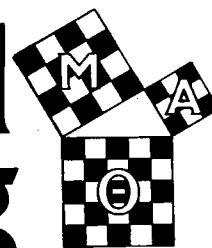
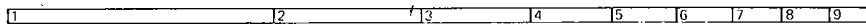


# The Mathematical Log



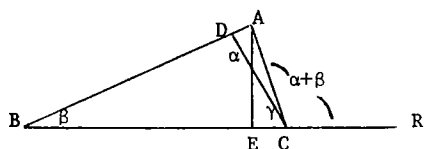
VOLUME XXIII, No. 1 – FALL 1978



## ANOTHER WAY TO OBTAIN $\sin(\alpha + \beta)$

Case 1.

In  $\triangle ABC$  place angles  $\alpha = \angle BAC$  and  $\beta = \angle ABC$  such that  $AB$  is their common side and the other sides meet in  $C$ . Extend  $BC$  to  $R$  and let  $AE \perp BC$  and  $CD \perp AB$ . It is clear that  $\angle ACR = \alpha + \beta$ .



Thus,

$$(1) \sin(\alpha + \beta) = \sin(180^\circ - \gamma) = \sin \gamma = \frac{AE}{AC}.$$

Also,  $\frac{1}{2}BC \cdot AE = \triangle ABC = \frac{1}{2}AB \cdot CD$  from which we derive

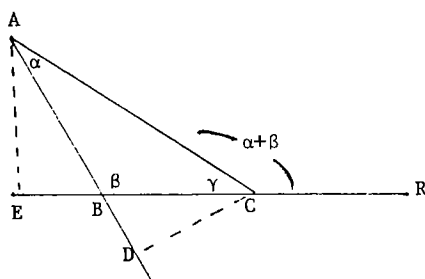
$$(2) AE = \frac{AB \cdot CD}{BC}$$

From (1) and (2) we conclude

$$\begin{aligned} \sin(\alpha + \beta) &= \frac{AE}{AC} = \frac{AB \cdot CD}{AC \cdot BC} \\ &= \frac{(AD + BD) \cdot CD}{AC \cdot BC} \\ &= \left( \frac{AD}{AC} + \frac{BD}{AC} \right) \cdot \frac{CD}{BC} \\ &= \left( \frac{AD}{AC} \cdot \frac{CD}{BC} + \left( \frac{BD}{BC} \cdot \frac{CD}{AC} \right) \right) \\ &= \cos \alpha \cdot \sin \beta + \cos \beta \cdot \sin \alpha \end{aligned}$$

Case 2.

In a second triangle,  $\triangle ABC$ , place all angles and points so that they fit the description in Case 1, but so they form a figure like that below. Again, we can see that  $\angle ACR = \alpha + \beta$ .



Lannie Lipke  
UWC – Rock  
Janesville, Wisconsin

Recall, from (1) that

$$\sin(\alpha + \beta) = \frac{AE}{AC}$$

and, from (2) that

$$AE = \frac{AB \cdot CD}{BC}$$

and we may proceed

$$\begin{aligned} \sin(\alpha + \beta) &= \frac{AE}{AC} = \frac{AB \cdot CD}{BC \cdot AC} \\ &= \frac{(AD - BD) \cdot CD}{AC \cdot BC} \\ &= \left( \frac{AD}{AC} - \frac{BD}{AC} \right) \cdot \frac{CD}{BC} \\ &= \left( \frac{AD}{AC} \cdot \frac{CD}{BC} \right) - \left( \frac{BD}{BC} \cdot \frac{CD}{AC} \right) \\ &= \cos \alpha \cdot \sin(180^\circ - \beta) - \cos(180^\circ - \beta) \cdot \sin \alpha \\ &= \cos \alpha \cdot \sin \beta + \cos \beta \cdot \sin \alpha \end{aligned}$$

## USA TEAM FINISHES SECOND IN INTERNATIONAL MATHEMATICAL OLYMPIAD

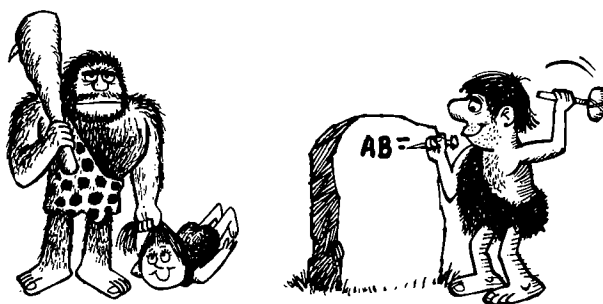
A team of eight US high school students won second place in the 20th International Mathematical Olympiad (IMO) held in Bucharest, Romania, in July. US team member Mark Kleiman of New York City received this year's only perfect score among the 144 contestants. This was Kleiman's third year in competition.

Three of his teammates, Randall Dougherty of Fairfax VA, Victor Milenkovic of Glencoe IL, and Ehud Reiter of Rockville, MD, earned individual second prizes. This was Dougherty's third year at IMO and Milenkovic's second.

Other members of the US team were: Andrew Bernoff, Fort Washington PA; Daniel Bloch, Bellport NY; David Montana, Yardley PA; and Charles Walter, Champaign IL. They were chosen on the basis of their scores in the USA Mathematical Olympiad (USAMO). Michael Larsen of Lexington, Mass., one of the eight USAMO winners, was unable to attend IMO and was replaced by Andrew Bernoff.

The IMO annually brings together teams of high school students from about 20 nations for a spirited competition based on an examination requiring both broad knowledge and great mathematical ingenuity. A strong Romanian team captured top honors this year, followed by the United States, Great Britain, Vietnam, and Czechoslovakia, in that order. Sample problem from the 1978 IMO examination:

Let  $m$  and  $n$  be two distinct positive integers, with  $m > n$ , such that  $1978^m$  and  $1978^n$  end in the same three digits (in the same order). Find the values of  $m$  and  $n$  which minimize the sum  $m + n$ .



Oh! My equation! Let us derive!  
We can make beautiful slopes together.  
I will range my sigma to the limit for your epsilon.  
A quantity squared cannot keep me from your tangent.  
A delta is not as sweet, not near so tempting as your sine.  
A new variable would not draw me away.  
You satisfy my equation. Our relation has absolute value.  
I think only in positive integers since our meeting.  
You are the greatest integer in my domain.

David Haynes  
Goose Creek High School  
Goose Creek, South Carolina

The official publication of the National High School and Junior College Mathematics Club, Mu Alpha Theta, which is sponsored by the Mathematical Association of America and the National Council of Teachers of Mathematics. Address correspondence to: Mu Alpha Theta, 601 Elma Avenue, Room 423, The University of Oklahoma, Norman, Oklahoma 73019

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## ANNOUNCEMENTS

The 1979 Mu Alpha Theta National Convention will be held in Decatur, Alabama. Conference Chairman is Thomas Thrasher of Austin High School... one of our new Governors and sponsor of the team that won the Math Bowl competition at Stevens Point.

Chi Alpha Mu, the national organization for junior high school mathematics students, held its 1978 annual convention in Tulsa, Oklahoma, at Thomas Gilcrease Junior High School in April. For more information on Chi Alpha Mu, contact Dr. Sarah Burkhart, Tulsa Public School System, Tulsa, Oklahoma.

The Ninth Annual High School Mathematics Examination will be on March 6. Over 360,000 students from the United States and Canada are expected to participate. A list of regional chairpersons as well as recent examinations and solution keys are available from Dr. Walter Mientka, University of Nebraska, 917 Oldfather Hall, Lincoln, Nebraska 68588.

We are extremely proud of the publication, *Mathematical Buds*. All of the chapters should have received a copy by now. It is available to members for \$1.50. Remember that this is a continuing project, and it's an excellent opportunity to let other students know about the mathematics you are working on.

When a paper is submitted, the following information should be given on a separate sheet: (1) title of paper, (2) author's name, address, and phone number, (3) school's name and address, (4) date, place and name of Math Fair competition at which the award was won and the nature of the award, (5) if there was a sponsor, his/her name and address.

Mail four copies to Harry D. Ruderman, 2624 Davidson Avenue, Bronx, New York 10468. Your name should not appear on the four papers. Also include a self-addressed stamped envelope for returning the paper if it is not selected for publication.

The publication, *Cryptarithms*, is available to Mu Alpha Theta members for \$1.77.

The *Mathematics Student* is published eight times a year. The new editor is Dave Logothetti. Subscription price for NCTM members is \$2.00. Group rates are \$5.00 for five copies of each issue and \$30.00 for thirty-five copies of each issue. You're going to like this one!

Florida's Fourth Annual Convention will be held February 16-17 at Coral Springs High School. Barbara Nunn is the sponsor and Lori Greenberg is the State President of Mu Alpha Theta.

There will be two events sponsored by Mu Alpha Theta at the April 1979 meeting of NCTM: a breakfast for sponsors on Friday morning and a section meeting on mathematics clubs. Reservations are needed for the breakfast and should be sent to the National Office. (Pay for the breakfast at the meeting)

## MESSAGE FROM THE PRESIDENT

At last August's Stevens Point, Wisconsin, National Convention, we convened our first Assembly of Student Delegates, one from each club in attendance. The Assembly in turn elected four representatives, one from each Region, to the first year-long Student Advisory Board: Hal Kohlman of San Antonio, Texas; Brad Long of Decatur, Alabama; Chris Mount of Bainbridge Island, Washington; Bill Thaden of Cuyahoga Falls, Ohio.

Brad was elected chairman. Beyond rendering student advice to the Governing Council, he will plan the next Delegate Assembly to be held during our next National Convention at Athens State College in Decatur, Alabama, in August, 1979.

With the benefit of advice from the Student Advisory Board, the Governing Council made decisions like these at its August meeting: accepted the invitation of the Marietta, Georgia, Walton High School chapter to host the 1980 convention at Georgia Tech; and that of the Crescenta Valley and La Canada chapters to hold the 1981 convention in Southern California; agreed to continue to provide awards of Mu Alpha Theta publications to the Atlantic Region Math League and National Olympiad winners; pondered improvement in contest rules for future conventions.

The Council also welcomed new members Adele Hanson of Wisconsin and Tom Thrasher of Alabama, respectively from the Northeast and Southeast Regions, and Katherine Layton of California as President-elect. It thanked retiring Governors Betty Lichtenberg and Harry Ruderman, and Past-President Sarah Herriot. Fortunately, we will have the benefit of Ms. Lichtenberg's continuing as *Log* editor, and Mr. Ruderman's continuing as *Mathematical Buds* editor.

Best wishes for a successful MuAlpha Theta year.

Robert Kalin  
Florida State University



## SECRETARY'S CORNER

A mailing was sent to each chapter the first week in October. It included the following: *Handbook for Sponsors*; *Mathematical Buds*; *Cryptarithms*; roster of clubs. If your club has not received this material, please write our office.

Last year was a great year for Mu Alpha Theta; 84 new clubs were chartered and 19,036 new members were added.

Our office has available for use by chapters a slide presentation on Mu Alpha Theta which was prepared by Diana Ruby of Riverdale High School, Jefferson, Louisiana. It would be excellent to use for an initiation or parents night since it deals with the purposes and goals of Mu Alpha Theta. The only cost to chapters is the return postage.

## CONVENTION HIGHLIGHTS

Two hundred ninety six persons attended the 1978 Mu Alpha Theta National Convention in Stevens Point, Wisconsin, in August. Eighteen states were represented. Wisconsin had 55 students in attendance and Texas had 42 students. The representatives from Hawaii were the farthest distance away.

The winner of the Math Bowl competition was the team from Austin High School of Decatur, Alabama. The sponsor of this team is Thomas Thrasher and team members are Richard Borie, Brad Long, Jamie Oliver, and Scott Sampson. The second place team in the Math Bowl was New Trier East High School of Winnetka, Illinois. Team members there are Tom Allen, Paul Green, Michael Spertus, and Kei-Mu Yi.

An excellent program was provided and a variety of speakers were present with topics that appealed to everyone.

The University of Wisconsin at Stevens Point is a beautiful place and the people were great! A special thanks is in order to Robert Meyer, Chairman of the Convention, and in particular to Miss Holly Meyer, Acting President of the Tomahawk Math Club of Tomahawk, Wisconsin. There are many more people we could thank that worked hard to put the convention together.

Begin making plans now for next summer's convention in Decatur, Alabama.

## CARDAN AND TARTAGLIA

In 1501, a boy named Girolamo Cardan was born in Pavia, Italy, the illegitimate son of a lawyer. The boy was destined to achieve fame as mathematician, physician, astrologer, scientist, gambler, and breaker of his word. He became a student at the University of Pavia but finished his course at Padua where he was graduated in medicine. His early efforts to build up a medical practice were so unsuccessful that he and his wife were forced to seek refuge in the poorhouse. Then fortune smiled on him; he was able to cure the child of a senator from Milan. As a mark of gratitude, the senator persuaded the authorities to let Cardan practice as a physician, permission having been previously refused on account of his illegitimate birth. Once installed in Milan as a physician, however, he spent so much time in gambling and in interests outside his profession that his practice suffered. However, he was again smiled on by fortune when he received the appointment of a professorship of medicine at Padua.

Cardan's interests, as have been said, were far from being restricted to medicine. He began to write about mathematics, and this interest led him into correspondence with a mathematician named Niccolo Fontana, better known as *Tartaglia*, "the stammerer". Tartaglia was born at Brescia in 1500. Twelve years later, when the French captured the town, many of its inhabitants, including Tartaglia's father, were massacred in the cathedral. Young Niccolo was left for dead, but his mother managed to force her way into the charnel-house of the cathedral and carry away his mutilated body. His skull, jaws, and palate were split open, but eventually his life was saved by his devoted mother, though he stammered for the rest of his days because of his injured palate. So poor were Tartaglia and his mother that he had to make use of tombstones as slates on which to work exercises from a book he managed to obtain. Despite the handicap of such poverty, he educated himself to such good effect that eventually he became a lecturer, and then a professor at Venice. While there, he discovered a method of solving a cubic equation, or equation such as  $x^3 + ax^2 = b$  where  $a$  and  $b$  represent constants. It was customary in his day for mathematicians to challenge other mathematicians to solve various problems. When Tartaglia announced that he could solve an equation like  $x^3 + ax^2 = b$ , he

was challenged to a contest with an obscure person called Fiore. Each was to draw up thirty problems and hand the list to his opponent. Whichever of them solved the greater number of problems within thirty days was to receive a sum of money deposited with a lawyer. Tartaglia was presented with a group of cubic equations, for whose solution, unknown to his opponent, he had discovered a general rule. In less than two hours, he solved all his opponent's problems, while his opponent failed to solve any of those drawn up by Tartaglia.

For some time, Tartaglia kept his method for solving cubic equations to himself, but after much persuasion he disclosed it to Cardan, who solemnly promised not to reveal his secret.

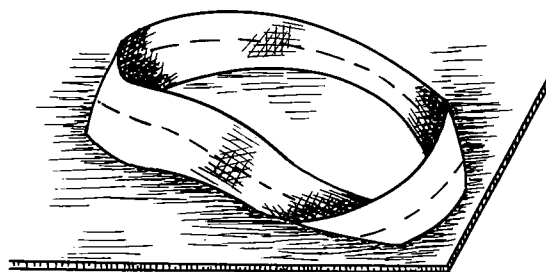
Some years later, to Tartaglia's amazement and indignation, Cardan revealed Tartaglia's method of solution in a book called the *Ars Magna*, published at Nuremberg in 1545. A long and bitter dispute resulted. There can be no question that Cardan broke his solemn promise, even though in his book he gave Tartaglia credit for the part he had played in the matter.

The *Ars Magna*, besides dealing with the solution of cubic equations, is a comprehensive treatment of the algebra known in Cardan's day. It was the first book to recognize what we now call negative roots of an equation, and the first to set forth clearly the idea of negative numbers.

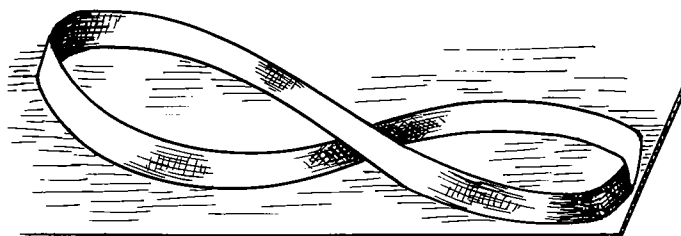
Today we remember Cardan principally on account of his method for solving cubic equations suggested by Tartaglia.

Nancy Carillo  
Plant City High School  
Plant City, Florida

*A one sided surface*



*Möbius Strip*



*after cutting*

## MICRO-COMPUTER CONFERENCE

The student chapters of the Association for Computing Machinery and the Data Processing Management Association at the University of Oklahoma produced a novel and highly successful *SHOW & TELL micro COMPUTER CONFERENCE* on May 13, 1978, in Norman. The conference ran from 8:30 a.m. until 5 p.m. but there were still gab fests going at 6 p.m. Participants were encouraged to bring and demonstrate their own micro-computers at the day-long conference.

The following three excellent 30 minute talks were given:

*Where Micro-Computers Are Going* by Charles Weddington  
*A History of Computer Circuitry* by David Aschbacher  
*Floating-Point Arithmetic: Beauty or Beast* by Andrew Oldroyd

The aim of the conference was to promote the exchange of ideas between participants. Twenty-one participants introduced their favorite "brag programs" in a 5 to 8 minute presentation and later demonstrated them to interested coparticipants in *Show & Tell* sessions. Other participants brought their systems and participated in *Show & Tell* without giving talks. Programs, advice, and stories were swapped by all.

Microframes present included: 5 APPLE II; 1 Audit-4; 3 ALTAIR 8800; 16 TRS-80 Level I; 4 TRS-80 Level II; 2 SWTP 6800; 1 VECTOR; 2 IMSK; 1 KIM-1; 1 EBKA Familiarizer/PROTO Board; 2 ITF; and 9 Home-Brew plus several partially completed micro-computers. Many of the above included extensive user-designed modifications and peripherals.

The brief presentations included:

*A Text Formatter for use in Story Generation.* Stephen Kenton (Altair 8800)

*Hunt the Wumpus.* Richard Todd (TRS-80)

*3D Graphics.* Mike Koss (Apple II)

*Micros in Psychological Research.* Charles Gettys (SWTP 6800)

*Hexapawn: A Game You Play to Lose.* Jim Trott (ITF)

*The Game of Life.* Mike Meyer (TRS-80)

*Very Versatile Instrument.* H.M. Bradbury (Altair 8800)

*Trilogy.* Rocky Rutter (Apple II)

*Attendance Records.* Dale Ernst (TRS-80)

*Haikku, Sonnets, & Accts. Rec.* Charles Coombs (Olivetti A-4)

*Random Numbers.* Julian Calderon (TRS-80)

*Inventory Accounting Systems/Hamarabi.* James Waldron

*Level II BASIC.* Ray Davis (TRS-80)

*IC-Testing with a Microprocessor.* Donald Walton (6502 Chip,

EBKA Familiarizer) Proto Board

*TRS-80 Architecture & Use of T-Bug.* Donald Flower (TRS-80)

*Demo of KIM-1 w TV interface.* Stanley Turk (KIM-1)

*First Order Differential Equations.* William Stockwell (TRS-80)

*4-Digit Prime Squares.* David Vincent (ITF)

*Hi-Low Game/ Reverse.* Bob Yarbrough (TRS-80)

*Stock Plotting.* Bill Winters (TRS-80)

*Introducing the ICCD Journal.* Harold Zallen

An extensive display of computer-assisted art was exhibited. A Programming Contest was held with 23 entrants. Prizes were awarded to Mike Koss, Robbie Reid, and Donald Fowler.

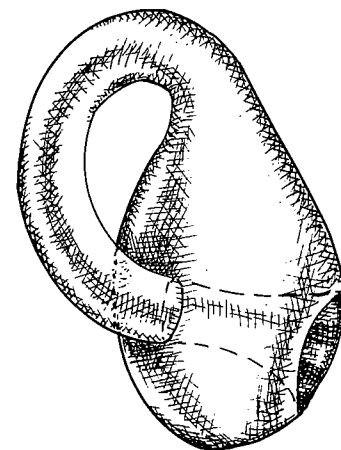
Many participants brought brown bag lunches and ate together in the beautiful 11th floor mathematics conference room with free beverages provided by the department.

Prizes of circuit boards and other hardware, computer-generated art, books and journals were presented to all who pre-registered for the conference and to at-the-door registrants and guests as far as supplies lasted. More than two hundred registered partic-

ipants attended what promises to become an annual event at the University of Oklahoma.

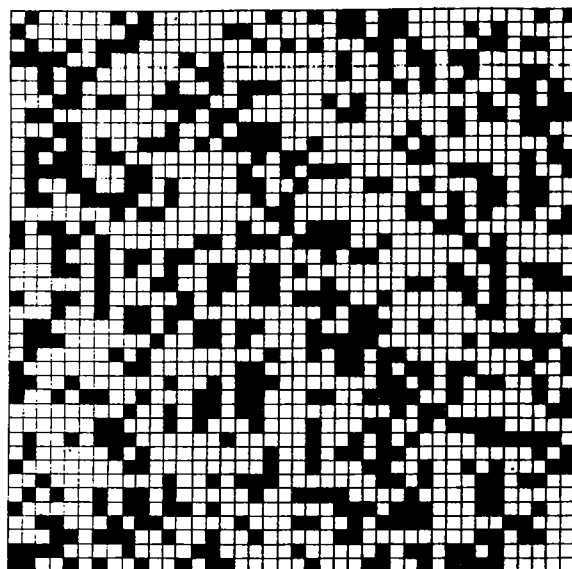
Anyone interested in future participation in similar events should contact Dr. Richard V. Andree, Math Dept., University of Oklahoma, 601 Elm Avenue, Norman, Oklahoma 73019.

Proceedings of the conference, giving summaries and program listings for most talks may be obtained by sending \$5.00 to the above address with your request. (\$2.00 additional for orders outside the North American continent or Hawaii, or for orders requiring billing or other special handling.)



One-sided surface drawings by Ali R. Amir-Moez, Texas Tech University, Lubbock, Texas

## Klein Bottle



Classic Beginning *Allen* 1978

## CLASSIC BEGINNING

Patterns and patternless of essentially mathematical situations can permit interpretation as striking graphic art. "Classic Beginning", a crossword-like grid, actually conceals a hidden message in a relatively straightforward way. Letters are encoded in what should be a familiar sequence, and represented as black and white squares in readily deduced permutations. The message is left as a standing challenge to *Mathematical Log* readers. Dr. H.D. Allen, Nova Scotia Teachers College, Truro, a long-time friend of Mu Alpha Theta, has the original framed on his office wall and has published a variety of such "mathematically-rooted graphics" in mathematics and general education periodicals.