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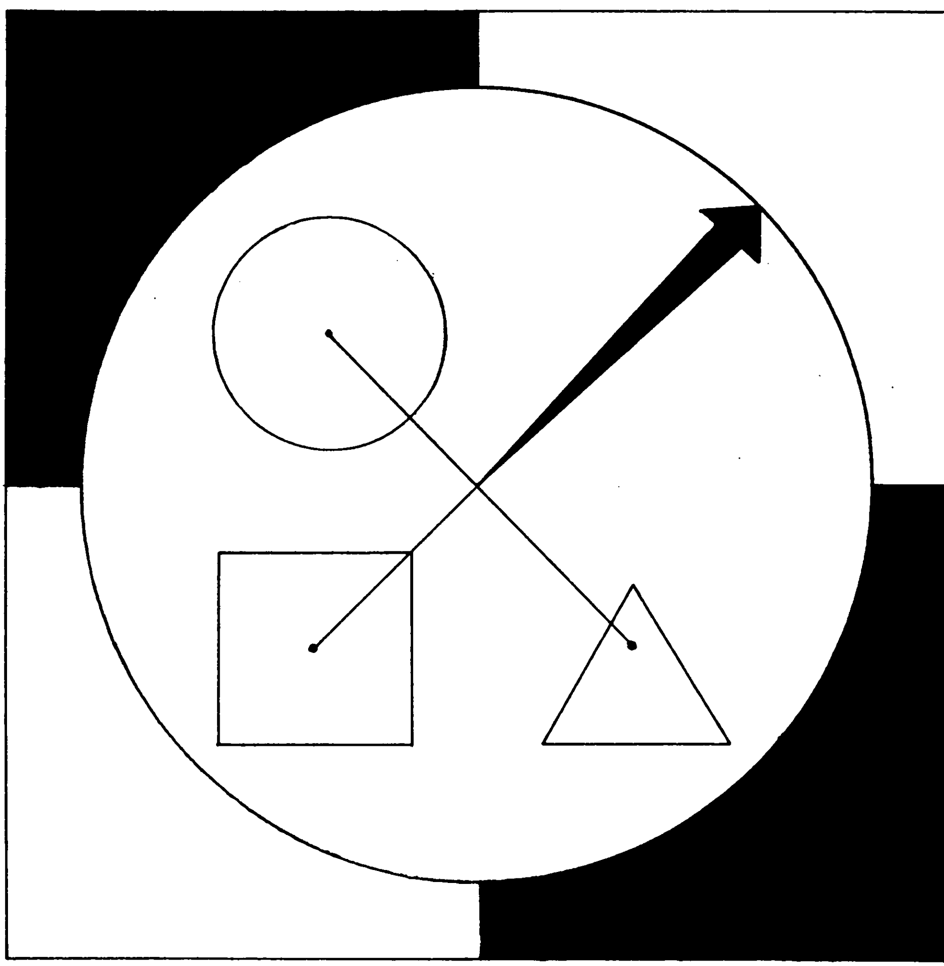
Vector

BRITISH COLUMBIA ASSOCIATION OF MATHEMATICS TEACHERS

NEWSLETTER



VOLUME 11, NUMBER 4 MARCH 1970

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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.

ELECTION RESULTS

The 1970-71 BCAMT elections are over and, as you might have guessed, the positions were filled by acclamation.

Mike Baker was nominated for re-election to the Treasurer's position and was elected by acclamation. For Vice-president, Meno Wiebe was nominated, but chose not to run. Henry Janzen of Delta will be, therefore, Vice-president (by acclamation). These men will hold office from July 1970 to June 1971.

ELECTIONS EDITORIAL

Does it speak well of us that the two executive positions open for election were filled by acclamation? That doesn't really bother me; it's that the executive members were the only ones to supply nominations.

Does everyone out there think things are great and don't need changing? Or is it that no one can think of anybody who could do a better job? Not even themselves?

Some serious thinking has to be done about the functions you want PSAs, and particularly the BCAMT, to serve. Is the BCAMT worth all the money (much more than your $4 membership fee) that the BCTF expends (out of your $80 membership fee)? Will you write to describe how the BCAMT has helped or can help you? Or will you write to explain why you aren't going to rejoin (or, perhaps, even offer to help make it worth rejoining)? Or will you just let it pass?

John W. Turnbull

SPRING GREETINGS

1. $\frac{V}{B}$ (of a cylinder) =

2. $\frac{1}{2}bh$ (of a triangle) =

3. $2L + 2W =$

4. $I / rt =$

5. $f(x) =$

6. $2.71828 =$

7. $S = \frac{n}{2}(\ ?\ + 1) =$

8. $\frac{1}{2}(a + b + c) =$

9. $\frac{D}{r} =$

10. $1 + \frac{1}{1} + \frac{1}{2!} + \frac{1}{3!} + \frac{1}{4!} \ldots =$

11. $\frac{C}{2''}$ (circle) =

from *Mathematics Teacher*, New Jersey

IN-SERVICE FROM BCAMT

The BCAMT (with a partial grant from the NCTM as a Golden Jubilee Project), together with the Professional Foundations Department at SFU is exploring the possibilities of embarking on a unique in-service project for teachers of mathematics in British Columbia. The idea is to construct a series of 'packages' or 'boxes,' each of which contains material relating to a particular mathematics topic -- Pre-Humber Activities, Fraction Difficulties in Grade 5, Sets and Their Value, Basic Geometry -- the list seems endless.

For example, a 'box' on basic geometry might contain, among other items, several plywood shapes of various sizes and colors, work cards, colored slides, lists of sources, tapes, paper and pencils.

The 'box' is designed to be used by teachers, preferably in teams of about four. The teachers actually do the exercises. Directions would be straightforward: 'Attempt the questions on worksheets 1 to 6; play the tape of Grade 5 pupils working the same problems; project the 10 colored slides showing alternate methods.'

After the 'box' has been used in one school, it is passed on to the next -- or shipped to the next school district. It is our view that the relative simplicity of the 'box' makes it a very attractive in-service aid. Because it is so simple, it can be expected both that the 'box' will be kept circulating among the schools and that teachers will actually use the kits -- thus becoming more involved with mathematics. On these grounds alone, the 'box' is worth trying.

This kind of 'box' approach to teacher in-service has great potential, not only in mathematics, but also in almost all other areas. In this age of rapid change it is essential that all teachers have the opportunity to up-date themselves and their methods. Therefore, this idea of taking the in-service experience where the teachers are -- in the schools -- is an idea that should be developed.

One 'box' (The Geo-board) is now ready and is more fully described in the following material. This box is available to any interested group for study purposes. Additional boxes now under construction are: Fractions, Measurement, Place Value, Games for Enrichment, Uses and Misuses of Colored Rods.

The box is of metal, approximately one cubic foot in size and capable of being transported by mail, by bus, or by car. If you have a group interested in seeing the first box (Geo-board), contact Mr. G. Bouman, 875 Camden Crescent, Richmond.

The Geo-board box is designed as follows:

The 'BEGIN' file contains instruction sheets for each teacher:

BRITISH COLUMBIA TEACHERS' FEDERATION

and

SIMON FRASER UNIVERSITY

C.O.L.E. boxes are the joint responsibility of the B.C.T.F. Association of Mathematics Teachers and the Professional Foundations Department of S.F.U.

Each box contains materials which can be used for the Creation of a Learning Environment in mathematics.

A box is for the use of a small group of teachers, five or six, who are interested enough to devote perhaps an hour of their time to the study of the contents of the box. This mini-form of in-service assistance is aimed at practical help in classrooms, although for that extra materials will be needed.

Notes on the acquisition of appropriate materials will be found in the file marked END.

We suggest that the teachers sit at a table and, when ready, open the box and follow instructions. All necessary materials are within except for large equipment like projectors and recorders.

TO BEGIN:

Each participant needs one copy of the INSTRUCTION SHEET.

They are to be found in this file.

Instruction Sheet

1. In the box marked G you will find some geo-boards. Take one with a supply or rubber bands.

2. For 5 or 6 minutes make any shapes you wish on the geo-board.

3. When you are ready, select one of the packs labelled A, B or C. Work independently, with a partner or with a small group.

WHEN YOU HAVE FINISHED THE SET OF WORK-CARDS....

-- please replace the materials back in the boxes and check contents,

-- clip together the Instruction Sheets as they were in the file,

-- refer to the file END.

Pack A consists of 6 work-cards;

Card 1 Clear the geo board

Find some of the different shapes to be made using one rubber band. Each of these shapes is called a 'polygon.'

Card 2 Make one of the smallest squares on the geo-board. Vertices must be at the nails.

We shall say that the area of the interior region of the smallest square is 1.

Make a polygon shape whose area is 2. Another of area 3, 4, 5, etc.

Compare the polygons you make with those of other students. Are all shapes of the same area congruent?

(...and so on, developing areas of 4-1/2, 4-1/4, etc.; polygons of maximum size on the board; triangles and parallelograms and their areas.

The work is continued on dot paper and plain paper which is supplied in the drawer PAPER.

Finally the teacher is referred to some textbooks on the use of geo-boards and asked to discuss the relevance of what he has done to the geometry topics of the currently-used textbook. The books are also in the C.O.L.E. box.)

Pack B, 2 cards, is concerned with the topic of symmetry.

The cards take the teacher through activities making pairs of symmetrical shapes on the geo-boards, doing it on paper, with and without measurement. Mirrors are used to suggest the reflection analogy of line symmetry.

A packet of card-mounted illustrations is included and questions posed about possible symmetry within the pictures.

'Which block letters of the alphabet have such symmetry? Have any two lines of symmetry? More than two?'

Pack C, 3 cards, quadrilaterals and kites.

Four-sided polygons are made on the geo-board. Kites are those with two pairs of equal adjacent sides. Properties are examined with a sequence of relevant questions.

Models of kites are made using thin lengths of dowel rod, joined with short plastic tubing. Again, properties are examined: angles, symmetry, diagonals, lengths, area, etc.

Kites are drawn on plain paper. Sets of kites are drawn according to some condition, as, for instance, a number of kites having the same diagonal.

Available in the C.O.L.E. box is a set of colored slides showing a 4th grade class in such a lesson.

Reference is again made to relevant books, including current local texts.

After the teachers have worked through the work-cards, examined the books, viewed the slides, etc., they are free to keep one of the reference sheets, listing suppliers of commercial geo-boards, relevant books, NCTM publications, etc. Instructions are also given for making home-made geo-boards, with advice about their use in classrooms.

Finally, stamped postcards are available in the END file for comments. These can be returned to the university.

NCTM MATERIALS

The following bibliographies are available free from the NCTM:

1. Free and Inexpensive Materials.

2. Computer Applications for Mathematics Education.

3. Films for Mathematics -- Titles and Sources (Exclusively American addresses and therefore not pertinent here.)

INSTANT INSANITY CUBES

The following is part of a letter to the editor of the October 1969 *The Mathematics Teacher* (NCTM).

Dear Editor:

Have you seen the 'instant insanity' cubes? They are four cubes that are colored white, red, blue, and green. All colors appear on all blocks, but not according to one pattern; for example, one cube might have two adjacent red faces while another might have two red faces that are parallel. The object is to have all four colors appear on all four sides when the cubes are assembled in a line.

Since there are four cubes with six faces each, it would seem that there are 6^4 or 1,296 ways that cubes could be arranged. How many of the 1,296 ways yield a 'correct' solution (all four colors on all four sides)? Are there other interesting patterns that could be formed (all sides a different color, for example)? If such a pattern is not possible, why not?

I guess what I'm suggesting is that there is some tremendous mathematics in the instant insanity game.

Barbara Almli
Hilbert Junior High School
Detroit, Michigan

Editor's Note -- See 'Have You Read?' p. 477.

The same issue of *The Mathematics Teacher* (Oct. 69, Vol. 62, No. 6, p. 477) has a review by Philip Peak of an article by T. A. Brown, 'A Note in Instant Insanity' from the *Mathematics Magazine* of September 1968, pp. 167-9. The review suggests a method of attack for the solution to the original problem.

If you haven't seen these 'cubes,' you should look in your local stores. I've seen them selling for from 39¢ to $1.00 under the name 'Brain Teaser.' You and your students should enjoy them.

If you have already used these cubes in the classroom, we should be interested in hearing from you.

REMEMBER

The Annual General Meeting and the Workshop, 'Probability and Statistics in General Mathematics,' are being held on Monday, March 30, from 9:00 a.m. to 4:00 p.m. in the BCTF auditorium. All the detail is on the flyer which was in last month's newsletter or sent to all Lower Mainland schools. If you are coming, try to let any one of the executive know. General Math teachers need all the assistance they can get. Here is your chance to get some solid, practical help. Come, share and learn.

LOGIC PROBLEMS SOLVED

The following problem is from the NCTM publication *Mathematical Challenges* (80¢), Stock Number 301-09210.

The organization of the business office of a certain company consists of the following: Manager, Assistant Manager, Cashier, Teller, Treatment Clerk and Stenographer. The names of the personnel of the office in alphabetical order are: Mr. Brown, Mr. Cowan, Miss Gordon, Mrs. Johnson, Miss Leonard and Mr. O'Shaunessy.

a) The Assistant Manager is the Manager's grandson.
b) The Cashier is the Stenographer's son-in-law.
c) The Teller is Miss Grodon's step-sister.
d) Mr. Brown is a bachelor.
e) Mr. Cowan is 25 years old.
f) Mr. O'Shaunessy is the Manager's neighbor.

What is the Cashier's name?

One method of solving the problem is to draw the following grid:

	Manager	Asst. Man.	Cashier	Teller	Clerk	Steno
Mr. Brown						
Mr. Cowan						
Miss Gordon						
Mrs. Johnson						
Miss Leonard						
Mr. O'Shaunessy						

Clue (b) tells you that the Cashier is male, therefore you can rule out Miss Gordon, Mrs. Johnson, and Miss Leonard. Hence put an X beside each of these names in the Cashier column.

Clue (c) tells you that the Teller is a woman, therefore put an X beside Mr. Brown, Mr. Cowan and Mr. O'Shaunessy in the Teller column. Also the Teller cannot be

Miss Gordon, hence an X beside Miss Gordon in the Teller column.

With some careful thinking you should be able to continue in this elimination process until each person is left with only one possible job. Hence the problem is solved.

A more sophisticated description of this technique is described in 'Mathematical Games,' by Martin Gardner in the February 1959 issue of *Scientific American.*

PROBLEMS

1. Toothpick problems:
a) Fifteen toothpicks make five triangles. If those triangles are lined up properly, the moving of just three of the toothpicks can result in seven triangles.

b) Twenty toothpicks make five squares. If those squares are lined up properly, the moving of just three of the toothpicks can result in seven squares.

(Hint: in both A and B you start with five toothpicks end to end.)

2. What is the smallest number whose notation is base 10 is all 1s and 0s and which is evenly divisible by 225?

3. There is a parallelogram, whose short side a is twice as long as the distance h between the long sides b. The perimeter is 20 units. The long side b is as long as the sum of the lengths of side a and height h. What are the lengths of a, b, and h, and the measures of the angles of the parallelogram?

4. A ship, with a crew of 175 men, set sail with a supply of water sufficient to last until the end of the voyage; but in 30 days the disease scurvy made its appearance, and carried off 3 men every day; at the same time a storm arose, which protracted the voyage 3 weeks. The ship was, however, just able to arrive in port without any diminution in each man's daily allowance of water. Required: the time of the passage and the number of men alive when the vessel reached harbor.

5. Draw and cut out an isosceles triangle with base 6 units and altitude 6 units. Cut it into 4 pieces that will form a rectangle 9 units by 2 units.

Oregon Council of Teachers of Mathematics Newsletter
Vol. 17, No. 2 December 1969.

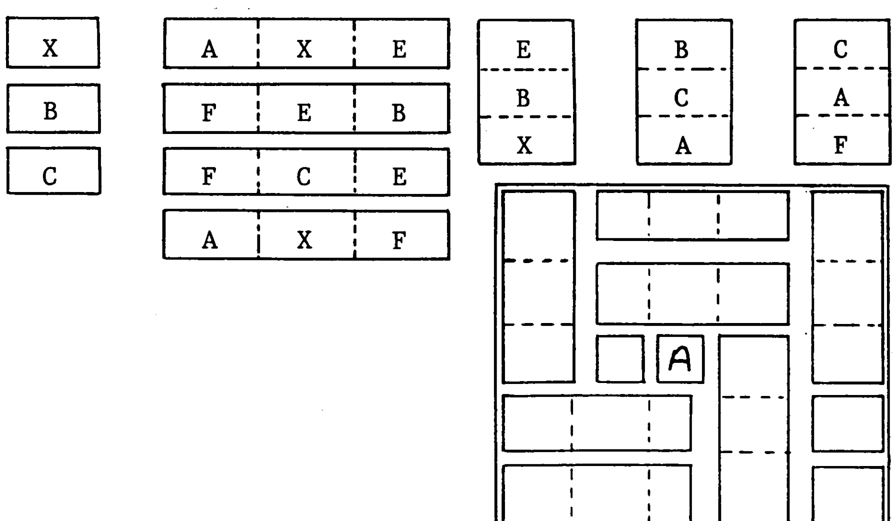
PROBLEM

A and B traveled on the same road, and at the same rate, from Cumberland to Baltimore. At the 50th milestone from Baltimore, A overtook a drove of geese, which was proceeding at the rate of 3 miles in 2 hours, and 2 hours later met a wagon which was moving at the rate of 9 miles in 4 hours. B overtook the same drove of geese at the 45th milestone, and he met the same wagon 40 minutes before he came to the 31st milestone. Where was B when A reached Baltimore?

(from Greater Toledo Council of Teachers of Mathematics *Newsletter*, Vol. 1, No. 3 November 1969.)

MAGIC SQUARE?

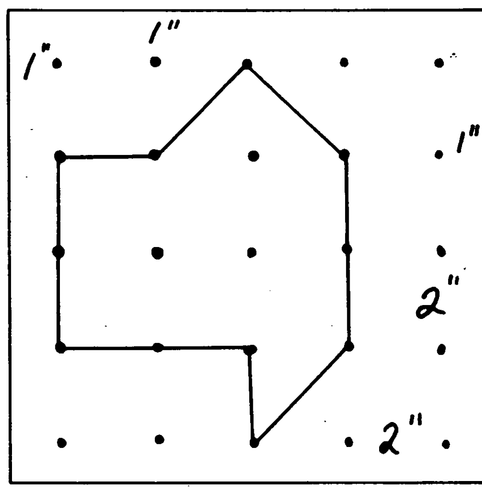
Fit the 10 pieces into the framework in such a way that no symbol is repeated in either the two main diagonals or in any one of the rows or columns. No piece need be turned to fit into the framework.



GEO-BOARD -- ELEMENTARY GEOMETRY

Make yourself a geo-board. Then with rubber bands and squared paper, you are ready for some geometry. The geo-board is a good laboratory tool for introducing the concepts of perimeter and area, or for studying the properties of quadrilaterals. There is an approximation for area based on the number of interior and border points and there is Euler's formula which relates the number of faces, edges and verticies. (See also article on COLE box in this newsletter.)

One way of making a geo-board is by preparing a 10" by 10" square of plywood with nails in a 8" by 8" pattern with 1" border, nails 2" apart. Rubber bands stretch over the nails to make triangles, quadrilaterals and other polygons. Light construction paper, marked with 2" squares, is easily folded or torn to cover the figures, from which one can easily see what the area is.



Division Problems

When decoded, the digits from 0 to 9 form a message.

```
          E G G
       ----------
B A G  | M A G I C
         L L O
         -----
         E N G I
         N M E G
         -------
           E E M C
           N M E G
           -------
             B L N
```

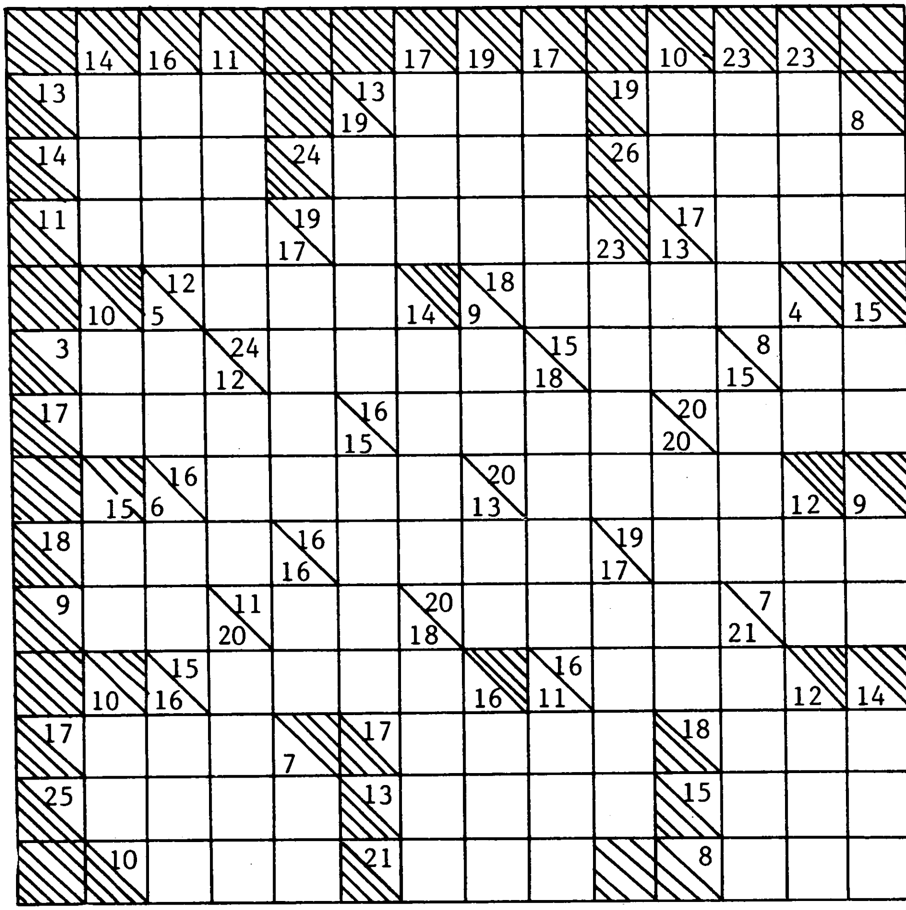
```
                 S O Y
           ---------------
P I P E   | P A S S E R S
          | Y E E A Y
            ---------
              A E I I R
              A S M E O
              ---------
                A G I E S
                  I R I S
                  -------
                  P P Y G
```

```
            S A T
        -------------
E A R  | T R E A T S
       | T E Y F
         -------
             R A T
             E A R
             -----
               Y B S
               O H F
               -----
               A E S
```

CROSS SUMS

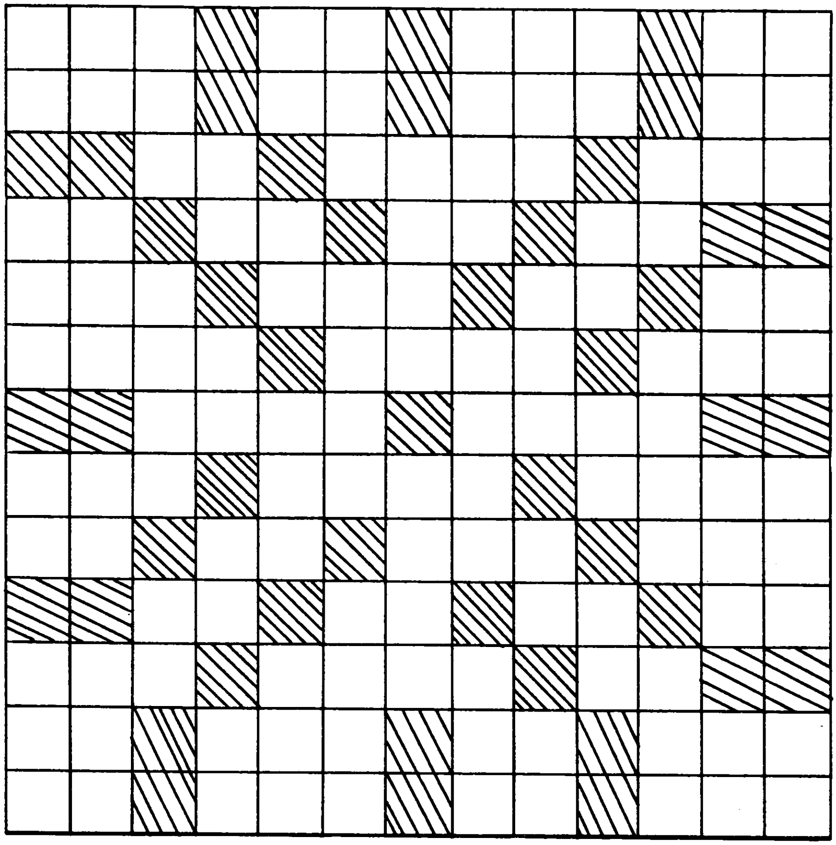
The numbers refer to the total of the numbers with which you are to fill the empty squares. The number written above a diagonal line refers to the empty squares directly to the right of that number. A number written below a diagonal line refers to the empty squares directly below that number.

No zeros are used and no digit higher than 9. A digit cannot appear more than once in any particular number.



NUMBER PROBLEM

Two Digit		Three Digit		Four Digit		Five Digit
82	15	729	238	9385	4123	82697
92	71	794	312	7598	2513	67893
25	39	513	549	1823	2135	
16	91	938	712	7321	3512	
15	59	367	931	6948	5231	
81	16	721	485	5826	1589	
13	29	127	421	1938	2531	
51	49	217	489	1253	3589	
85	58	861	469	8971	6385	
51	16	251	319	2315	2316	
18	15	241	124	3421	2136	
53	58	253	798	9548	2915	
17	91	382	938	1629	1632	
83	68			4123	8937	



A DIFFERENT APPROACH TO QUADRATICS

John DiPaola
Mission San Jose High School
Fremont Unified School District

As a student and as a teacher, I have marveled at the methods of solution for quadratic equations. One aspect of the problem has always annoyed me. Having displayed a distaste for computations involving fractions, it has become a personal crusade to eliminate the need for computation with fractions in solving quadratic equations.

The method of completing the square to solve a quadratic usually involves a certain amount of fraction work. The following method eliminates these distasteful manipulations.

Consider the equation $3x^2 + 5x - 4 = 0$. Since the coefficient of x^2 does not divide the coefficient of x evenly, and since the coefficient of x is odd, will we have to use tedious computations with fractions to gain a solution? Not at all!

1. $3x^2 + 5x - 4 = 0$
2. $6x^2 + 10x - 8 = 0$

(Getting coefficient of x even)

Now consider this auxiliary equation in the variable $\dot{x}$:

3. $\dot{x}^2 + 10\dot{x} - 48 = 0$

(Multiplying constant by coefficient of x^2 and dropping lead coefficient)

4. $\dot{x}^2 + 10\dot{x} + 25 = 73$

(Completing square)

5. $(\dot{x} + 5)^2 = 73$
6. $\dot{x} = -5 \pm \sqrt{73}$

(Square rooting and simplifying)

The solution to the original equation is now given:

7. $x = \dfrac{-5 \pm \sqrt{73}}{6}$

(Dividing solution by coefficient of x^2 in 2)

Three simple operations away from the norm, no computations with fractions, and the result is the solution to the original equation -- AND SIMPLIFIED!

PROOF: Consider the general quadratic:

$$ax^2 + bx + c = 0$$

Its solutions:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Using the method described above on the general quadratic:

1. $ax^2 + bx + c = 0$

2. $2ax^2 + 2bx + 2c = 0$
(Guaranteeing x-coefficient even)

3. $\dot{x}^2 + 2b\dot{x} + 4ac = 0$
(Auxiliary equation in variable $\dot{x}$)

4. $\dot{x}^2 + 2\,b\dot{x} + b^2 = b^2 - 4ac$

5. $(\dot{x} + b)^2 = b^2 - 4ac$

6. $\dot{x} = -b \pm \sqrt{b^2 - 4ac}$

7. $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

We next consider the problem of solving quadratics by factoring. Will the above method apply? Solve the following equation by factoring: $8x^2 - 22x + 15 = 0$. Since there is no need to have the coefficient of x even, we will eliminate the first step in the method, although using it would still yield the required solution.

1. $8x^2 - 22x + 15 = 0$

2. $\dot{x}^2 - 22\dot{x} + 120 = 0$

3. $(\dot{x} - 10)\ (\dot{x} - 12) = 0$
(Factors readily seen, eliminating the need for extensive testing)

4. $\dot{x} = 10,\ 12$

5. $x = \dfrac{10}{8},\ \dfrac{12}{8}$
(Dividing solutions by the original coefficient of x^2)

These methods have been tried by students in the classroom and found to be successful. The reduced amount of work involved in the above solutions more than compensates for the extra effort expended in mastering these techniques.

(from *ACME*, Alameda County Mathematics Educators, Winter 1968, Vol. 1, No. 2.)

MATH IS A PROBLEM

Sally was in tears when her father (a mathematics teacher) came home from work.

'Oh, Daddy!' she exclaimed, 'arithmetic is so hard, I just can't do it!'

Her father, genuinely concerned, decided to find out what was wrong and gave her the problem 4 plus 3. Sally went to work. After a few minutes her father inquired whether she was finished. 'No,' she answered.

'What!' he exclaimed, 'can't you find the answer?'

'Oh, I know the answer, it's seven. That part is easy. The hard part is drawing the bunnies.'

(Reprint from *Idaho Council of Teachers of Mathematics*)

MATHEMATICAL RECREATIONS

1. Take any number of three unequal digits in which the first and last differ by not less than 2. Form a number by reversing the order of the digits. Take the difference between these two numbers. Form another number by reversing the order of the digits in this difference. Find the sum of the results in steps 3 and 4. The sum will be 1089.

2. From the bottom of a well 45 feet deep, a frog commenced traveling toward the top. In his journey, he ascended 3 feet every day, but fell back 2 feet every night. In how many days did he get out of the well?

3. A farmer had six pieces of chain of 5 links each which he wanted made into an endles piece of 30 links. If it cost him a cent to cut out a link and a cent to weld it, what did it cost him to have the chain made?

4. From six you take nine; and from nine you take ten. Then from forty take fifty, and six will remain. (Hint: Try another number *system* (not base) that was used extensively 2,000 years ago.)

Solutions:

2. 43 days

3. 10 cents

4.
$$\begin{array}{r} S\,I\,X \\ \underline{I\,X} \\ S \end{array} \qquad \begin{array}{r} I\,X \\ \underline{X} \\ I \end{array} \qquad \begin{array}{r} X\,L \\ \underline{L} \\ X \end{array}$$

SIMPLE? YOU BET, BUT IT HELPS

Brian Prior, president of Calgary Junior High Mathematics Regional Council

I sometimes have a feeling that we teachers ignore very simple ideas and fail to pass them on, thinking perhaps that our colleagues will laugh at our naïeveté. Yet the simple idea we produce may be just the answer for which another teacher is looking.

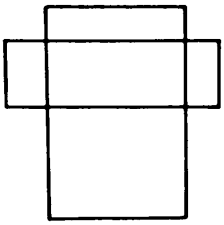
With the thought that I may just be able to help another, and that others will contribute ideas to me, I offer the following.

The problem was to present visual and manipulative material to show the reason for the formula $S = 2\ (lw + hw + lh)$. A need was felt to relate the visual aid to the board summary.

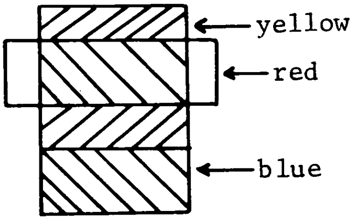
Starting with the basic 'developed' model of a rectangular prism (Sketch 1), cover the opposite faces with paper of matching color (Sketch 2). When folded, you have a multi-colored prism (Sketch 3).

While teaching with this aid, colored chalk can be used effectively to code the faces of the prism with the development of the lesson on the board.

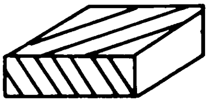
Sketch 1



Sketch 2



Sketch 3



This approach was highly successful with slower students. The color system seemed to provide a visual crutch.

Other models can be produced using similar techniques.

(from Alberta Teachers Association Mathematics Council *Newsletter*, January 6, 1969.