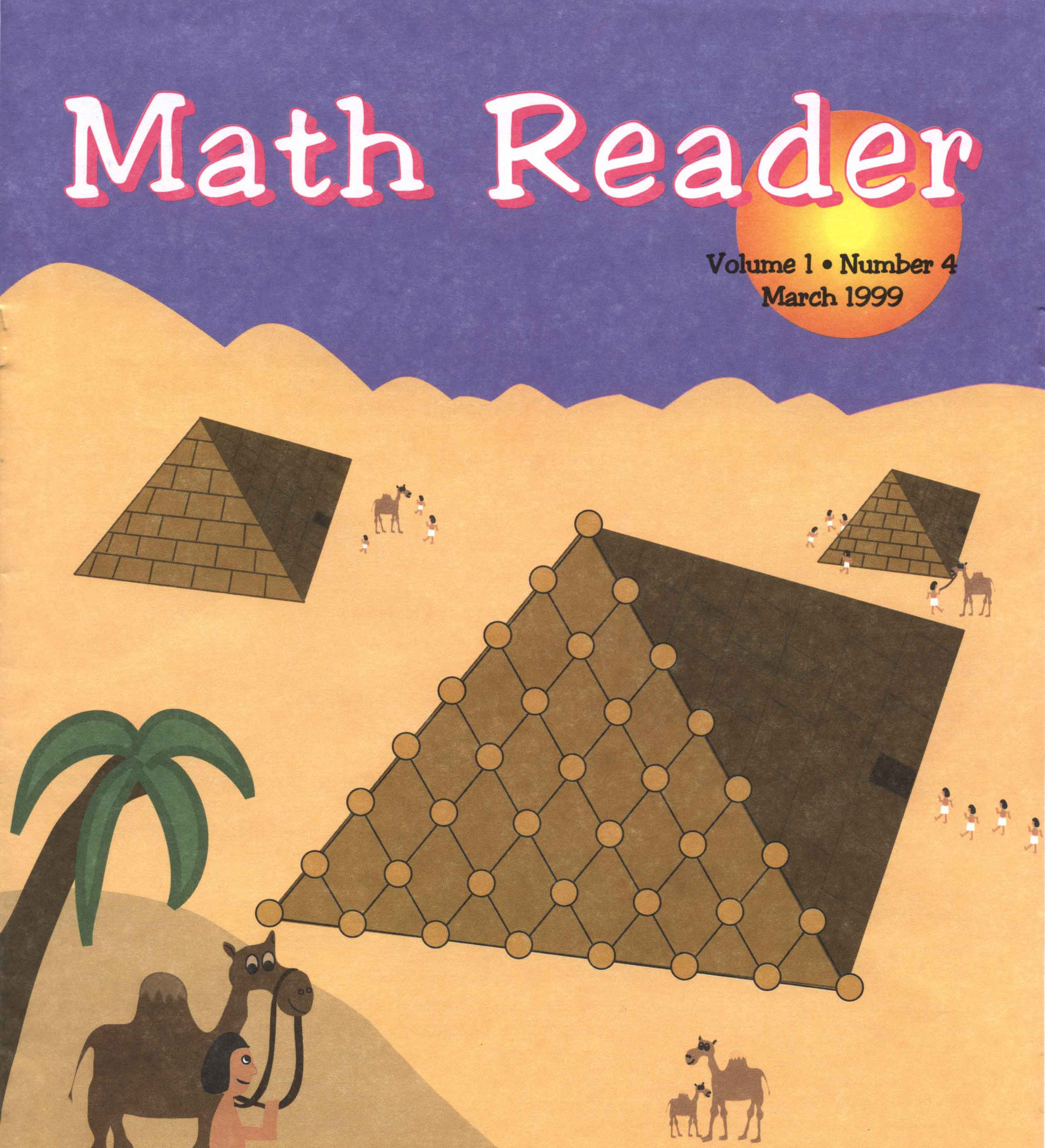
Math Reader

Volume 1 • Number 4
March 1999



Pascal's Triangle

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Math Reader

Contents

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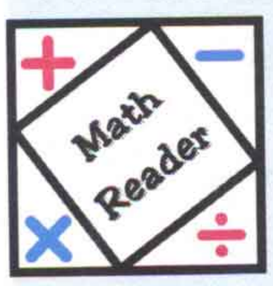

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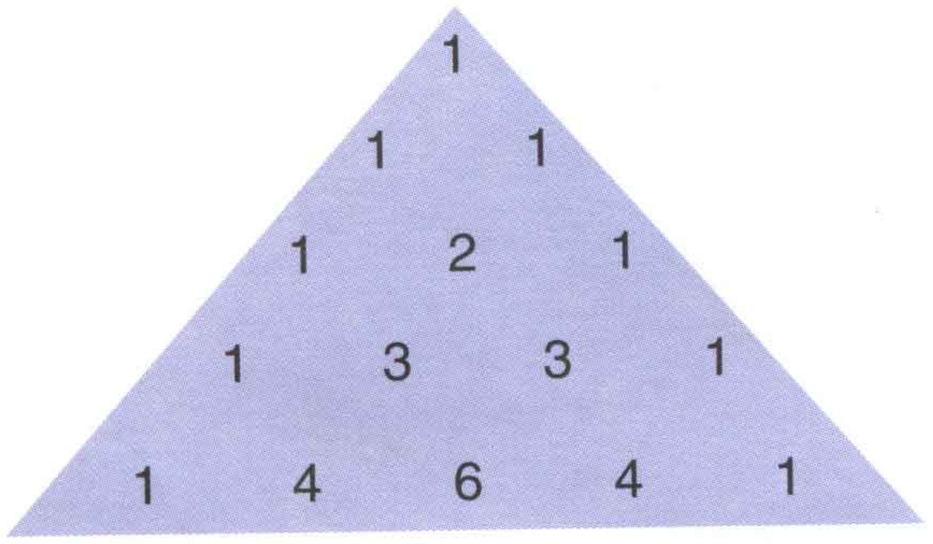
Pascal

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.

In this issue of *Math Reader*, we will look at an interesting arrangement of numbers. These numbers are written so that they form a triangular shape. We call this **Pascal's Triangle**, named after the famous French mathematician, Blaise Pascal. Only 5 rows are shown below, but Pascal's Triangle actually has an infinite number of rows.



Pascal was born in Auvergne, France on June 19, 1623. He got an early start in mathematics with the guidance of his father, Etienne Pascal, himself an amateur mathematician. By age 14, he was attending mathematical meetings in Paris with his father. At age 16 he proved a very famous theorem (a mathematical statement or proposition) in geometry, and at age 18, he invented the first basic adding machine.

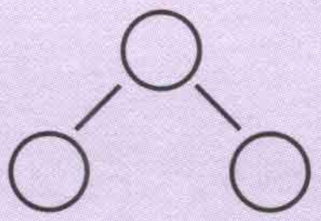
In his short life of 39 years, Pascal made mathematical contributions in the areas of geometry and probability, working very closely with two other mathematicians, Desargues and Fermat. The triangular array of numbers in **Pascal's Triangle** is related to Pascal's studies of games of chance, or probability theory. The number patterns that occur in this triangle arise in many areas of mathematics as well as disciplines such as biology and statistics.

[B] Bell, E. T., *Men of Mathematics*, Simon and Schuster, NY, NY, 1965.
[Ho] Hollingdale, Stuart, *Makers of Mathematics*, Penguin Books, NY, NY, 1989.

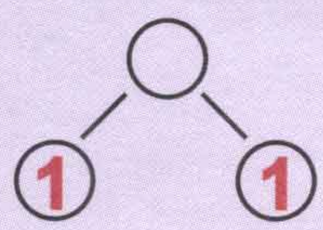
Pascal's Triangle

by Hiroko Warshauer

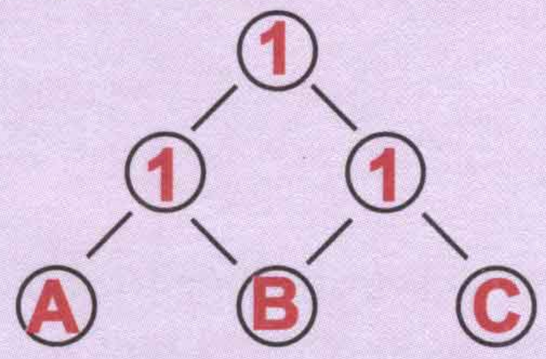
When it comes to spinning a spider web, our spider Pascal is a terrific geometer. She weaves the simplest of polygons, a triangle. From her uppermost starting point, she connects to two new places.



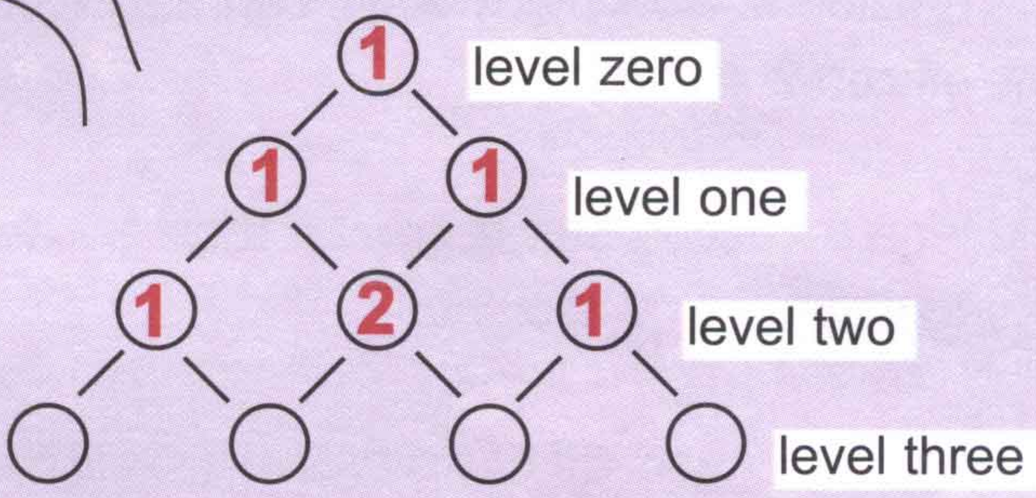
Let's keep track of how many ways Pascal can travel from the top of the web to the spots at the bottom.



Pascal now adds a new level. Assuming Pascal moves only downwards on her way from the top of the web, there is only one way for her to get to point A. Point C can also be reached in only one way. However, there are two different paths to reach point B.



Suppose Pascal continues to build her web in this way. Fill in the number of paths that lead from the top of the web to each spot below. Hint: If you are trying to figure out how many paths there are to a particular spot, you might consider the points that Pascal passes through on her way to that spot.

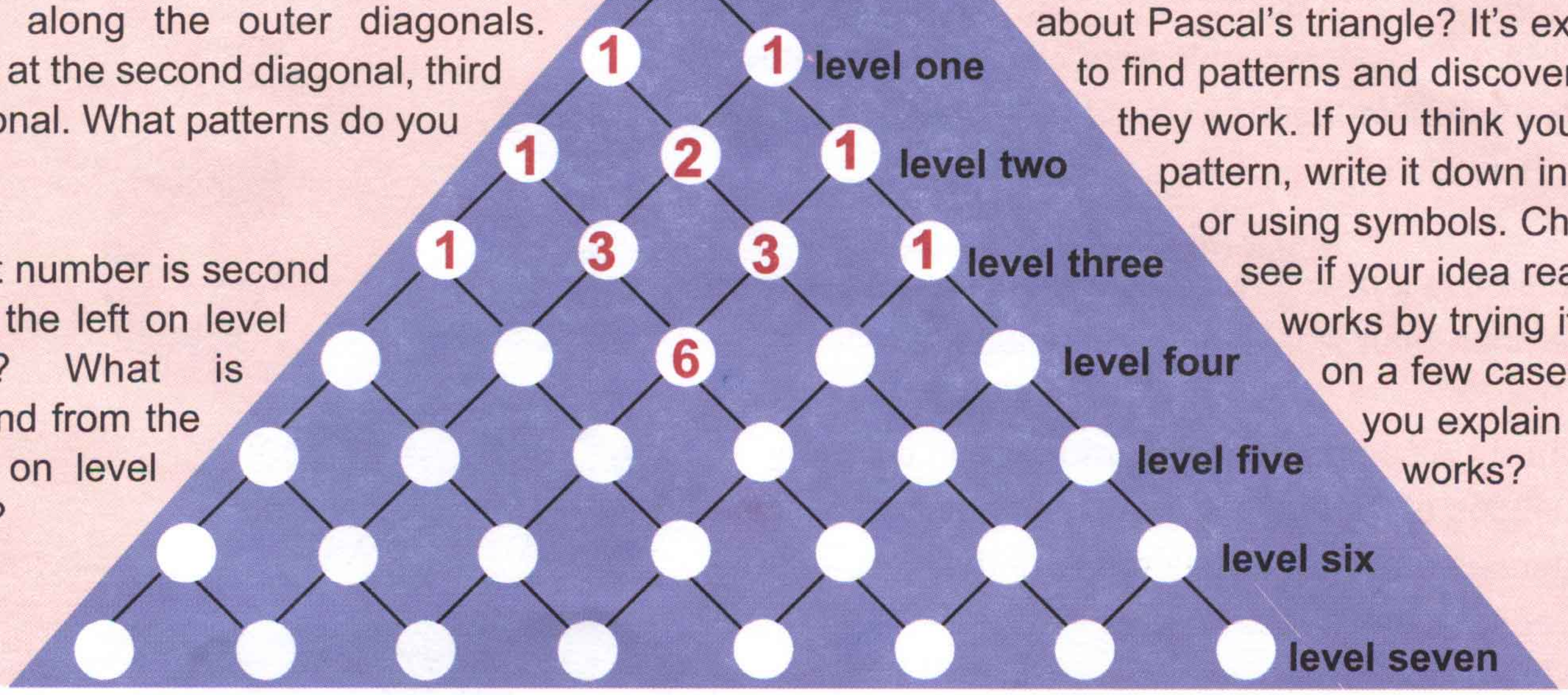


The Pascal's Triangle below goes from level zero to level seven. The numbers in the triangle are exactly the same as the numbers we marked on Pascal's web above. Fill in the missing numbers. Each new entry is the sum of the two numbers above it. Do you see why? Is this what you observed for Pascal the spider?

Look along the outer diagonals. Look at the second diagonal, third diagonal. What patterns do you see?

What number is second from the left on level nine? What is second from the right on level nine?

Do you notice any other patterns? Add the numbers on the first level and write down your answer. Do the same for the numbers on the second and third levels. What do you think the sum of the numbers on the fourth level is? Add the numbers to check your guess.



What other observations can you make about Pascal's triangle? It's exciting to find patterns and discover why they work. If you think you see a pattern, write it down in words or using symbols. Check to see if your idea really works by trying it out on a few cases. Can you explain why it works?

PROBLEMS OF THE MONTH

Send your solutions to ***Math Reader*** ! We will publish the best solutions each month and send a free ***Math Reader*** pen to everyone whose solution we publish.

1. Juan goes to a pet store that has 4 puppies and 3 kittens. His mother tells him that he can select two pets. How many ways can Juan make his selection?

2. Juan decides (in Problem 1) to choose two puppies. How many ways can he make his choice?

3. Isaac, Aaron, Jacob, David and Michele are starting a club. They decided to elect a president and vice-president. How many ways can they elect their new officers?

4. Find a fraction that is greater than 1/2 and less than 2/3. Explain your reasoning.

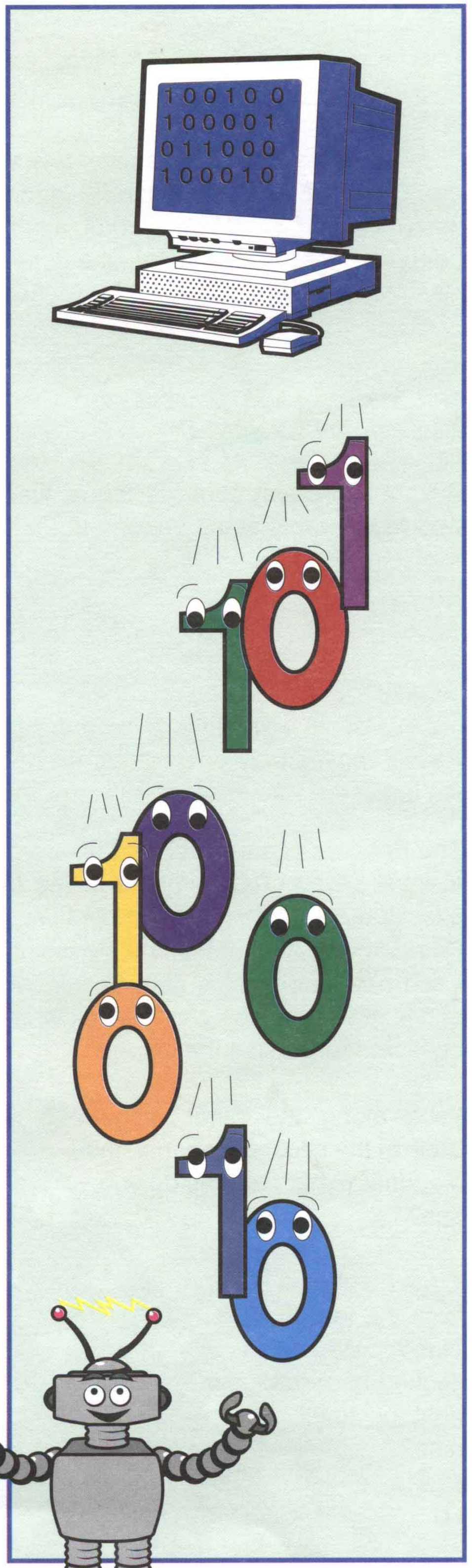
5. A rocket blasts off at noon on Tuesday carrying the space shuttle. Its mission is scheduled to last 200 hours. At what time and on what day of the week should it land?

6. How many numbers between 1 and 100 contain only odd digits? How many contain only even digits?

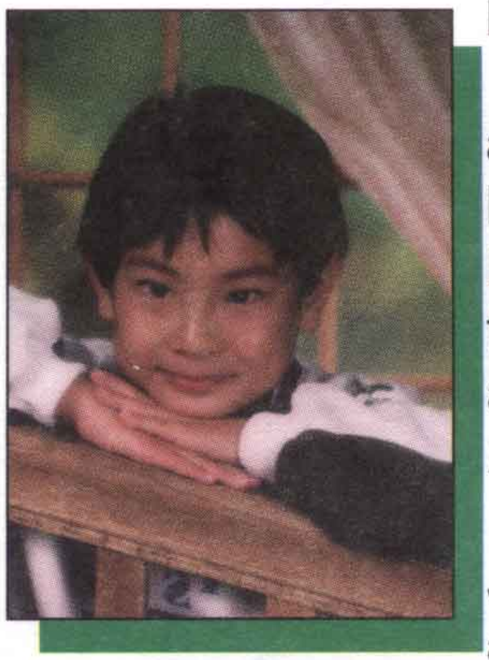
7. Ten-year old Dana asked nine-year old Josephine: "How old is your Dad?" Josephine answered: "If my father were 4 years younger he would be 4 times as old as I am." How old is Josephine's father?

8. What time is it now if twice as much time has passed since noon than what is left until midnight?

8. **Ingenuity** A computer stores information by using sequences of 0's and 1's. How many distinct 10-digit sequences are there? How many of these 10-digit sequences contain exactly two 1's?



Math Notes



Dear Dr. Warshauer:

I am Wesley Chen. I'm a third grade student in Mrs. Lord's class in Kiker Elementary. I solved the following problem from Jack and Jill on the Puzzle Page in *Math Reader* Nov. 1998.

Jack: Have you seen all my hens and pigs?

Jill: Yes, I counted 25 heads total.

Jack: That's right--25 heads, and 65 legs!

Jill: That's odd! How can that be?

Jack: Ah, didn't you notice. One of the pigs is missing a leg.

Jill: So you own the famous three-legged pig!

How many hens and how many pigs does Jack have? (And what did Jill find odd about a total of 65 legs?)

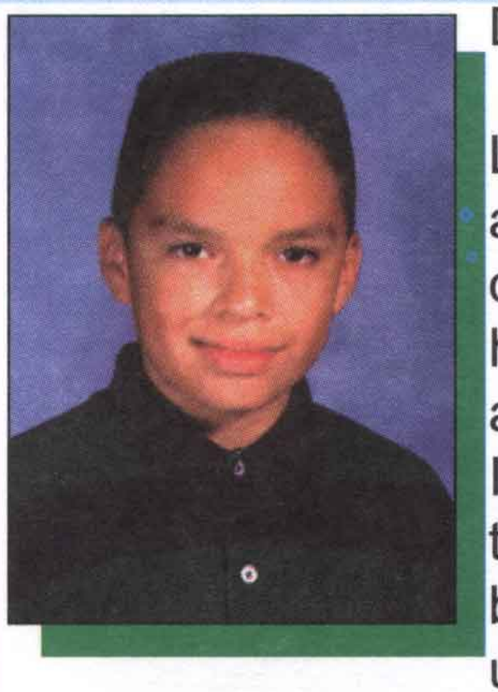
My solùtion: First I made a table of the different possibilities. I stopped here because Jack has 17 hens and 8 pigs which gives me 25 heads and 66 legs, but one pig has 3 legs which will give me 65 legs. So Jack has 17 hens and 8 pigs.

heads of hens	heads of pigs	legs of hens	legs of pigs	total # legs
1	24	2	96	98
2	23	4	92	96
3	22	6	88	94
4	21	8	84	92
5	20	10	80	90
6	19	12	76	88
7	18	14	72	86
8	17	16	68	84
9	16	18	64	82
10	15	20	60	80
11	14	22	56	78
12	13	24	52	76
13	12	26	48	74
14	11	28	44	72
15	10	30	40	70
16	9	32	36	68
17	8	34	32	66

Jill noticed that all the animals have an even numbers of legs and when you add even numbers to even numbers it will always equal another even number. So the total number of legs could not be 65, which is why Jack explained that there was a three-legged pig.

Sincerely,
Wesley Chen
Mrs. Lord's class
Kiker Elementary
Austin, Texas

Editor's Note: Good job Wesley!



Dear Dr. Warshauer:

My name is Lorenzo and I have attended two years of Math Camp. I have learned about algebra and graphs. I would have to say that graphs were fun because you would use the (x,y) axis and there were other math problems that would make you think by using combinations. The drama was great because it was something different this year. Everything is cool with math and I will try to join every year of math camp.

Sincerely,
Lorenzo Martinez
Hernandez Intermediate
San Marcos, TX

Editor's Note: We look forward to having you back at Math Camp this summer too!

Puzzle Page

Math Readers,

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 Reader* pens.

WORD SEARCH

Forwards or backwards, up, slanted, or down. Where can the words in this puzzle be found?

PASCAL
TRIANGLE
NUMBER
SEQUENCE
ZERO
ONE
SELECT
ARRANGE
DIGIT

S S E L E A N G L E H S M B
W A D I G I T I V E E M A T
Z P R O S R I E N Q L S D R
X A O M M U R A U D O M A I
S S E N I P A E H S I R K J
O C T R I A N G L E E A I N
V A R F T C I C E R A U R U
T L E O E C L V Q I N Q B M
K P A T T A I O T B G S K B
C A D E I L I O N E L H L E
R U G O A B E G N A R R A R
T E R G N G L E O I M E W X
R E R E B M U N R V A T R M
Z N X I T C E L E S S U F I

THE MILK PROBLEM

Tova is milking her cows, and has three containers holding 19 liters, 13 liters, and 7 liters respectively. How can she collect 10 liters of milk without spilling any and using only these 3 containers. You may have left-over milk in one of the containers. Explain your answer.

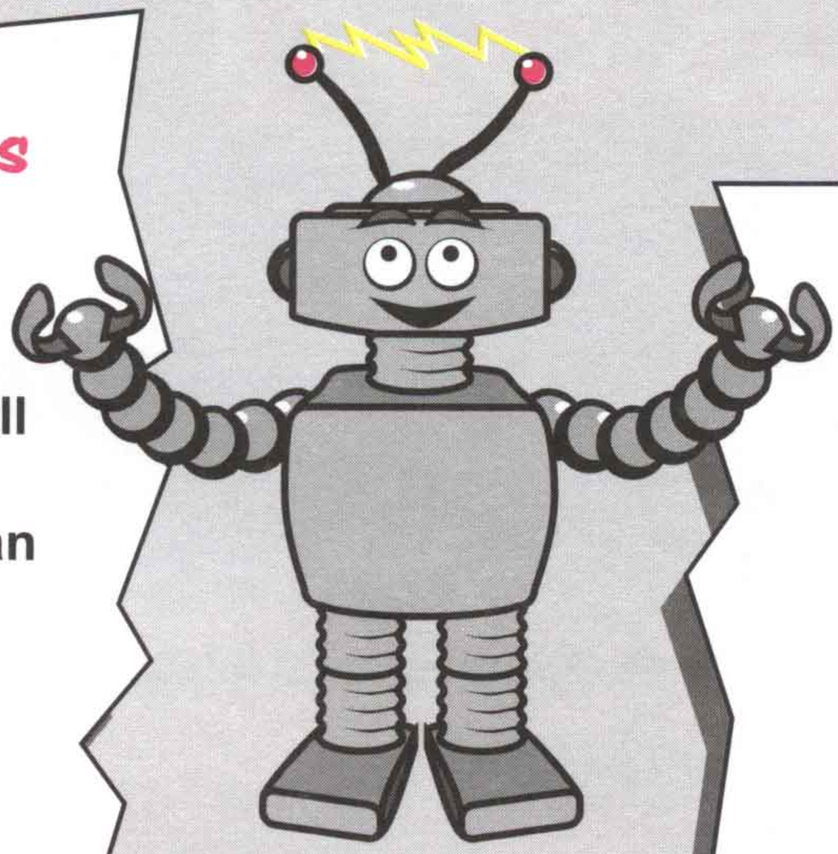
THE JUMPING FROGS

A frog can hop one space to the left or right to move to an empty lily pad, or a frog can jump over a neighbor (only one at a time) to an empty lily pad. Can you help the yellow frogs swap spots with the green ones? In how few jumps can they do this?

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.



Poetry Corner

Can you read this poem so that it makes sense?

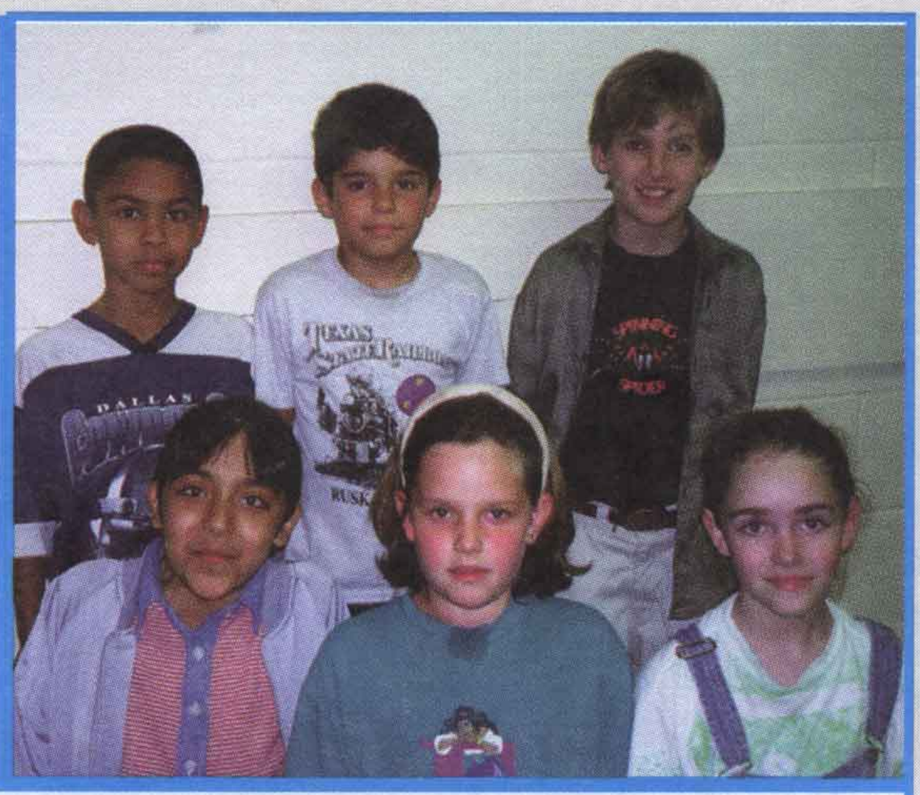
11 was a racehorse.
12 was 12.
1111 race.
12112.

AND THE WINNER IS...

JUDY BROWN'S 3rd GRADE CLASS!!!

They chose the name TOBOR for our new ROBOT friend. Do you see why they picked this name? So welcome to earth TOBOR!

Judy Brown teaches in the Gifted and Talented Program at Crockett Elementary in San Marcos. Pictured on the front row, L to R, are Ashley Falcon, Kayleigh Moore, and Katie Moore. Second row, L to R, are Brandon Banks, Andre Gibson, and Andre Evrenos.



Students in San Marcos are enjoying working on math together. Pictured on the left are students from the 1998 Southwest Texas State University (SWT) Junior Summer Math Camp. For more information about the 1999 Junior Summer Math Camp, contact Dr. Max Warshauer at 512-245-3439.

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