Math Explorer

MATH & GEOGRAPHY

Helena's logic? those greedy algorithm's counting on Neighbors!!!

Vol. 2.4 January 2000

Math Explorer

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Southwest Texas State University

San Marcos, TX 78666

Phone: (512) 245-3439, Fax: (512) 245-1469

e-mail: mathexplorer@swt.edu.

Visit our website: www.mathexplorer.com

Math Explorer and **Math Reader** are published by Southwest Texas State University Math Institute for Talented Youth (MITY).

SWT

Helena Rasiowa

Helena Rasiowa spent her young adulthood studying mathematics during World War II. She was born in Vienna, Austria in 1917 but her Polish parents moved back to Poland in 1918. She entered the University of Warsaw in 1938 with the country on the brink of war. In 1939, the university closed because of the German invasion of Poland. Rasiowa attended an underground version of the university that was strongly opposed by the German Nazi authorities. We say that the university was underground because it was forbidden by authorities and it was a secret. Classes were not actually held below ground. Even during the war, Helena studied with many famous mathematicians. She took a risk by studying for her master's degree in this situation because if she were caught, the penalties would have been extreme. She risked her life to study the math she loved.

In 1944, the Warsaw Resistance, a group of people in Poland fighting against the Nazis rose up to fight again. Their efforts were stopped by German authorities and 160,000 people were killed. The city was destroyed and Helena's written work burned in a house fire that also destroyed the house and all of their possessions. Helena and her mother lived through the fire by hiding in a cellar.

After the war, Helena taught high school, but she was persuaded to come back and finish a second master's thesis at the university. Soon she was working on her doctorate. Her research was in algebraic logic and the theoretical basis of computer science. Theoretical means having to do with the general principles or ideas behind the computer science. Helena was able to see far into the future by guessing the importance her mathematical work could have for computer science. She became a professor in 1967. She wrote over 100 books and papers. Helena also helped start the Polish Society for Logic and the Philosophy of Science. She wanted Poland to have mathematical societies so that people could discuss interesting problems. Helena's actions proved her to be a brave woman who managed to continue her math education during a violent time. She spent her entire life studying, publishing, and teaching math until her death in 1994.

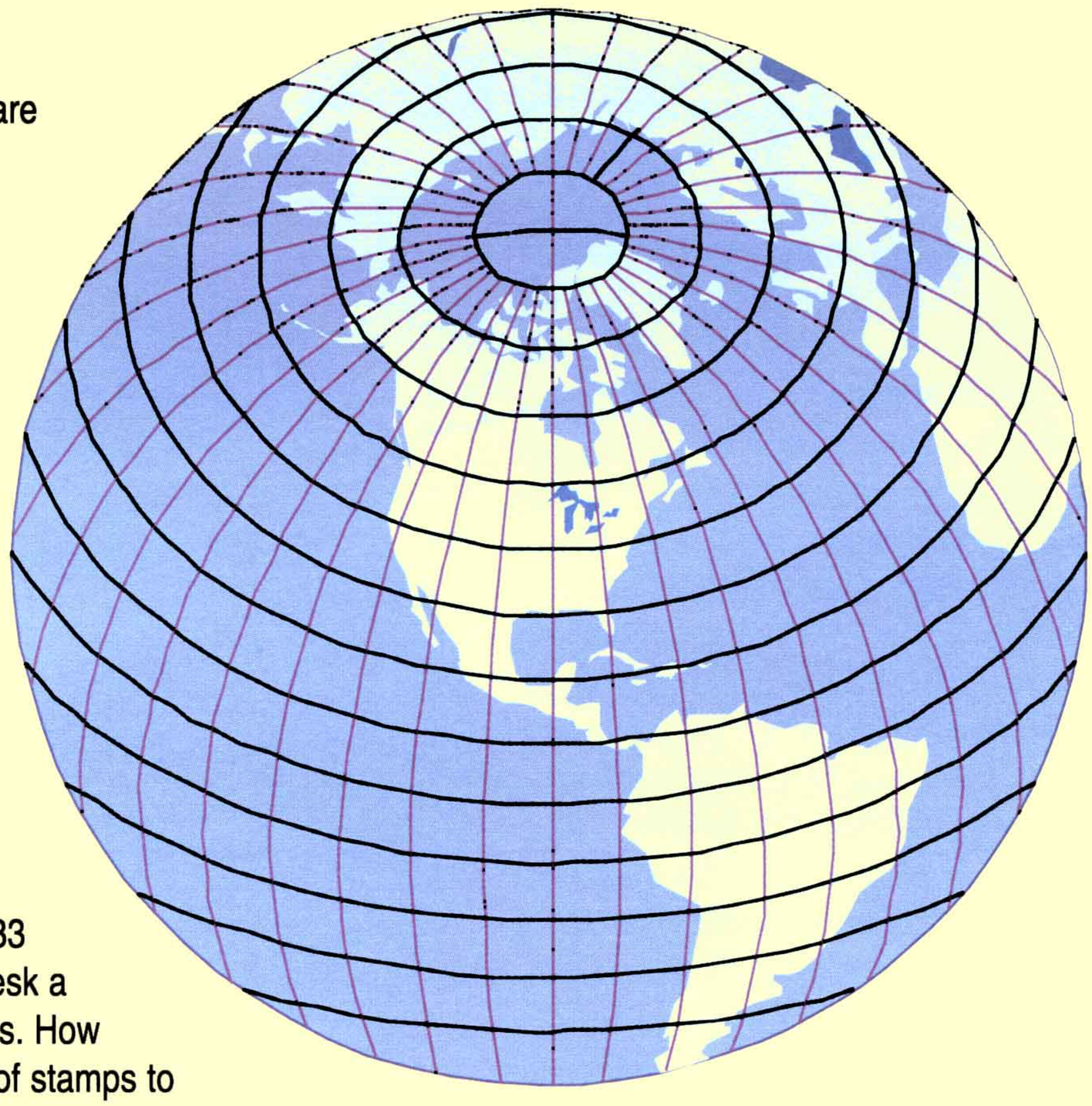
Source: http://www.history.mcs.stand.ac.uk/~history/Mathematicians/Rasiowa.html

by Laura Chavkin, who attends Yale University.

PROBLEMS OF THE MONTH

1. At 12 o'clock the hour hand and minute hand of a clock point in exactly the same direction. At how many other times in a 12 hour period does this happen?

2. The major longitude lines on a globe are every 15º. Between which two major longitude lines is Kansas City? What about Boston? The region between each of these major longitude lines is approximately one time zone. How many of these zones are there in the continental United States? How many time zones are there in the country of Russia? (Make sure you use a recent map.)



3. When it is 6 PM in Paris, France, what time is it Atlanta, Georgia? When it is 3 AM in Toyko, Japan, what time is it in Chicago?

4. Tim wants to mail a letter and needs 33 cents worth of stamps. He finds in his desk a book of 3 cent stamps and 5 cent stamps. How many ways can he mix these two kinds of stamps to make exactly 33 cents?

5. Find two prime numbers which add up to 220.

6. You must get to a point 4 blocks north and 3 blocks east of your current position. How many routes do you have to choose from? You must travel north or east at all times. (There are no alleys. You must go complete blocks.)

7. Divide the numbers 1, 2, 3, ..., 20 into seven groups, each with the same sum.

8. Which number between 1 and 100 has the largest number of positive divisors? (For example, the positive divisors of 9 are 1, 3, and 9 because they divide evenly into 9, with zero remainder.)

9. Jane has eleven coins in her pocket, worth a total of 42 cents. What are the coins?

10. Find the spot at latitude 48º north and 63º west. If you dig a hole directly through the center of the earth, at what location would you emerge on the other side of the earth?

Send us your solutions! Every month, we will publish the best solutions on our website: www.mathexplorer.com. If we print your solutions, we will send you and your teacher free *Math Explorer* pens!

Texas

Distance Table (in miles)

	Abilene	Austin	Dallas	Houston	San Antonio
Abilene	0	216	180	352	250
Austin		0	195	186	79
Dallas			0	246	270
Houston				0	199
San Antonio					0

The table above indicates the distance between pairs of cities. What is the distance from Dallas to San Antonio? What is distance from Houston to Abilene?

Suppose a company in Texas has developed a very advanced computer system to connect the offices in the cities listed above. An engineer must design a plan for each office to be connected to every other office with a special communication cable. Each office does not need to be connected directly to every other office but can be connected indirectly through several other cities. The communication lines cost $1000 per mile to build. So if you connect Austin to Dallas for $195,000, then connecting San Antonio to Austin for $79,000 allows the San Antonio office to communicate with the Dallas office.

Connection Problem

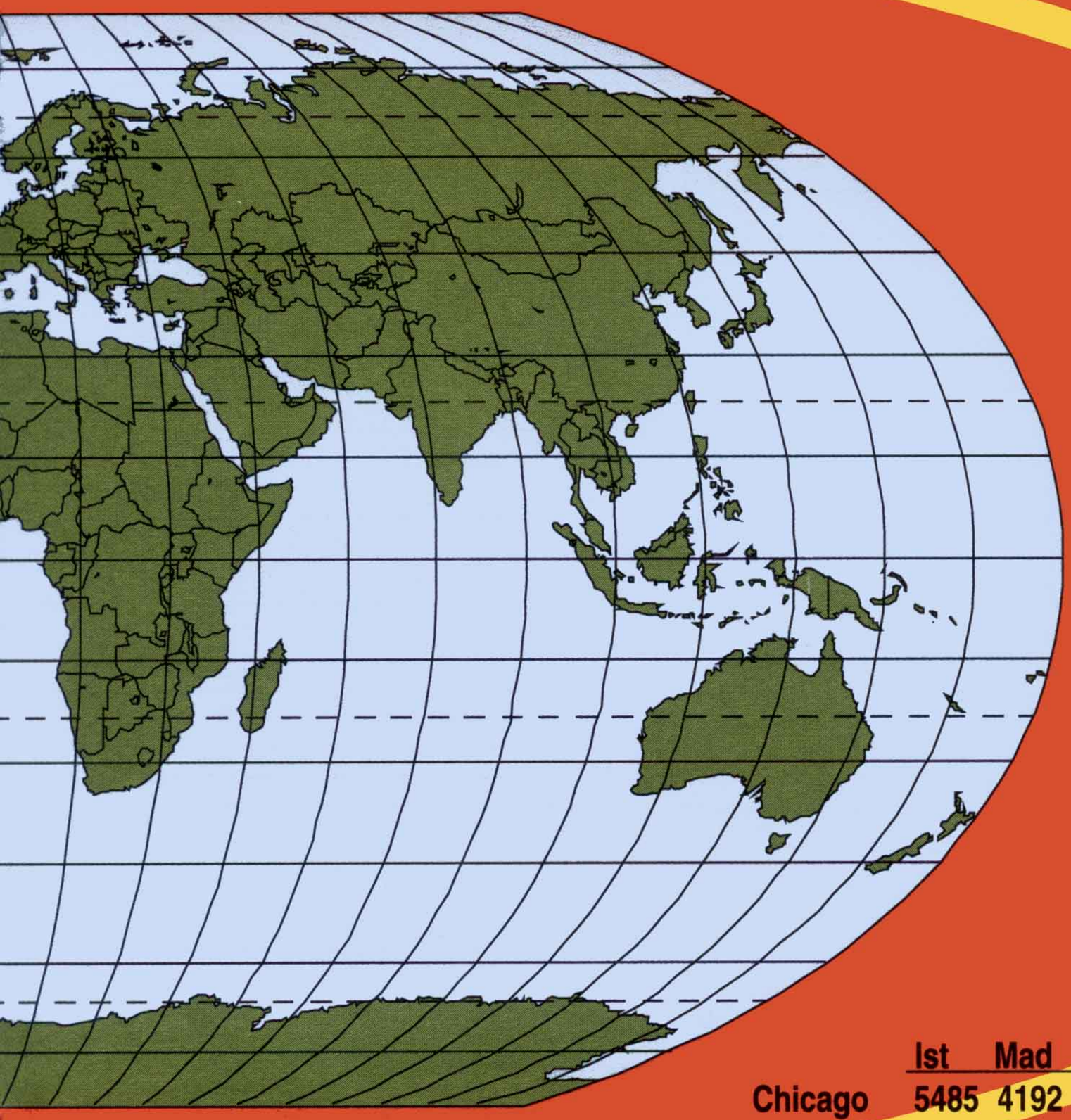
Find the cheapest way to connect the offices in the five cities so that there is a path from any city to any other city. One possible solution would be to have a path from Austin to each of the other cities in the table. But this might not be the cheapest connection.

Tour Problem

As part of her duties, the engineer needs to visit all 5 cities, starting and ending at her office in Austin. Since her time is valuable, she wants to travel the fewest possible miles on her trip. In this problem you are looking for a circuit to visit all 5 cities.Try out your own strategy for solving these two problems. One way to approach these problems is to use what is called a **greedy algorithm**. For

Connections

by Eugene Curtin and Terry McCabe



the connection problem, one greedy approach is as follows. First, make the cheapest connection anywhere. That is the Austin-San Antonio connection for $79,000. Next connect another city to one of the cities above as cheaply as possible. So make the Austin-Houston connection for $159,000. Then connect another city to one of these 3 as cheaply as you can until all 5 are linked. Do you get the cheapest way to connect the cities using this method?

For the tour problem a greedy approach is to go to the nearest place first. You would leave Austin for San Antonio, traveling 79 miles. Next you leave San Antonio for the nearest city not yet visited. Go to Houston. Continue until you have visited all 5 cities, then return home to Austin. Do you get the best answer using this method?

The method we used on the connection problem always gives the cheapest way and is due to a mathematician named Prim.

The method we used for the tour problem is called the **Nearest Neighbor** algorithm. It almost never gives the best answer to this kind of problem! In fact, no one knows a really good way to solve the tour problem for large numbers of cities. Even 25 cities is too large a problem for the fastest computer to solve in a reasonable amount of time.

After such a good job on cities of Texas, here is a more challenging problem using cities from around the world. First solve the connection problem for the group of cities listed in the table below. Then try the Tour Problem. Find the best solution you can.

	Ist	Mad	Mel	Nai	ND	Rio	St. P	Sing	Tokyo
Chicago	5485	4192	9667	8012	7486	5288	4589	9376	6313
Istanbul		1701	9100	2957	2837	6378	1306	5379	5574
Madrid			10766	3840	4528	5045	1985	7079	6704
Melbourne				7159	6340	8218	9263	3767	5070
Nairobi					3371	5556	4505	4636	6996
New Delhi						8747	3069	2574	3638
Rio de Janeiro							7028	9776	11535
St. Petersburg								5575	4733
Singapore									3304

Distance Table (in miles)

Puzzle Page

Math Explorers:

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

Bonnie had four parts of a broken golden necklace. Each part contained 3 rings. She wanted to have her necklace repaired by putting the parts back together to form a circular chain, but she was afraid that she did not have enough money. The jeweler took a look at the parts and said:

"I charge a dollar for opening a ring and another dollar for soldering it. In order to put all the parts together, I have to open a ring on every part and then I have to close them. That means 4 openings and for 4 solderings. It will cost you $8."

Bonnie had only $7. "I don't have enough money," she said sadly. "I was hoping to wear my necklace tonight, but it doesn't even matter anymore..."
"Wait, I thought of something else!"

Can you think of a cheaper way to fix this necklace?

four 7's

Use the operations

+ − × ÷

and parentheses to combine the four 7's and make each equation below true. For example, we can use four 7's to make 0 like this:

(7×7)−(7×7)=0

7 7 7 7 = 1

7 7 7 7 = 2

7 7 7 7 = 3

7 7 7 7 = 4

7 7 7 7 = 5

7 7 7 7 = 6

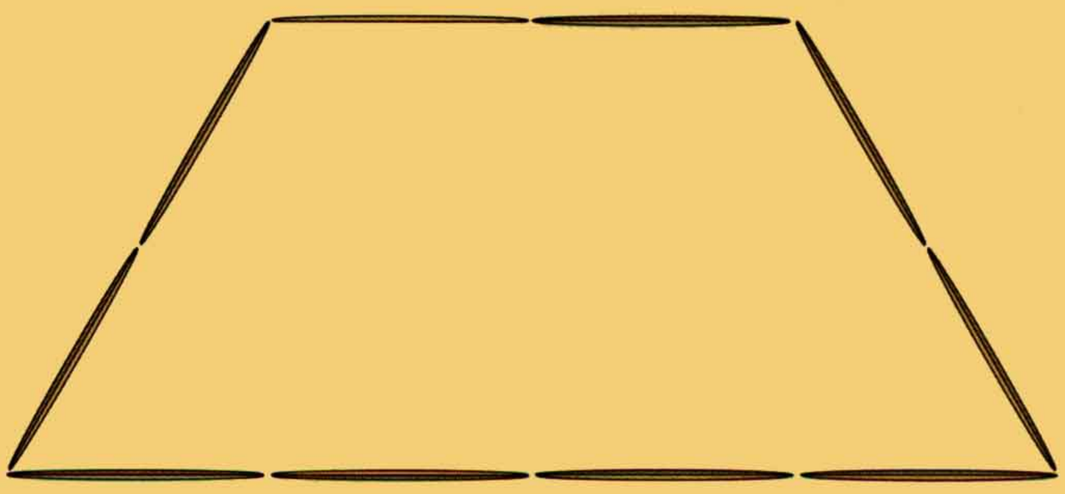
7 7 7 7 = 7

7 7 7 7 = 8

7 7 7 7 = 9

7 7 7 7 = 13

Using 10 toothpicks, we created a trapezoid.



Using 5 more toothpicks, break up this trapezoid into 4 identical areas.

Bulletin Board

Check it Out!

For a lot of cool math activities for upper elementary grades, check out the Math Forum for Elementary School Teachers Place on the web at: http://forum.swarthmore.edu/teachers/elem/

Did you know?

Did you know that fractal geometry is being used to build antennas for wireless phones? See the Scientific American article in the July 1999 issue, page 38.

Starting in 1999, five states will be featured each year on the "tails" side of quarters, in order of their joining the United States. Find out when your state joined. What year will it be when your state is featured?

Primary Mathematics World Contest

Po Leung Kuk 3rd Primary Mathematics World Contest was held in Hong Kong from July 12-17, 1999. Look for news about future contests in upcoming issues!

Math Explorer

Welcome to *Math Explorer*!

Geography is the study of the earth and its life. Geographers take measurements of climate, weather, land and many other aspects that affect our planet. Mathematics is an important part of the study and we hope you'll enjoy reading about the connections it has to geography.

We at Math Explorer would like to encourage you to send us your solutions to the puzzles and problems. We'd like to share them with the readers.

Sincerely,

Hiroko K. Warshauer

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SWT

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Southwest Texas State University

601 University Drive San Marcos, TX, 78666-4616