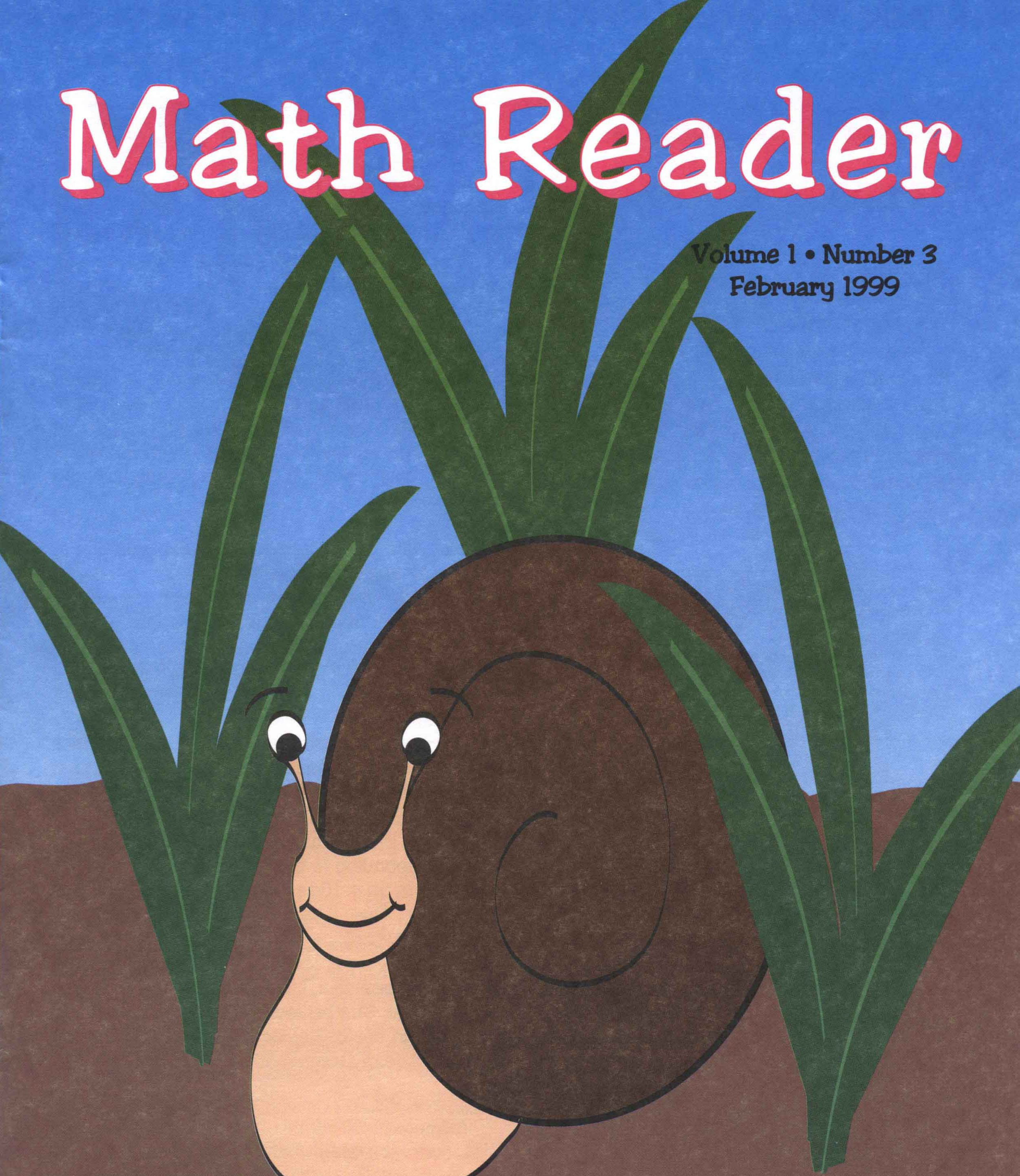
Math Reader

Volume 1 • Number 3
February 1999



The Snail Problem

see page 4

Math Reader

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 Reader* at the address or phone below.

Address all correspondence to:
Math Reader
Southwest Texas State University
San Marcos, TX 78666
Phone: (512) 245-3439
Fax: (512) 245-1469
Email: mathreader@swt.edu

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Director: Max Warshauer
Senior Editors: Terry McCabe, Hiroko Warshauer, Eugene Curtin, Anne Sung
Design: Jennifer LeGrévellec
Circulation: Kristi Carter
Administration: Lydia Carbuccia
Special Writers: Tivadar Divéki, Sándor Róka, Jean Davis, Janet Chen

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Hypatia

by Jean Davis
Jean Davis teaches mathematics at Southwest Texas State University and enjoys reading and writing historical articles about mathematicians.

The first woman mathematician we know was Hypatia, who lived from 370 to 415 A.D. Her father Theon was a professor of mathematics at Alexandria in Egypt. Alexandria was the greatest seat of learning in the world at that time and Hypatia was immersed in an atmosphere of learning from her earliest years. She was an excellent student and later was asked to teach mathematics and philosophy at Alexandria.

Hypatia wrote mostly commentaries, explanations of the great works of the time. These were very important because they made it possible for other people to understand very difficult mathematics. Many of her writings were prepared as textbooks for her students. Hypatia was particularly interested in a type of equation we now call a "Diophantine equation."

For example, consider the question: In what ways can a person make change for a dollar using nickels and dimes? We can model this problem using variables, letting

n = the number of nickels
d = the number of dimes

The equation corresponding to this problem is

$$5n + 10d = 100$$

Do you see why? This type of equation is called a Diophantine equation.

Hypatia was a beautiful, highly intelligent woman and a very popular teacher. She achieved things that in her time few thought a woman could. Her death in 415 signaled the end of the Golden Age of Greek mathematics.

[G] *Women of Mathematics*, edited by Grinstein, Louise, and Campbell, Paul J., Greenwood Press, 1987.

[O] Osen, Lynn M., *Women in Mathematics*, MIT Press, Cambridge, MA, 1974.

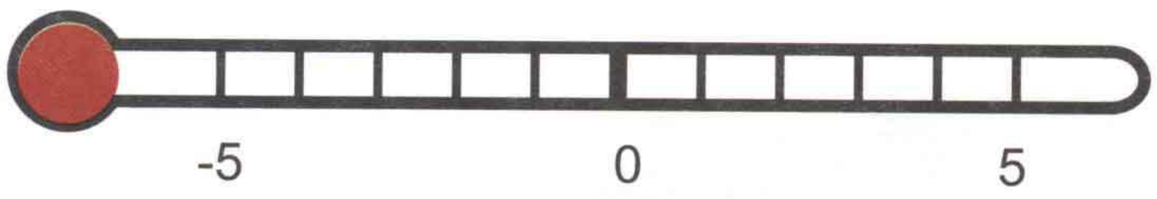
[P] Perl, Teri, *Math Equals: Biographies of Women Mathematicians and Related Activities,* Addison-Wesley, Reading, MA, 1978.

What's Below Zero?

by Hiroko Warshauer

Central Texas is usually very hot in mid-August. The mercury in the thermometer rises higher and higher in the afternoons, hovering around the 100 degree (100°) marker. However, when the sun sets in Juneau, Alaska, in January, the thermometer often shows the temperature below freezing. As the temperature continues to drop, the mercury reading can drop below zero. To indicate 5 degrees below zero, we'll use the notation -5°; this is read as "negative 5 degrees." Colder still is 12 degrees below zero, which we write as -12°.

Let's put this thermometer on its side, in the horizontal position as below.

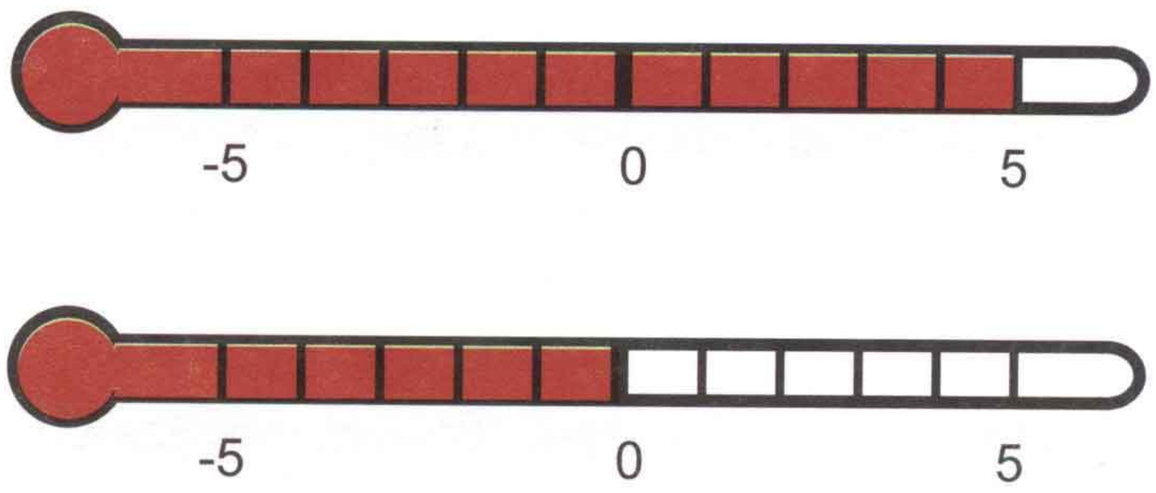


The thermometer can be used as a model for a **number line**. When the temperature increases, the mercury moves to the right. When the temperature decreases, the mercury moves to the left. In fact, our 5 degrees below zero is now 5 degrees to the left of zero. Whether -5° means 5 below zero or 5 to the left of zero depends on the direction of the number line.

Just for emphasis, let's write 5 degrees above zero as +5°. Notice that both +5° and -5° are a distance 5 units from 0° on the number line and that the plus and minus signs tell us which direction we should go on the number line.

Observe that -12° is farther left than -5° since -12 is a greater distance left of 0 than -5. In fact, the more negative the number the farther left it is on the number line. The numbers -1, -2, -3, -4,... are called **negative integers**.

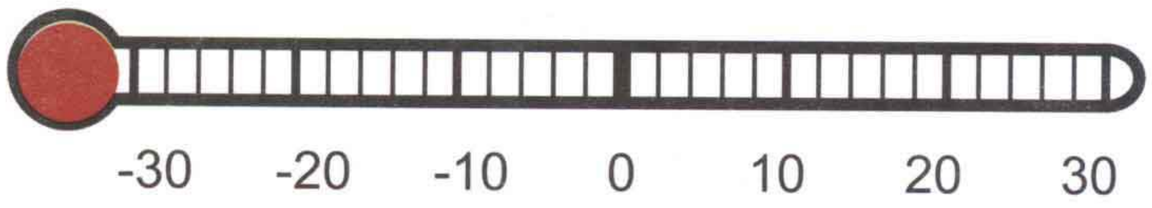
If the temperature is 5° now and it drops 5°, what will the new temperature be? Let's use the number line to find 5° then move 5 units to the left. The new temperature is 0°.



We can write this as 5° - 5° = 0°.

Notice that if the temperature had fallen 6° from 5° we'd be down to -1°. In other words, 5° - 6° = -1°. And if we start at -5° and drop 6°, we'd have -5° - 6° = -11°.

After a very cold night in Juneau the late morning sun begins to warm up the air a bit. If from -5° the temperature rises 6°, the new temperature will be -5° + 6° = 1°.



Use the number line above on both the left and right side of zero and explore adding and subtracting positive and negative numbers. Can you work the following problems:

5 + 10 = 5 - 10 =

4 + 6 = 4 - 6 =

23 -11 = 11 - 23 =

Does it help to use your number line? You can think of each number as representing the temperature. When we add, the temperature is getting warmer. When we subtract, the temperature is getting colder.

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. It was 12° at 4 o'clock in a town in North Dakota. By midnight, the temperature had dropped 20°. What was the temperature at midnight?

2. If the temperature rises 20° from the subfreezing -7°, what will the new temperature be?

3. In a cash box, Jack found IOU's for $17 and $18. He also found bills for $22 and $12. What was the total value of the contents of the cash box? (Hint: Assume that IOU's are negative values.)

4. Three straight lines are drawn from edge to edge across a sheet of paper, dividing it into sections. What is the largest number of sections into which the sheet of paper can be divided?

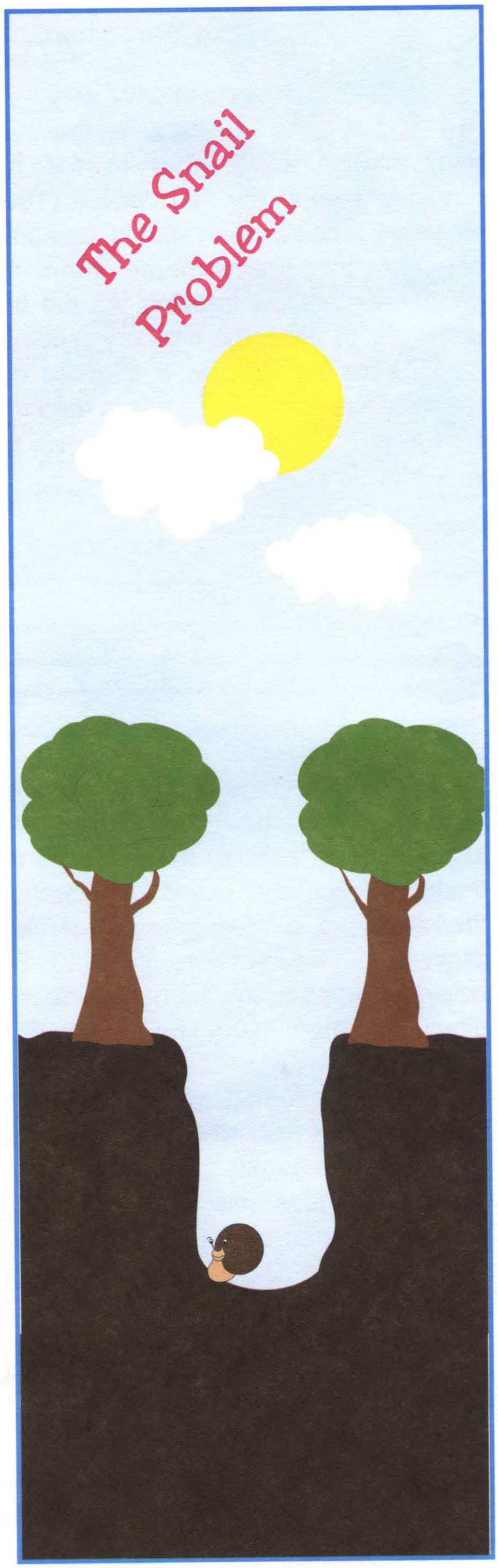
5. If today is Tuesday, what day will it be in 100 days?

6. Over a four day period, the temperatures were -8° , -5° , 2°, and 7°. What was the average temperature?

7. How many 3-digit numbers can you create using the digits 0, 1, and 2, so that each number contains all three of these digits?

8. Josephine has 10 hens. Each of 5 hens lays an egg every day and each of the other 5 lays an egg every other day. How many eggs do the 10 hens lay in 10 days?

9. **Ingenuity** (The Snail Problem) A snail fell into a hole 20 meters deep. During the day it can climb up 5 meters, but at night it slides back 4 meters. How many days does it take the snail to escape from the hole?



Take a Random Walk

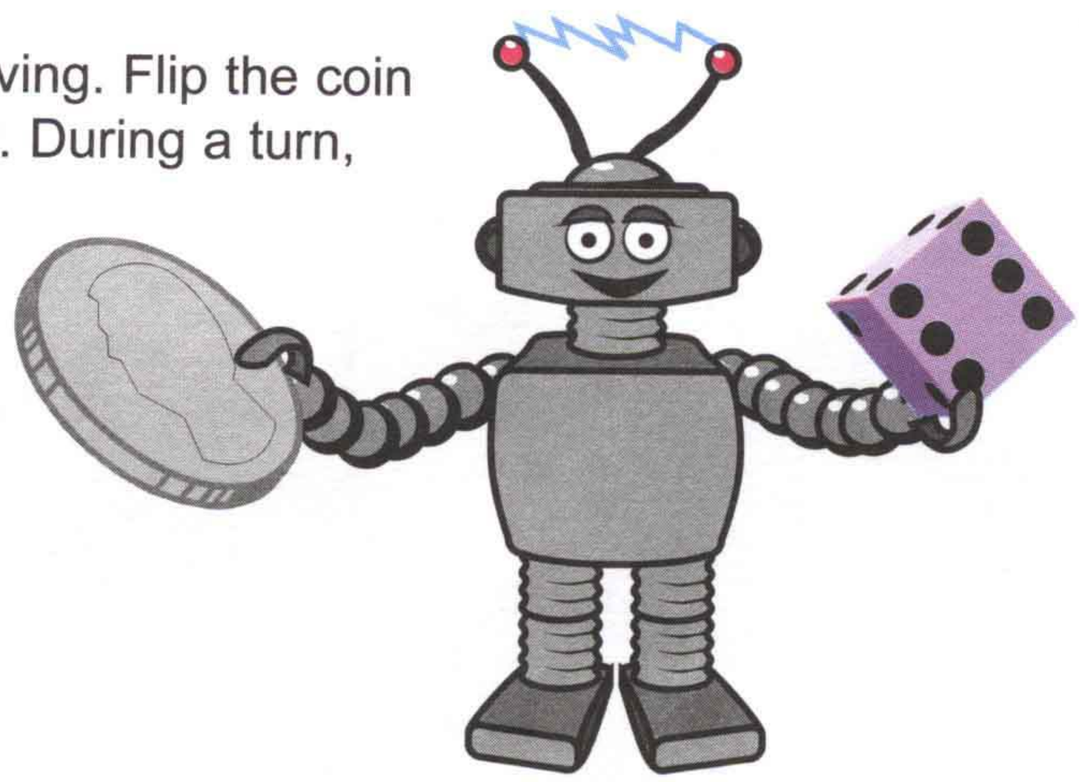
by Terry McCabe

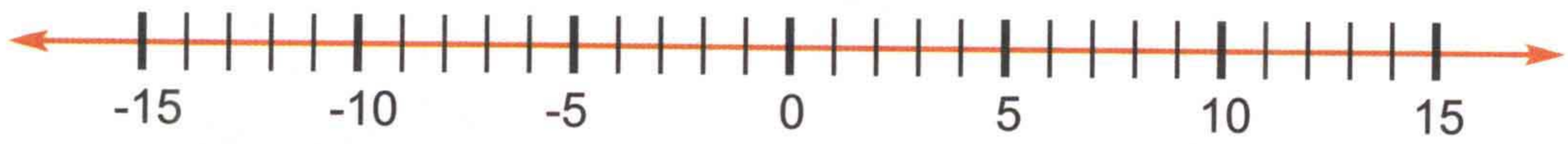
Scientists use the process of a random walk to study problems. We now describe a simple game based on the idea of a random walk on a number line.

Equipment: You will need a number line like the one below, with the numbers from -10 to 10 labeled. You will also need a coin and a die (one of a pair of dice), and two small markers.

Set-up: Each player places their marker by the zero position on the number line.

Playing: Take turns moving. Flip the coin to decide who goes first. During a turn,





a player rolls the die and flips the coin. If the coin lands on heads, the outcome is the value of the die roll. If the coin lands on tails, the outcome is the negative of the value of the die roll. For example, a tails and a roll of 4 gives the outcome of -4. Heads and a roll of 6 gives the outcome of +6. The player then adds this outcome to the position he or she is on to compute the new position. Players should also check that their opponents are making the correct moves!

Object of the Game: To escape past 10 to the right or -10 to the left. The game ends when a player lands on a number greater than 10 or less than -10 and that player wins!

Example 1: The player is on the +9 position and rolls a 4, together with the coin landing on tails. We then say that the outcome is -4. The new position is computed by

$$9 + (-4) = +5.$$

Example 2: The player is on the -7 position and rolls a 5 together with the coin landing on heads. We then say that the outcome is +5. The new position is computed by

$$-7 + (+5) = -2.$$

Can you compute your next position without using the number line? For example, suppose you are on +3 and you roll a 5 and the coin lands on tails. What is your new position? As you might expect, the moves of each player are unpredictable. They are random. Look up the word random in the dictionary for fun. Do you see why this called a random walk?

Understand the game: Playing alone or with an opponent, keep track of the number of moves it takes a player to escape. How does the average number of moves change if you change the game to escape past different numbers instead of 10 and -10? Try 5 and-5.

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?

POSITIVE
NEGATIVE
NUMBER
LINE
INTEGER
LESS
GREATER
RANDOM
WALK

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

NUMBER 1

Using each number below exactly once, insert + and - signs to make them add up to 1.

1
2
3
4
5
6
7
8
9

How many ways can you do it?

MAKING SQUARES WITH TOOTHPICKS

We can make 4 identical squares using exactly 16 equal toothpicks as follows

Can you make 4 identical squares using 15 toothpicks? 14 toothpicks? 13 toothpicks? 12 toothpicks?

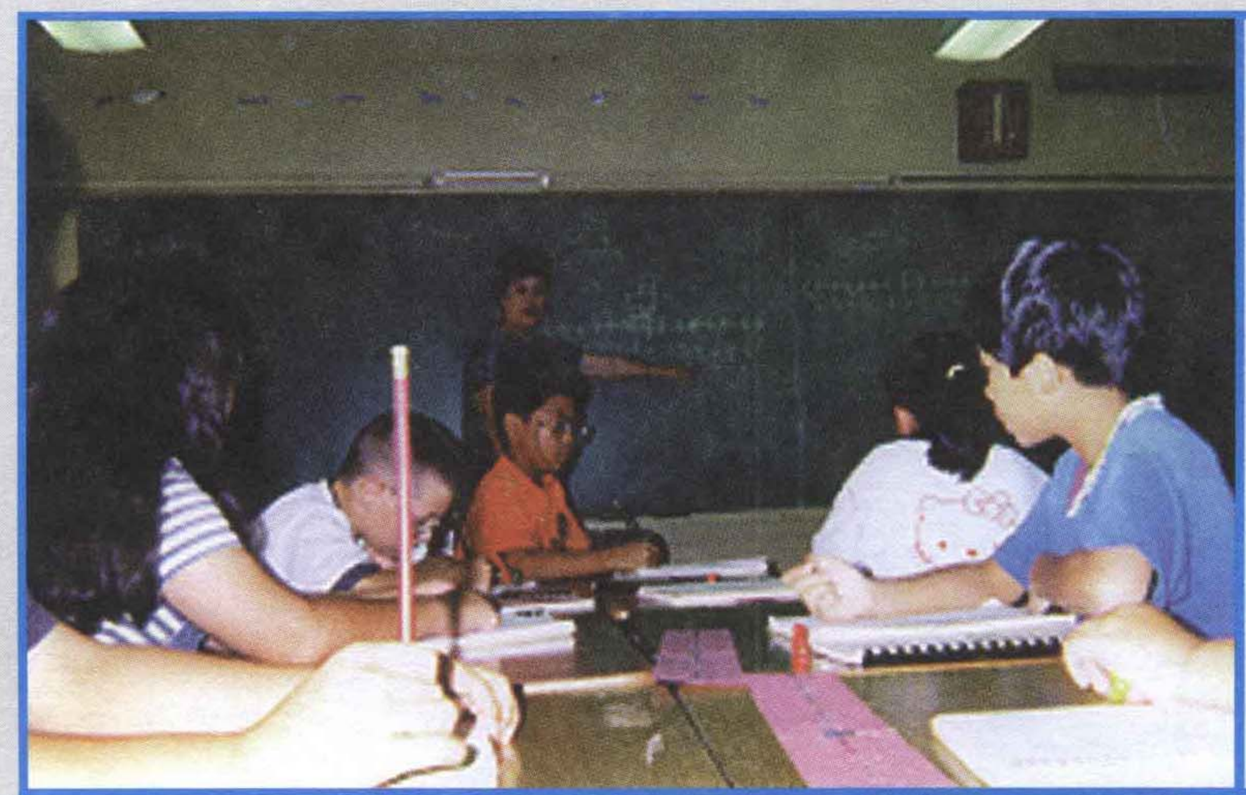
BULLETIN BOARD

Summer Math Camps in Texas

School Districts in San Marcos, Port Lavaca, McAllen, Rio Grande City, Donna, Progreso, and Mission are planning summer math camps in 1999. Check for a

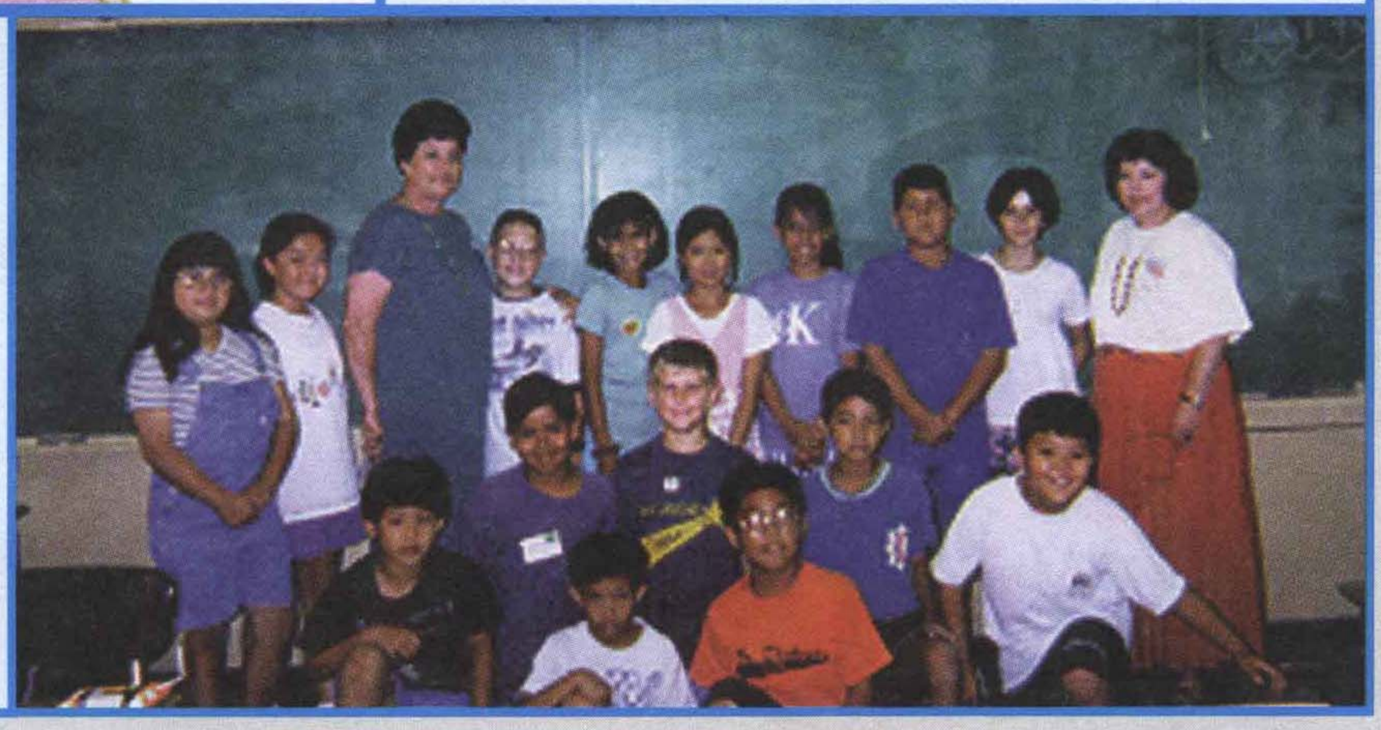
Math Riddle

Why is 10 afraid of 7? (See Math Notes for the answer!)



Students in Port Lavaca are enjoying working on math together. Pictured on the left is Kathy Hoelscher and some of her students from the Port Lavaca Junior Summer Math Camp last summer. Kathy and Linda Carruthers began a math enrichment program last summer, and plan to expand the camp in 1999.

Port Lavaca offered the first annual Port Lavaca Junior Summer Math Camp in 1998. Pictured on the right are Kathy Hoelscher and Linda Caruthers with their students. The program will be offered again in 1999.



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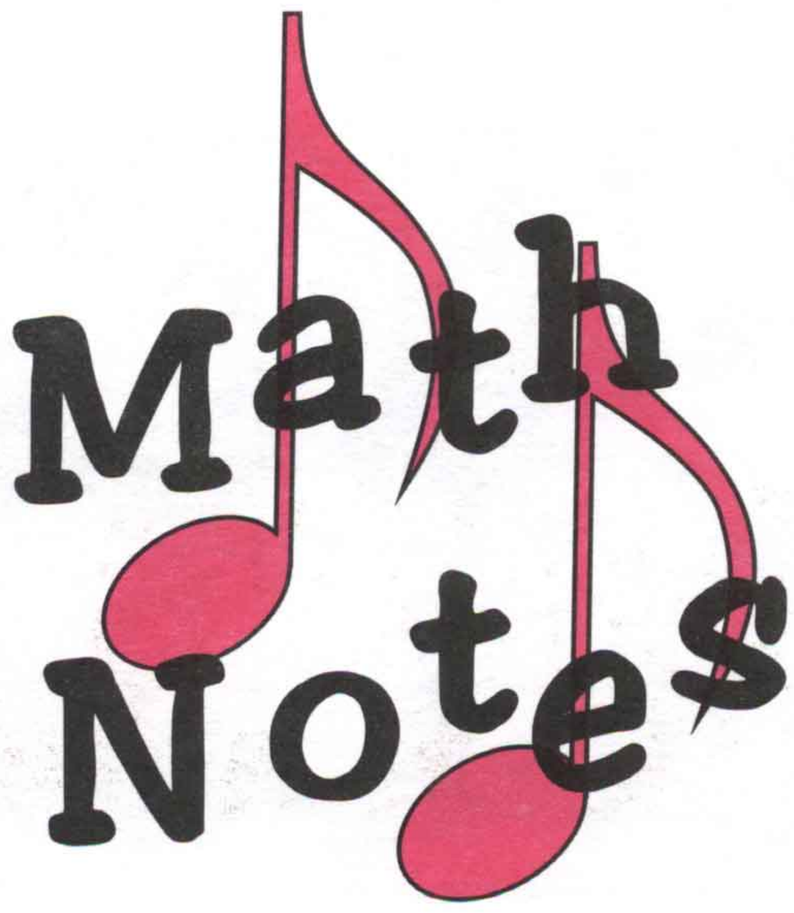

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Math Notes is our Reader's Showcase. Write us with news from your school; about math events you've enjoyed; or with your own puzzles, activities, and problems. Please include:

• Your name • Your teacher's name • Any related pictures.

We'll publish as many letters as we can each month. I hope to hear from you soon.

Sincerely,

Max Warshauer

Max Warshauer

Answer to Riddle: Because 7 8 9.