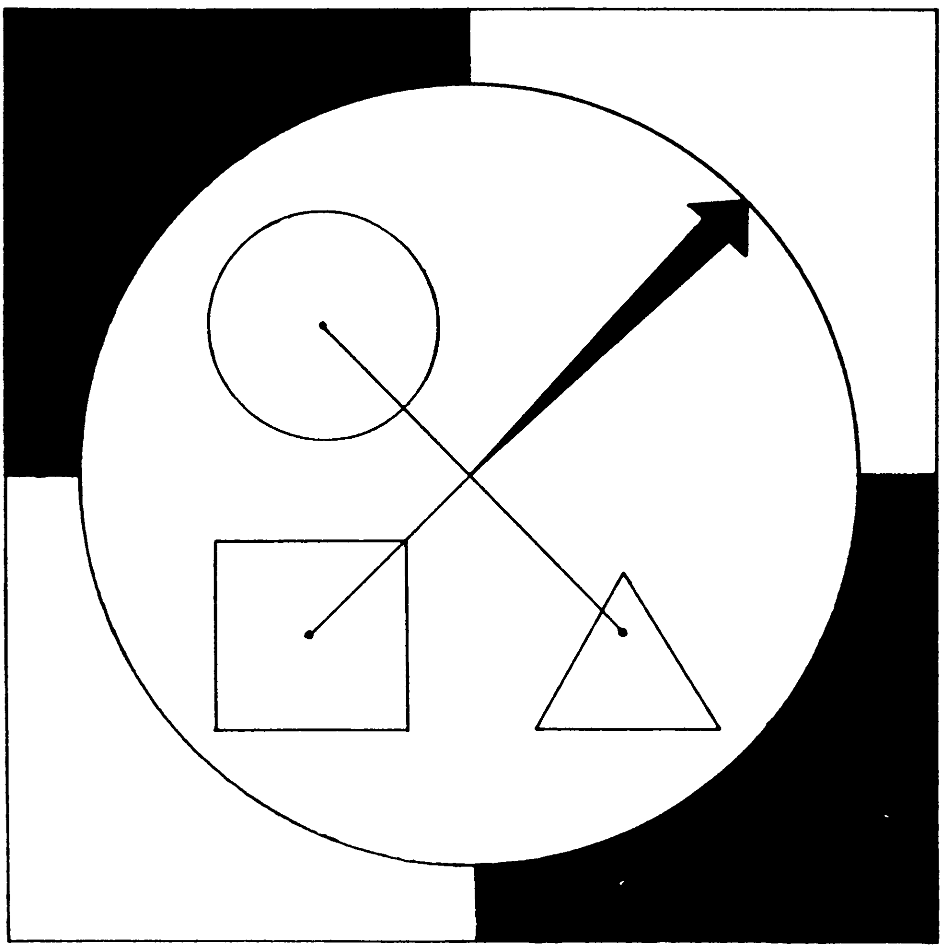
Vector

BRITISH COLUMBIA ASSOCIATION OF MATHEMATICS TEACHERS

NEWSLETTER



VOLUME 12, NUMBER 4 MARCH 1971

BCAMT EXECUTIVE

President
Leonard J. Gamble,
R.R. 2,
Clearwater.
674-3590 (home)
674-3220 (school)

Past President
Curriculum Representative
Peter Minichiello,
2484 Eddington Drive,
Vancouver 8.
226-7369 (home)
736-0344 (school)

Corresponding Secretary
Isobel C. Leask,
306 - 157 East 21 Street,
North Vancouver.
987-9415 (home)
987-3381 (school)

Journal Editor
Dr. Thomas Bates,
15550 Thrift Avenue,
White Rock.
531-5924 (home)

Publications
John W. Turnbull,
5093 - 7B Avenue,
Delta.
943-1701 (home)
274-1264 (school)

Vice-president
Henry Janzen,
1677 Babcock Place,
Delta.
943-3292 (home)
946-4194 (school)

Treasurer
J. Michael Baker,
87 - 14909 - 107A Avenue,
Surrey.
581-3898 (home)
588-3458 (school)

CAMT Representative
Roy Craven,
2060 Willow Street,
Abbotsford.
853-1888 (home)
859-2187 (school)

The B.C. Association of Mathematics Teachers publishes *Vector* (newsletter) and *Teaching Mathematics* (journal). Membership in the association is $4.00 a year. Any person interested in mathematics education in British Columbia is eligible for membership in the BCAMT. Journals may be purchased at a single copy rate of $1.50. Please direct enquiries to the Publications Chairman.

NOTICES

1. Election results will be made known at the AGM. The position of secretary was not filled and an appointment will therefore be made by the executive when a candidate appears.

2. The 10th N. W. Mathematics Conference will be held in Seattle, Washington in October 1971.

3. Needed soon: a chairman for the 12th N. W. Mathematics Conference to be held in B. C. in 1973.

4. Math Contest -- The top ten students in the MAA contest will be invited to UBC for April 30 - May 1. The BCAMT helps to sponsor this event.

5. Roy Craven (BCAMT representative to the CAMT) returned from the CAMT convention at Sir George Williams University, Montreal on February 26. He will be submitting a report.

EASTER CONVENTION

The annual general meeting of the BCAMT will be held on Tuesday, April 13, 1971 at the Hotel Vancouver. We have reserved the Garibaldi Room from 9:00 a.m. to 5:00 p.m. During the morning we plan to have present one or more members of the Mathematics Revision Committee. The business meeting will start at 1:00 p.m. and will last approximately one hour. Throughout the day the room will be used as a drop-in center, featuring a multi-media approach. We shall have the NCTM Elementary Teacher Education films along with displays from Thomas Nelson, McIntyre, Creative Publications, J. Weston - Walch, Sony, Wm. Clare and W. V. Gage. Drop by and come in.

The following was received from the Mathematics Department of Bert Bowes School.

REVISION OF JUNIOR SECONDARY MATHEMATICS COURSES

Math 8

Starting with Math 8, it seems possible that some of the material in the present course will be covered in the lower grades. Even now students from the elementary schools arrive with different groundings in arithmetic.

Diagnostic tests should be administered before a student starts Math 8. The results of such tests should be used when assigning students to mathematics classes.

Math 8 could consist of core topics for all classes plus a selection of additional topics. I should not consider these additional topics as enrichment only. They should be chosen to suit the students' needs as indicated by the diagnostic tests as well as cover enrichment material.

Paperbacks, pamphlets (some produced in the school or district) could be given or sold to the students. How do the social studies people feel about several little books in place of one big one?

Geometry

As currently taught in Math 10, the geometry has, I believe, two aspects:

(a) learning definitions and doing constructions and calculations
(b) formal reasoning.

The (a) material could be dispersed throughout all mathematics courses, starting in the elementary grades. If desired, a summary could be given the students near the end of Math 10 -- possibly another little paperback that they could use in Math 11 and 12.

As it is currently taught the (b) material is not satisfactory. During a class discussion, one of my students suggested that the only reason for learning this was to become a teacher and teach it to other students. Have you ever asked your class at the end of the year to write you a paragraph on what they got from the course?

Why not use games to help with reasoning? I suggest 'Patterns' (see *Scientific American*, November 1969, page 140). I have used this with Math 9 and Math 10 classes. It was much enjoyed by all of us. There must be many others, including 'Wff'n Proof.'

Algebra

Algebra, together with geometry, could be taught in Grades 9 and 10. Additionally, we could include some optional units involving activity, laboratory work, consumer or social arithmetic. Do we assume that academic students are too smart to be fooled by time-payment plans?

Once again, a textbook plus inexpensive booklets could be used.

General Math

We believe that GM 9 is too easy and repetitive for about 50% of those enrolled. The one person teaching GM 10 this year is 'satisfied' with the course and text. He suggested that it be used in GM 9.

The general mathematics courses (9 and 10) are in far greater need of repair -- should I say complete rebuilding? -- than are the academic courses. Too much of the material repeats that of lower grades, going back to the elementary school level. In preparing new material, we must remember the reading difficulties of many general mathematics students.

As suggested for Math 8, it would be possible to give diagnostic tests to students entering the general mathematics area. A core of material, presented in an *attractive* book, could be accompanied by inexpensive booklets and other materials, such as slide rules, that the students could keep. A variety of optional topics should also be used.

As you know, Science 10 is a terminal course for non-academic students. Is there any reason why, after revision, GM 10 could not also be a terminal course? It seems more sensible that any further mathematics needed in other subjects (industrial education, for example) beyond Grade 10 should be picked up by the student as required.

After having commented on the various grade levels and courses offered at the junior-secondary level, I have some ideas that apply to all of them.

1. Elective courses in mathematics -- more at the senior than junior level.

2. Provision for students to progress at their own rate and start a new course in mid-term.

3. Employ a variety of methods, including programmed learning, mathematics lab and games.

4. Have calculating machines available to take the drudgery out of some discovery topics. Perhaps even rent a computer terminal.

5. Keep in mind the variety of school days and terms (semester, etc.) that are springing up.

6. Try to facilitate more effective mathematics education in other subjects. Who should do it, the mathematics teacher or the other teacher? I have often taught a class of mathematics and science in the same year and am interested in the transfer of knowledge -- or lack of it.

7. Invite interested mathematics teachers throughout the province to try out courses and assist in their revision and re-revision. Bring such a group together in Vancouver once or twice a year to further this project.

I hope that these ideas will be of some help. Please let me know if you think that our teachers can make any further contribution.

Respectfully submitted,

Greg Lindsay, Head
Math Department.

MAGIC SQUARES

A. Can you produce a 3 x 3 magic square using the numbers 5, 8, 11, 14, 17, 20, 23, 26, 29?

B. Can you produce a 5 x 5 magic square using the numbers 1, 5, 9, 13, 17, 21, 25, 29, 33, 37, 41, 45, 49, 53, 57, 61, 65, 69, 73, 77, 81, 85, 89, 93, 97?

C. Can you produce a 3 x 3 magic square using 703, 707, 711, 715, 719, 723, 727, 731, 735?

DIABOLICAL SQUARE

	12	1	
2			11
16			5
	6	15	

(2 + 12) + (15 + 5) makes up 2 'broken diagonals' that total an ordinary diagram, as does (16 + 6) + (14 + 11). The sum of 2 such broken diagonals is 34. Can you use the remaining natural numbers from 3 to 14 to complete this magic square?

NUMERALS

There is no doubt our present numerals have evolved to their current form from simple beginnings. It reasonably follows that they will continue to evolve. The numerals on bank cheques today are one example. Dr. Farrell, in the following article, shows how numerals could evolve from another standpoint.

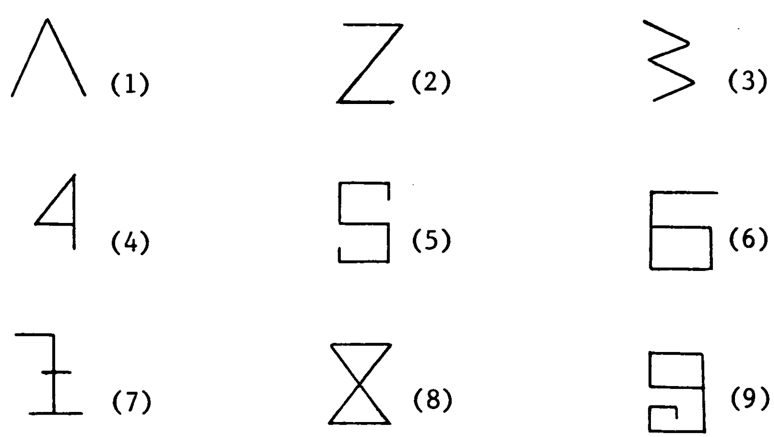
ANGLE SYMBOLS FOR NUMBERS

R. Keith Farrell, Giesela E. Turley* and Shirley D. Johnston

Animal marking and identification are essential to studies employing either wild or laboratory animals. Criteria for good marks require that they be permanent, unalterable and easily read from a distance. Ideal marking instruments use a minimum number of symbols to produce a maximum number of marks.

In ancient times, sticks were used to make straight line impressions on clay tablets to tally grain supplies and other commodities. Perhaps the man who developed our present Arabic system used such tallics. A symbol that contained only one angle could represent the number 1. By adding angles, a simple set of symbols developed (Figure 1).

FIGURE 1



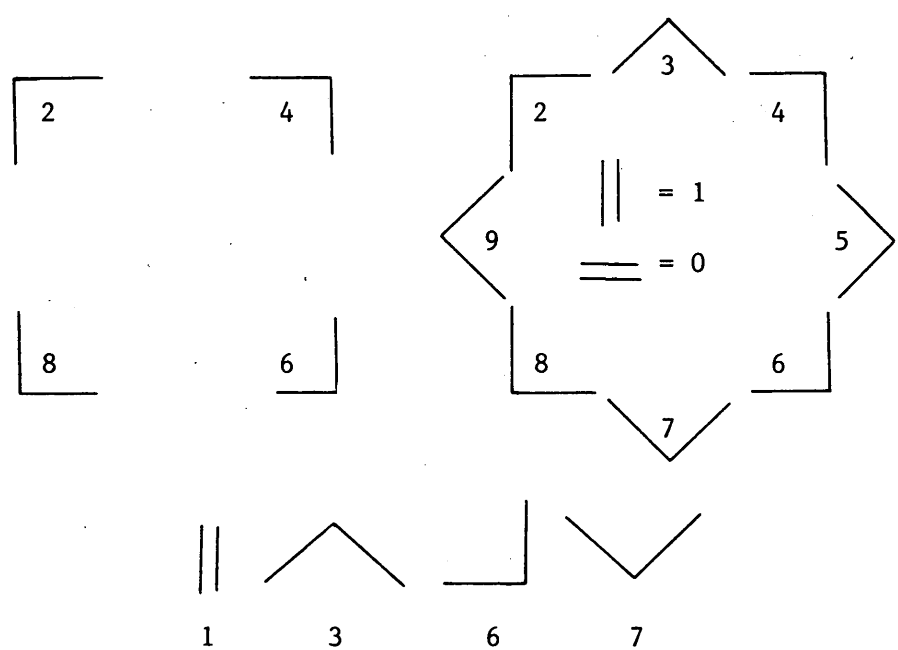
From the Veterinary Science Research Division, ARS, USDA, and the College of Veterinary Medicine, Washington State University, Pullman, Washington 99163.

* Livestock Brand Registrar, Washington State Department of Agriculture, Post Office Box 125, Olympia, Washington 98501.

If you examine each symbol and count the angles, you will see he had a good thing going until he got to 9. Imagine the poor fellow scratching his head to account for the last figure he needed. I should like to think he noticed at that time a round piece of bamboo and picked it up to make the impression that revolutionized the system: 0, with no angles at all. This description may be far from the truth, but it does bring us to the point that straight lines are easy to make with crude instruments. An identification system developed at our laboratory uses only a right angle and a double straight line to form digits 0-9.

To learn the system, one need only visualize a basic square with four right angles representing the even numbers: 2, 4, 6 and 8 (Figure 2). Two is in the upper left-hand corner, and 4-6-8 are represented by the remaining three angles, counting clockwise around the inside of the square. The basic square is then shifted through 45° to give four new angles representing the odd numbers: 3, 5, 7 and 9. To find the angle representing 3 one uses the basic square to find 2 and 4; 3 falls in between. The number 1 is represented by two vertical lines (||); two lines are used to avoid confusion with the angles. Zero is represented by two horizontal lines (═), which is the symbol for one rotated through 90°. None of these symbols can be altered to make another.

FIGURE 2. THE ANGLE SYSTEM* Angles for number 1367 are shown below.



---

* U.S. Patent Application No. 831,850

A visibility study using 1" square Arabic and angle symbols dramatically demonstrated the superior legibility of right angles. Each symbol was posted at a height of 5'; observers stationed 80 feet away moved forward until they could identify the symbol. Beyond 35 feet, angles were recognized much more easily than Arabic numbers, notwithstanding the observers' greater familiarity with numbers.

The Angle System has been used to mark a variety of animals. Marking techniques used include tattooing, freeze branding and laser marking. The use of only two symbols (the right angle and the double straight line) instead of ten number symbols facilitates marking processes; resulting symbols can often be read without restraining the animal that has been marked.

Problems from: *Mathematical Pie* (100 Burman Road, Shirley, Solihul, Warwickshire, England).

A BASE QUESTION

Find a three-digit number in base ten which has the digits reversed when written in base nine.

Let the three digits be a, b and c, then

$$a\ b\ c_{ten} = c\ b\ a_{nine}$$

$$10^2a+10\ b+c \ = 9^2c+9\ b+a$$

$$99a + \ b-80c=0$$

$$99\ a+b = 80\ c.$$

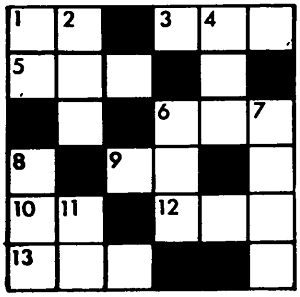
Test various possible values of a and c, and try to find a value for b within the number systems being considered.

$a=5$ and $c=6$ gives $495+?=480$, impossible.
$a=4$ and $c=5$ gives $396+?=400$, leads to $b=4$.
Thus $445_{ten}=544_{nine}$.

Now consider a similar problem in other number bases. Can you find a three-digit number such that its digits are reversed when changing from base nine to base eight, base eight to base seven, etc.?

B.A.

JUNIOR CROSS FIGURE



Clues Across

1. $a+b+d$.
3. a^3.
5. $(a+b+d)^2$.
6. $(b+d)^2$.
9. $3(a+b)$.
10. Twice 1 across.
12. $a(a^2 - a)$.
13. $d^3 - 1$.

Clues Down

1. $2(a+b)$.
2. $4bd$.
4. $2(a+b)^2$.
6. $9(2b+3a)$.
7. $9d^3$.
8. b^2+d^2.
11. b^2.

A.B.

$a = 5$, $b = 7$, $d = 10$.

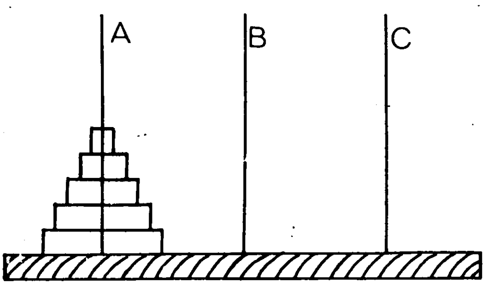
HAVE YOU EVER BEEN ADD?

Do you want to increase your reputation as a lightning calculator? Here's how! Get a friend to write down two numbers less than twenty, one under the other, without letting you see them. Now tell him to make a third number by adding the first two together and write it below the first two. Now he must make a fourth number by adding, the second and third, a fifth by adding the third and fourth, and so on, until he has a column of ten numbers. Now ask him to show you the column of ten numbers and immediately you write down the total underneath—in the example this is 891.

The clue is to look at the seventh number, here 81, and multiply it by 11. Why does it work? R.M.S.

5
7
12
19
31
50
81
131
212
343
—

THE TOWER OF HANOI



Many of you have probably seen at some time the puzzle called the "Tower of Hanoi." The illustration shows the side view of five blocks which fit on to the spikes A,B,C. The aim of the game is to move the tower from spike A to spike C, moving only one block at a time from one spike to another. Easy?—yes, but putting a large block on top of a smaller one is not allowed. If you find difficulty now, try reducing the number of blocks from five to four, three, two and look for a system. The least number of moves for five blocks is thirty-one. Can you explain why? Find out how many times each block moves. Mr. Whittell of the Harold Malley School, Solihull, suggests as further investigation: how far does each block move horizontally if AB and BC are each one unit?

How far does each block move if the tower is moved from spike A to spike B? E.G.

A TEACHER WORKSHOP – Part I

J. N. C. Sharp
Co-ordinator of Mathematics
Board of Education of Etobicoke

Activity Graphing

Project 1.
Materials: Thermometer, electric kettle, container and water, watch with sweep second hand.

Method:
1. Boil water.
2. Pour it into the container.
3. Observe and record the temperature of the water as it cools, using one minute intervals.

Problems:
1. Draw a graph illustrating the relationship between temperature and time elapsed.
2. Should the graph be a continuous curve? Explain.

Project 2.
Materials: 20 sheets of 1/2" square paper.

Method: Make an addition square of the numbers 1 to 15 inclusive. Mark all points that have a sum of 7.

Problems:
1. Do you recognize the pattern formed? If the numbers in the bottom row are on the x-axis and those in the left column on the y-axis, what relationship exists between the x and y values of the points you have marked?
2. Repeat (1) for points whose sum is 15.
3. Are the above graphs continuous? Why?

Project 3.
Materials: 20 sheets of 1/2" square paper.

Method:
1. Make a multiplication square of numbers 1 to 25.
2. Mark all points that have a product of 24.

Problems:
1. Do you recognize the pattern formed?
2. If the numbers in the bottom row are on the x-axis and those in the left column on the y-axis, what relationship exists between

the x and y values of the points you have marked?
3. Repeat for the points that have a product of 36. Do you obtain the same pattern? What is the relationship this time?
4. Are the above graphs continuous? Why?

Project 4.
Materials: Pencil and paper.

Method: Make a table showing the natural numbers from 1 to 10 inclusive with their respective squares.

Problems:
1. Draw the graph illustrating the relationship between a number and its square.
2. Should the graph be a continuous curve? Explain.
3. If a general point on the curve is (a, b), express a in terms of b and b in terms of a.
4. Read the value of 3.5^2 from the graph. Check by multiplication.
5. Read the value of $\sqrt{30}$ from the graph. Check by multiplication.

Project 5.
Materials: Stop watch, marble, and 4 to 6 foot piece of drapery track.

Method: Raising one end of the drapery track by means of books, form an incline.

Problems:
1. Draw the graph showing the time required for the marble to go down the incline for various heights -- 3", 6", 9", 12", 15".
2. Should the graph be a continuous curve?
3. Read from the graph the time for a height of 10".

Project 6.
Materials: Ruler, pencil, paper.

Method: Draw figures with 4 sides, 5 sides, 6 sides, 7 sides, 8 sides, 9 sides and for each draw its diagonals.

Problems:
1. Draw the graph of the number of diagonals for each of the figures.
2. Should the graph be a continuous curve? Explain.
3. From the graph determine the number of diagonals for a figure with 11 sides.

Project 7.
Materials: 64 cubes (more if possible), graph paper.

Method: Use small cubes to make successively larger cubes.

Problems:
1. How many variables are there in completing a new cube?
2. Draw a graph to show relationship between size and number of cubes required.
3. Is this a continuous graph? Why?
4. Compare surface area to volume and draw a graph. Is this continuous?
5. Compare surface area to weight (assume blocks weigh one ounce each) and graph.
6. Can you use the above to explain why a mouse can fall 100 feet and not be hurt, but a human cannot.

FARMER – HORSE PROBLEM

A farmer left to his sons by his will his horses, which numbered 17. The will stipulated that the horses be divided in the factions 1/2, 1/3, 1/9. However, since 17 does not provide integer solutions to the problem, a neighbor offered one horse, making a total of 18 horses.

$$\begin{aligned} 1/2 \text{ of } 18 &= 9 \\ 1/3 \text{ of } 18 &= 6 \\ 1/9 \text{ of } 18 &= \underline{2} \\ & 17 \end{aligned}$$

There being one horse now left over, they returned it to their neighbor.

The above problem is no doubt an old one. The task I suggest for you or your students is to create new numbers or situations.

(i.e.,) 7 + 1 horses 1/2, 1/4, 1/8 has the same ending

12 + 1 horses 1/2, 1/3, 1/4 has a different ending

WHAT IS A PROOF?

Perhaps these examples will help your students understand.

A. Proof that 4 = 3

$(4 + 3)(4 - 3) = 7(4 - 3)$
$16 - 9 = 28 - 21$
$16 - 28 = 9 - 21$
$16 - 28 + 49/4 = 9 - 21 + 49/4$

$$(4 - 7/2)^2 = (3 - 7/2)^2$$
$$4 - 7/2 = 3 - 7/2$$
$$4 = 3$$

B. Proof that 2 < 1

$1/4 < 1/2$

$$(1/2)^2 < 1/2$$

$$\log (1/2)^2 < \log (1/2)$$
$$2 \log (1/2) < \log (1/2)$$
$$2 < 1$$

C. 4 Is IRRATIONAL

Proof: Assume $\sqrt{4}$ is a rational number; then $\sqrt{4} = p/q$ where p and q are relative prime integers.

Now, $q\sqrt{4} = p$

and $4q^2 = p^2$.

Thus, since p^2 is even, p is even.
Let $p = 2r$

$$q^2 = r^2$$
and $q = r$.

Then $4q^2 = 4r^2$,
But $p = 2r$, so r is a common factor of p and q. This violates the assumption that p and q are relatively prime. Therefore, $\sqrt{4}$ is irrational.

Is there a flaw in this proof? Is the same flaw in the similar proof that $\sqrt{2}$ is irrational? An excellent way to understand the proof that $\sqrt{2}$ is irrational is to find the flaw in the above 'proof.'

THE GELFAND CLUB OF ONTARIO

This club is designed to interest talented students in different aspect of mathematics. At the beginning of each month, definitions, exercises and problems are sent to members, who return their solutions to the club for criticism. Anyone may obtain a problem set by sending a stamped self-addressed envelope (about 9 in. by 12 in., folded) to The Gelfand Club, Mathematics Department, University of Toronto, Toronto 5, Ontario.

The following were the problems for December 1970.

(a) Write down the decimal expansions of the reciprocals of the positive integers (viz., $1/2 = 0.5$; $1/3 = 0.\dot{3}33\ldots$; $1/6 = 0.16666\ldots$; $1/7 = 0.142857142857\ldots$). Some expansions terminate; others have recurring digits, either right from the decimal point or else after a non-recurring section. Conceivably, some expansions may neither terminate nor have a recurring pattern. The *period* of a recurring pattern is the number of digits in it. Can you find any connection between the properties of a number and the properties of the decimal expansion of its reciprocal? What can you say about the period of recurring patterns? What happens in bases other than 10?

(b) Multiply the number 142,857 by 2, 3, 4, 5, 6, 7 in turn and look at the results. Are there any other numbers exhibiting the same phenomenon?

(a) $3^2 + 4^2 = 5^2$; $5^2 + 12^2 = 13^2$; $7^2 + 24^2 = 25^2$. Also,

$8^2 + 15^2 = 17^2$ and $3^3 + 4^3 + 5^3 = 6^3$.

(b)

1	~~2~~	3	~~4~~	5	~~6~~	7	~~8~~	9	2 + 1 = 3
1		4		9		16		25	4 + 4 = 8
1	2	~~3~~	4	5	~~6~~	7	8	~~9~~	3 + 3 + 1 = 7
1	~~3~~		7	~~12~~		19	~~27~~		6 + 12 + 8 = 26
1			8			27			

(a) The following is a list in order of increasing size of all fractions in lowest terms between 0 and 1 inclusive whose denominators do not exceed 5:

$$\frac{0}{1}, \frac{1}{5}, \frac{1}{4}, \frac{1}{3}, \frac{2}{5}, \frac{1}{2}, \frac{3}{5}, \frac{2}{3}, \frac{3}{4}, \frac{4}{5}, \frac{1}{1}.$$

What can you say about the relationships between the digits in two adjacent fractions? What is the relation between any fraction with a neighbor on either side and these two neighbors? Is there a quick way of writing down in order those fractions whose denominators do not exceed 6?

(b) Consider the points in the cartesian plane whose co-ordinates are both integers. What is the condition on integers p and q that the line segment joining (0,0) and (p,q) not pass through any other point with integer co-ordinates? Let a polygon whose sides do not cross each other and all of whose vertices have integer co-ordinates be given. How can the area of this polygon be related to the number of points with integer coefficients that either are vertices, lie on a side or lie within the polygon? What is the area of the parallelogram, three of whose vertices are (0,0), (2,3), (3,4)? Is there any connection with (a)?

Draw a regular polygon, i.e., a plane figure all of whose sides are line segments of equal length. A *diagonal* is any line segment joining two non-adjacent vertices. How many distinct diagonals are there? How many points of intersection are determined by pairs of diagonals? Are all of these points of intersection distinct? How many different lengths are possible for the diagonals? Into how many pieces do the diagonals cut the polygon?

Two piles of poker chips (or counters) lie on a table at which two players A and B are seated. A and B play a game in which the players make, alternately, a move consisting of either (i) removing any number of counters from one pile or (ii) removing the same number of counters from each of the two piles. What strategy should each player follow in each of these cases:
Case I -- The winner is the one taking the last counter;
Case II -- The winner is the one who forces his opponent to take the last counter. Can you generalize (more piles or more players)?

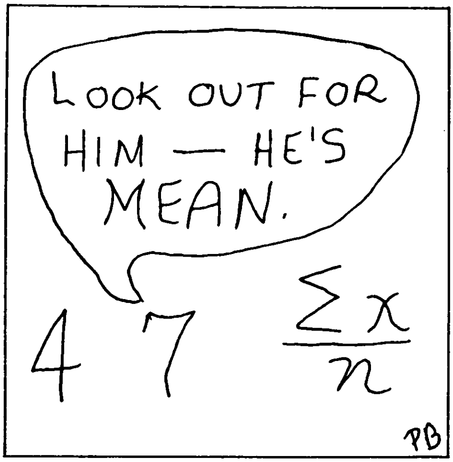
Note: The questions asked for each situation are to help guide your thinking. Do not restrict yourself to thinking only about them, but pose a few of your own also.

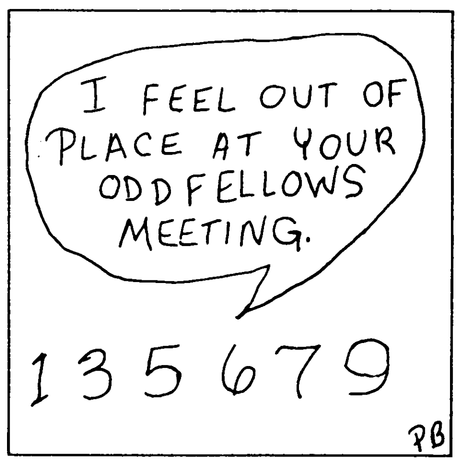
Here are a few famous conjectures that have never been settled:

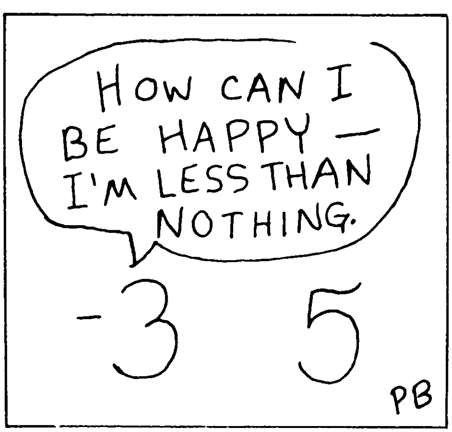
(a) every even number is the sum of two odd primes;
(b) there are infinitely many pairs of primes whose difference is 2;
(c) there is no odd number that, like 6, is the sum of all its positive divisors;
(d) when n exceeds 2, there are no positive integers a, b, c with $a^n + b^n = c^n$;

(e) every map with connected countries can be colored with no more than four colors so that any two countries with a common border have different colors.

From: *Mathnotes* Vol. 70, No. 2
Maryland Mathematics Council.







KRISS KROSS

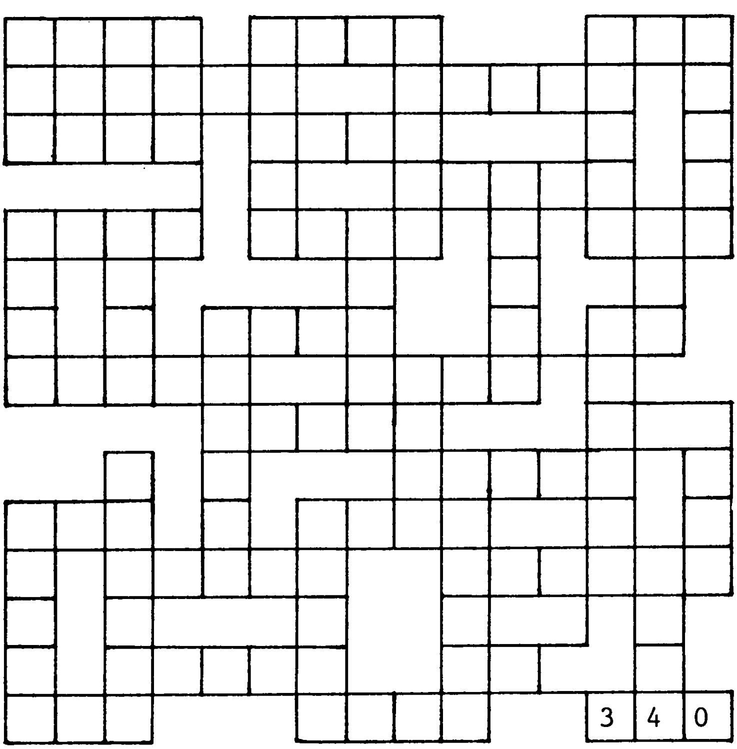
Solve as you would a regular Kriss Kross, using numbers instead of words.

3 numbers
234
280
316
340
364
398
449
507
698
871

4 numbers
1236
1982
1987
3148
3578
4185
5064
6134
7186
8217
8264
8326
8761
3469
9162
9830

5 numbers
09824
18751
21753
27949
30764
31636
34625
41832
54321
59823
61436
62740
81032
89364
89473
97329

6 numbers
012345
384987
473419
698273
879436



Sources of Free Computer Information

General Electric Co., Relations Publications, 570 Lexington Avenue, New York, N.Y. 10022. *You and the Computer*

Honeywell, Electronic Data Processing Div., 151 Needham Street, Newton Highlands, Mass. 12161. *Franklin High School, Computer Application Profile*
Honeywell in Education
Data Processing Technology in Education (A Case Study)

International Business Machines Corp., Armonk, N.Y. 10504.
More about Computers

National Cash Register Co., Marketing Services Dept., Main and K Sts., Dayton, Ohio 45409.
Electronic Data Processing for the Layman series

Bk. 1. *What Is Data Processing?*
Bk. 2. *What Is Binary Arithmetic?*
Bk. 3. *What Is a Computer?*
315/RMC: The Compatible Family of Computers

Century Series

RCA Instructional Systems, 530 University Avenue, Palo Alto, Calif. 94301. *You're an Educator: By Definition, then, You've Got Problems*

Sperry Rand Corp., UNIVAC Div., Att'n Community Relations Dept., P.O. Box 8100, Philadelphia, Pa. 19101.
How the Computer Gets the Answer (Life reprint)
Input for Modern Management, quarterly
Mighty New Servant to the Mind of Man
This Business of Computers -- a Photographic Essay

Teletype Corp., Dept. 1155, 555 Touhy Avenue, Skokie, Ill. 60076.
How to Get Answers to Your Questions about Teletype Equipment

U.S. Atomic Energy Commission, P.O. Box 62, Oak Ridge, Tenn. 37830.
Computers
Automatic Digital Computers

PSA-71-54:lw