For example, we can use four 4's to make 0 like this:

$(4 - 4) \times (4 + 4) = 0$

4 4 4 4 = 2

4 4 4 4 = 3

4 4 4 4 = 4

4 4 4 4 = 5

4 4 4 4 = 6

4 4 4 4 = 7

4 4 4 4 = 8

4 4 4 4 = 9

4 4 4 4 = 24

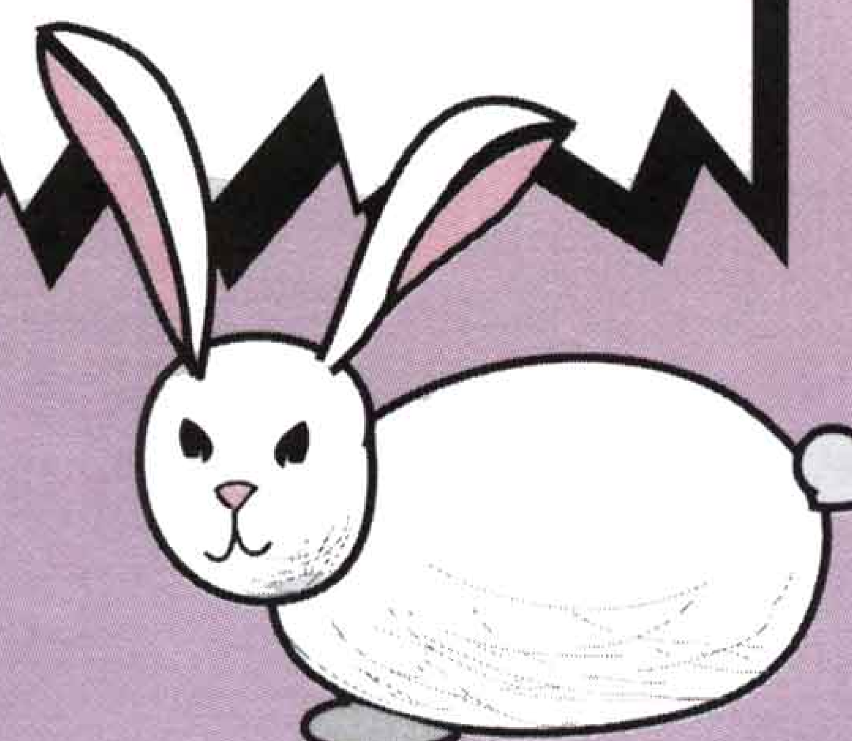
BULLETIN BOARD

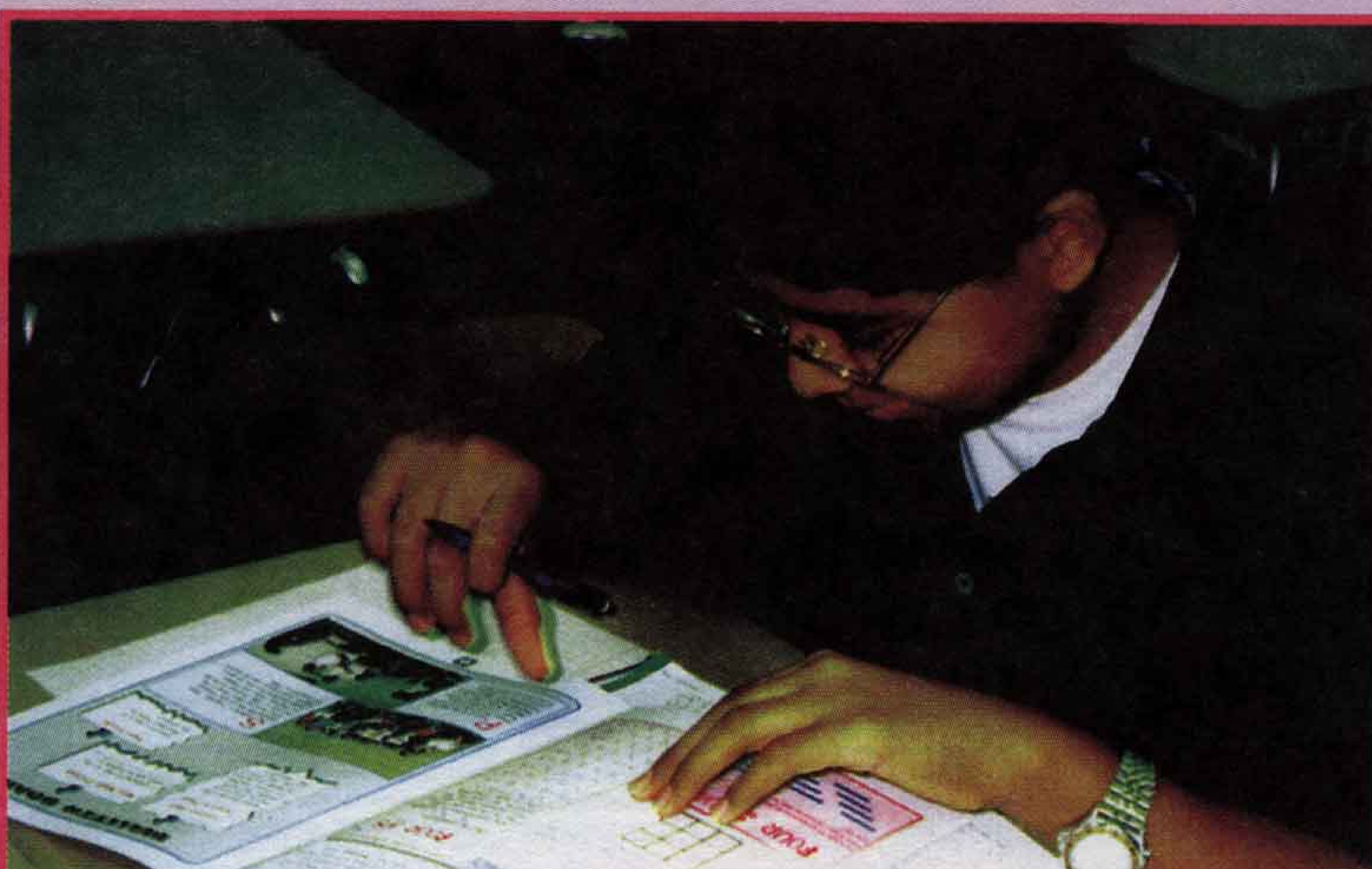
Summer Math Camps in Texas!!!

Junior Summer Math Camps are springing up all over Texas. Camps are planned this summer in San Marcos, Port Lavaca, Houston, Lockhart, McAllen, Donna, Rio Grande City, La Joya, Progreso, Mission, and Hidalgo. Check for a camp in your area.

Happy Easter!!!

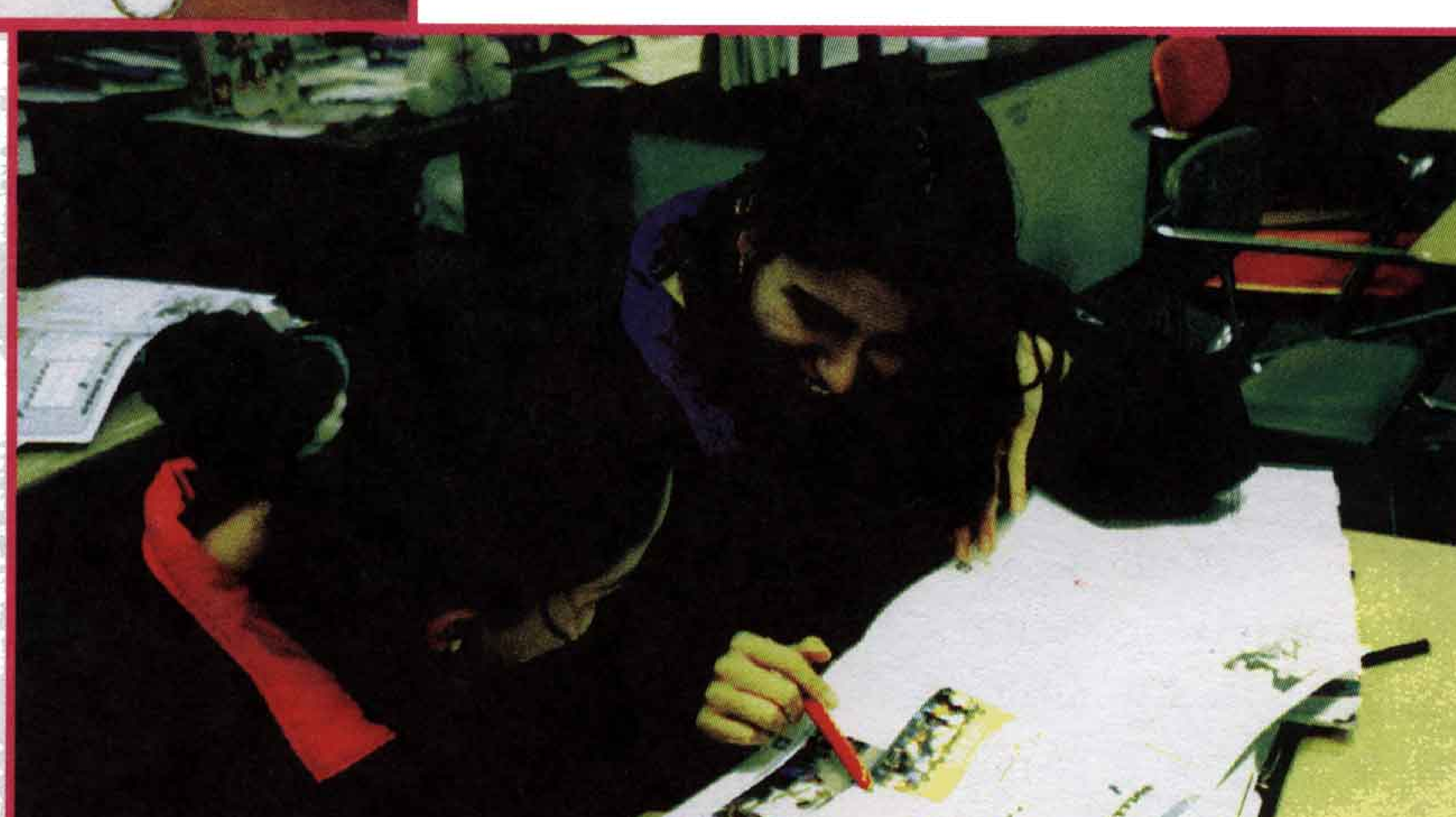
Did you use your mathematics over the Easter Holidays? Tell us how, and we'll send you an Easter surprise!





Students in Judy Carlin's 8th grade class at Brown Middle School in McAllen, Texas, are enjoying working on problems in *Math Explorer* . Pictured on the left is Harley Espinoza, who especially likes the Puzzle Page. Send us your pictures, too, and tell us what you enjoy most!

Pictured on the right are Crystal Zavala and Miriam Cuellar who are two of Judy Carlin's 8th grade students. Since they liked the Bulletin Board, we thought it would be great for them to be on it!



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Math Notes

Welcome new subscribers from Old Town Elementary in Austin, Godley Middle School in Godley, Aldine ISD in Houston, Lubbock ISD in Lubbock, and Spring Valley Elementary in Dallas. Students throughout Texas are enjoying **Math Reader** and *Math Explorer*.

Schools and individuals are encouraged to subscribe now for next year to ensure that you don't miss any issues! Our May issue will be the last in Volume I. We will resume next September with Volume II. All subscribers from last year will continue receiving *Math Explorer* until they have a full collection of 8 issues, which in most cases will be in October. Thanks again to everyone for your wonderful support. We hope to hear from you all soon!