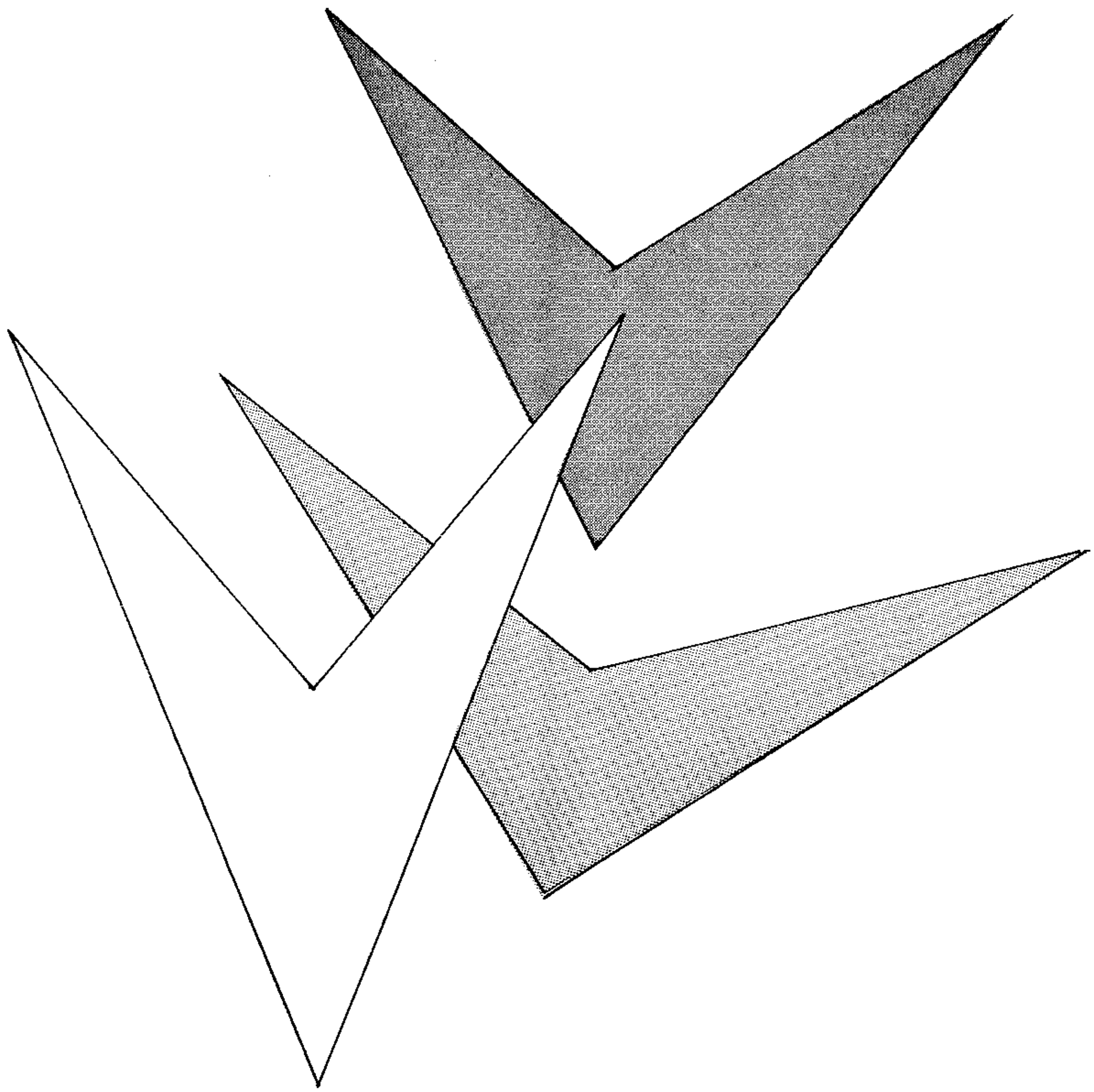
T.C.T.M.

TEXAS MATHEMATICS TEACHER



Texas Council of Teachers of Mathematics

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TEXAS MATHEMATICS TEACHER

Texas Council of Teachers of Mathematics

Volume XXXIV March, 1987 No. 2

President's Message

Once there was a man who was restless and dissatisfied with his job. He explained his problem to a wise friend, who replied with a request. "Inhale as deeply as you can." The man did. "Now exhale as fully as you can." The man complied. The friend then said, "Now exhale again, before you inhale." The man tried, but quickly began to sputter and wheeze. Regaining his composure, the man asked the friend the reason behind such a silly request. The friend replied, "That's exactly what you've been doing in your life and that's why you're all used up!"*

As teachers we cannot continuously exhale enthusiasm, inspiration, and beautiful mathematics unless we pause and take time to inhale. We must breathe into ourselves these same precious gifts that we wish to present our students.

The Gulf Coast Council of Teachers of Mathematics January workshop was one of those inhaling experiences for me. The fellowship with caring math teachers and supervisors and the excellent teaching ideas of the speakers, Rick Krustchinsky and John Huber, rejuvenated participants for return to the classroom.

Attend your local council meetings this spring. When you get involved, the organization profits and your life is enriched. If you are not a member of a local NCTM affiliate, write me at 4622 Pine, Bellaire, TX 77401, and I'll put you in touch with the local council nearest you.

There are some especially notable fresh breaths available for you to inhale this spring and summer. The National Council of Teachers of Mathematics annual meeting will be in Anaheim, California, on April 8-11. Air fares are low! If you can get away for a Thursday - Saturday meeting, you'll find the national meeting exhilarating!

Available to <u>all</u> <u>of</u> <u>us</u> for the first time is the Conference for the Advancement of Mathematics Teaching that is held annually in Austin. How wonderful that we will be free from teaching duties during this TRADITION-BREAKING CAMT which begins on MONDAY, AUGUST 3, 1987. Let's demonstrate our enthusiasm by breaking all previous attendance records at CAMT.

TCTM is awarding two $100 scholarships to members for attending CAMT this summer. Watch the May issue of the Texas Mathematics Teacher for the details and application form.

Officers of local mathematics councils, I challenge your council to give a CAMT scholarship to one of your members. The Spring Branch CTM is awarding five at $100 each to be won in a drawing at their Annual Spring Barbecue in April. Can you top that? Let me know if you do!

Don't miss some Very Important Activities. Read the May journal carefully and alert others to do the same. Watch for the ballot for officer elections and two constitution changes. The invitation to the TCTM Breakfast meeting, August 4, along with the reservation form will be included in that issue.

Rather than exhaling and exhaling until you are all used up, take advantage of the enriching mathematics activities offered in Texas and inhale some of them for yourself and your students.

Maggie Dement

*A Purnell Bailey story told by Bill Forbes, minister, St. Philip Presbyterian Church, Houston, TX.

DATES FOR CAMT

1987: August 3 - 5 1988: August 2 - 4

Note your mailing label for renewal date of TCTM membership!

TCTM Member is Texas Teacher of the Year

Mathematics teachers have done it again! Just two years ago, the Texas Teacher of the Year was math teacher Meliane Morgan. Now that title belongs to Texas Council of Teachers of Mathematics member Jim Stones of Spring Branch ISD.

If you made a visit to his classroom you might find Jim teaching honors calculus. On the other hand, you might see a class paper folding to learn informal geometry. Equal to him are the thrill of seeing a bright mind leap beyond the scope of the material being studied and the pleasure of seeing a remedial student finally grasp the nature of a problem and revel in his accomplishment.

If you looked for Department Chairman Stones after class, you could find him coaching the Spring Woods High School Decathlon team, leading a Boy Scout troop, refereeing a football game, giving blood, or involved in a church activity. For Jim, teaching is not merely a profession, but teaching and giving of himself are his way of life.

In his Teaching Philosophy (part of the paper-work required along the way of becoming Texas Teacher of the Year) Jim Stones says, "I strongly believe that mathematics has an underlying beauty in its logical order. I encourage my students to understand this logical order rather than relying upon mere memorization of formulas and methods. If the student grasps the concept, he will be able to apply it to new situations and will be less bound by the limitations of memory. Having been exposed to both types of teachers in my own education, I am determined to be a teacher who helps the student to visualize material and comprehend the underlying concepts." He adds, "Any teacher who does not grow in subject matter and in ideas of teaching will surely regress. I will continue to attend conferences and to work with other teachers to improve my own knowledge and skills."

Let us all strive for this kind of growth in our own professional lives.

One of his colleagues wrote in the scrapbook submitted to TEA, "Jim Stones is the teacher in whose class I'd most like to be." You can discover for yourself at CAMT in August why this was said of him. He'll be sharing his teaching ideas on making functions understandable and fun.

ANNOUNCEMENTS

Mathematics Education Month - April, 1987

This year's winning logo is "Math Keeps the World in Motion." There will not be a formal logo contest this spring for another logo. However, the Special Member Products brochure will have available for purchase stickers and buttons with the new logo. Please encourage your members to promote enthusiasm for mathematics by involving parents, teachers, students, and business leaders in activities focusing on mathematics. A copy of the logo is attached.

MATH KEEPS THE WORLD IN MOTION

Presidents – I would like to encourage you to have a special proclamation issued by the governor or other official proclaiming April to be Math Education Month. Recognize outstanding teachers of mathematics, as well as outstanding students during this month.

Recommendations for Committees

John Dossey, president of NCTM, is asking for recommendations for committees and board of directors positions for the coming year from all affiliated groups. Please send names to the NCTM office in Reston, Virginia.

Awards to Mathematics Teachers

The Presidential Awards for Excellence in Mathematics and Science Teaching have been an excellent focus on exemplary mathematics teachers at middle and secondary school levels. Elementary teachers have not been eligible for this award. Local affiliates are encouraged to establish or continue a recognition program that will reward and recognize these teachers.

How Can We Teach *&#! Math More Effectively

Jan Sherman, Shallowater ISD, Shallowater, TX 79363

Let's play the word association game: MATH! "Don't call on me. I'm dumb." "Call on me and you'll know." "Everyone will know."

The math was simple. It was explained slowly and carefully. For some reason, though, the child in the third row looks lost, frightened or apathetic. This isn't the first time for this child nor the first child who displayed math anxiety. The important questions are what could we as teachers and parents be doing to lessen the panic, and by knowing a student has math anxiety or is anxious about math, how can we help. This is certainly not a new thought. Libraries have several shelves devoted to the effects of math anxiety. Many prescriptions have been handed out, but this disease still seems prevalent.

There are many reasons for math anxiety and apathy. two of these seem to be standouts: relevance and homework. "Math has nothing to do with me. It just isn't relevant!" "I have piles of homework in math and I still don't understand it. I'm scared to come to class because I didn't understand the homework and I didn't get it done."

Relevance is connecting the material of the subject to real life situations. If the material is important, or relevant to the student, it is assumed that the student will see the importance, enjoy what he is doing, and work harder. Not all students are going to be real "turned on" to income tax problems, budgets, and reading gas meters. Whereas that is relevant to the real world and certainly should not be ignored, some students will connect with puzzles and games. These may be more enjoyable and create thinking skills, too. What may be relevant to one student is that he simply enjoys tackling the problem. Solving puzzles and games may be his starting point (Buxton, 1981, pp. 116-117). The National Council of Teachers of Mathematics stated in 1980 that the greatest need for our math programs was to develop problem solving and thinking skills. More recently in a report by the National Science Commission on Precollege Education in Mathematics, Science, and Technology, we are informed, "Mathematics is a way of thinking that opens doors to new knowledge in virtually every field and is essential for understanding the sciences." (National Science Commission on Precollege Education in Mathematics, Science, and Technology, 1983). Edward Begle states; "The real justification for teaching mathematics is that it is a useful subject and, in particular, that it helps in solving many kinds of problems." As teachers, we are seeing more of these statements in every book or pamphlet we pick up. Less paper and pencil, more in thinking skills is encouraged. Students need to recognize that all of life requires problem solving skills.

Laurie Buxton states in his book, Do You Panic About Maths, "We should be more aware of the value of what is happening inside the person. Are we helping him or her to think? It is sometimes not appreciated that this is an end in itself. In educating people we are trying to develop their general abilities in order that they may readily adapt to the various specific practical needs that they may meet." (Buxton, 1981, p. 117).

Math should be more relevant to the student's world in the 21st century. Tom Romberg, a Univesity of Wisconsin math education specialist, says, "Kids should be using the new technology to expand their math abilities. Certainly students have got to understand addition, subtraction, multiplication, and division of whole numbers, but the days when we needed clerks to keep ledgers by hand are long past. Let's free up kids--as we've done for ourselves--from these tedious calculations and let's use these machines to help kids learn skills useful for the 1990's and beyond." (Romberg, 1985, p. 5).

Doing math in school is usually an exercise in getting it done by the end of class because it is seatwork, or getting it done at home because it is homework. "Play the game." "Make the grade." "Keep the teacher happy." "Understand what I'm doing? No. Was I suppose to?" Math is an enigma because often it is something to memorize, not understand. I always looked at it like a foreign language. "Just do it." "Don't ask questions." We need to promote an atmosphere that creates understanding. It's not a sin to make math fun! If the atmosphere of the class is one of acceptance, then the student will be more likely to listen and to learn. A new concept should be taught slowly with many introductory activities. The stage is then set for the evening's homework. Unfortunately the typical homework setting is one of despair--despair for the student and also for the parent watching his child going through the confusion.

What is the purpose of homework? In the book, Meaningful Mathematics Teaching, Aaron Hankins states it should be for a short amount of time, not longer than 30 minutes. It should also be an extension of classwork--something students can successfully complete. The student has a chance to practice what he has been taught in class. The teacher should look at these problems before they are assigned to make sure that they are following the procedures taught in class and do not have any built-in snags that might lead to confusion (Hankins, 1961, pp. 9-10).

A letter to the parent explaining the new material covered in class would be helpful. Teachers are often encouraged to send newsletters home from time to time, informing parents of activities in class. This would be an excellent time to explain math procedures which will insure understanding at home of all homework. In some textbooks there are parent letters already prepared. Some of these encourage parent and student working together. This would eliminate the problems of parents trying faithfully to help, only to be met with cries of, "But, Dad, the teacher doesn't do it that way and I won't get it right doing it your way!" The newsletter might also include a number where you could be reached in case parent and student need help with a problem.

The homework assignment might not even be to actually solve the problem. George Polya believes in understanding the math. He suggests only two or three problems be given. By going through a series of steps, the students get a better idea of exactly what the problem is asking. The first step is to state the problem in their own words. The next is to determine what is being sought. The last is to guess what the solution might be. How can you solve a problem if you don't understand? This problem solving strategy can be used in solving many problems, not just those in math. You might find the answer memorizing and playing the game as we always have. However, the point of this method is to develop thinking skills, the problem solving skills, that come from really understanding why you came to that solution. Homework should be that time to gain confidence in the lesson taught, instead of building hostile feelings toward math. Let's provide the student a feeling of success.

What is the purpose of math? Teachers are being challenged to teach students to think, to apply learning, and to solve problems. We can make math connect with their world by (1) making it relevant, even if it takes theatrics, (2) playing games with numbers, (3) taking it slowly for some and making it challenging for others, (4) laying down the mighty textbook when there are more appropriate aids to instruction, (5) launching out into some new adventure to get the point across, (6) using our creativity to make math more fun, (7) being careful of our class atmosphere, (8) taking out the risks in homework, (9) avoiding homework that is just busy work for some and extra grading for you, and (10) re-examining our purpose in assigning homework. How are your thinking skills when it comes to thinking through your lesson plans and understanding the needs of your students? I prescribe some of the following puzzles and games for students as one valuable way to eliminate math anxiety.

Proving Your Age (grades 4-6)

Multiply the number 9 by any other number lower than 9. Substract this product from 10 times your age. The first two

See page 7

Sometimes Two Wrongs Do Make a Right

by John Davenport and John Lamb, Jr.
Department of Mathematics, East Texas State University, Commerce, TX 75428

In Mary Kay Hudspeth's geometry textbook titled Introductory Geometry there is an exercise that led to some interesting discussion of equivalent methods of solving problems in a geometry course for teachers. The exercise appears as follows in the text (Problem 18 on Page 260):

> For problems 13 through 18 determine the area of the given figure. Assume that sides are parallel or perpendicular if they appear parallel or perpendicular in the drawing. If a drawing appears symmetric, you may assume that it is.

The figure for problem 18 is given below (See Figure 1):

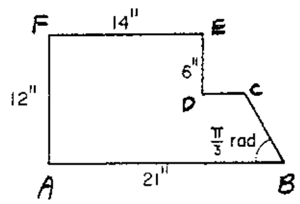

Figure 1.

Note that it appears that if BC is extended, it will pass through point E. This seems true even if the figure is constructed to scale (See Figure 2).

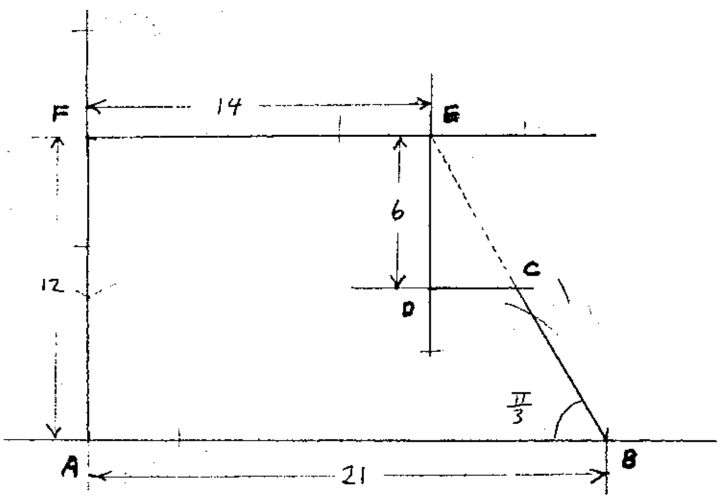

Figure 2.

One student in the class found the area of ABCDEF by extending BC and assuming it passed through E. Then it was a simple matter to compute the area of trapezoid ABEF and subtract the area of triangle EDC (See Figure 3).

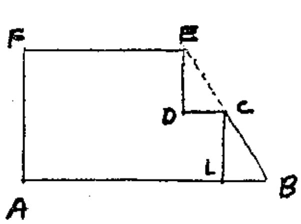

Figure 3.

The student subtracted an area for EDC as if it were the same as the area for triangle CLB which would be correct if BC did pass through E.

However, when the given dimensions are examined with a little trigonometry, the true picture emerges. First, we use the linear dimensions to determine the actual size of the angle at B (See Figure 4).

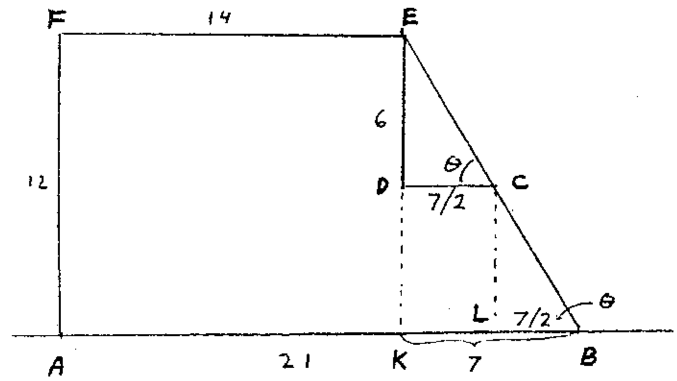

Figure 4.

Since AF = 12 and DE = 6, DK = 6 so DC bisects KE. Since DC is parallel to KB, DC bisects EB. Now since CL is parallel to KE, CL bisects KB. Thus LB = DC = 7/2. Therefore $\tan \theta = 6/(7/2) = 12/7$ so $\theta = 59.743563^\circ$ which is close to the given 60°.

Now if the angle is taken to be 60° and we use the given linear dimensions, we can determine where BC meets DE (See Figure 5).

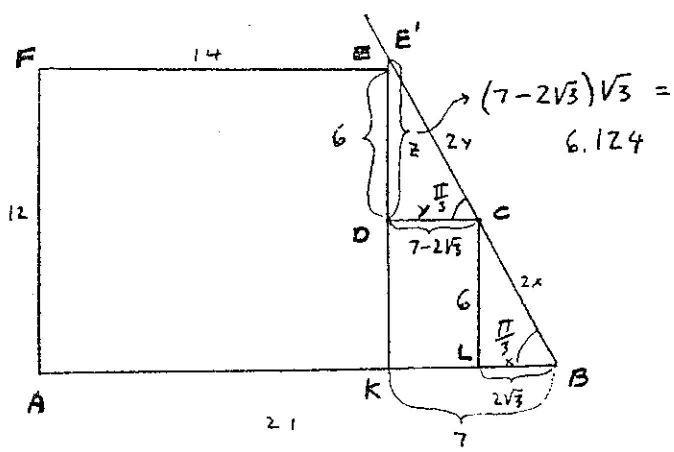

Figure 5.

Using the Pythagorean Theorem in right triangle BLC, we have $(2x)^2 = x^2 + 36$, so $x = 2\sqrt{3}$, so $BL = 2\sqrt{3}$. Subtracting BL from BK, we get $LK = 7 - 2\sqrt{3}$, so $DC = 7 - 2\sqrt{3}$. In 30-60-90 right triangle DCE, we have $DE' = DC\sqrt{3} = (7 - 2\sqrt{3})\sqrt{3} = 6.124$ which is close to the given length of 6. Therefore, the student's approach to solving the problem seems understandable, and one might expect the solution to be close but not exact. Amazingly, though, it is exact. Let's see why.

HOW CAN WE TEACH, continued from page 5

digits plus the last digit gives you your age.

Example:

$$9 \times 6 = 54$$
$$10 \times 30 \text{ (age)} = 300$$
$$300 - 54 = 246$$
$$24 + 6 = 30 \text{ (your age)}$$

Guessing Your Age and House Number (grades 4-6)

Take your house number and double it. Add 5. Multiply by 50. Add your age. Add 365. Subtract 615. The last two digits are your age. The other digits are your house number.

Bowling (grades 3-4)

Contruct tenpins by using empty paper towel cylinders. Obtain a large, soft rubber ball. Place the tenpins in three rows at the back of the room. Let each tenpin count 2. The pupils take turns rolling the ball, determining the number of pins knocked down, and keeping score. If a child knocks down six pins, he should keep his score in this way: 6x2=12. When the game is over, the pupils read each other's scores for more practice. Variations of this game may be used for division and for fractions, as well as whole numbers.

Store Sales (grades 4-6)

Start a class store in which empty cans and boxes brought from home are "purchased" by pupils. The storekeeper must correctly total the prices of goods purchased or the customer becomes the storekeeper. The game may be varied by having a "Sale" in which all articles are four cents less than the price marked on each.

I Can Read Your Mind (grades 2-6)

Think of a number. Double it. Add 10. Divide by 2. Substract from the total the original number.
Answer: is always 5.

All of these games and more may be found in Arithmetic Enrichment Activities for Elementary School Children by Joseph Crescimbeni.

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Buxton, Laurie, Do you panic about maths? London: Heineman Education Books, 1981.

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Hankins, Aaron, Meaningful mathematics teaching. New York: Teachers Practical Press, Inc., 1961.

National Science Board Commission of Precollege Education in Mathematics, Science, and Technology, Educating Americans for the 21st century. Washington, D.C.: National Science Foundation, 1983.

Romberg, Tom, "Math educators identify need for reform," Advocate, October, 1985.

SOMETIMES TWO WRONGS, continued from page 6

One of the correct ways to find the area of ABCDEF (See Figure 6, Exaggerated for clarity at point C) is to find the area of rectangle JDEF and rectangle ABHJ and subtract the area of triangle CHB.

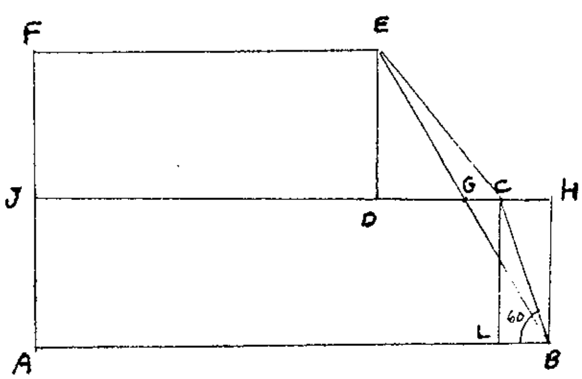

Figure 6.

It turns out that the answers are the same for the student's method and this method, so the student argued that her method was correct too, since she got the same correct answer. Where is the error?

Note that in Figure 6, FJ = JA = CL = HB = ED = 6. Therefore, triangles EDG and BHG are congruent by leg-angle. (vertical angles at G and equal legs DE and BH), so they have the same area. Therefore, if one computes the area of ABCDEF by subtracting the area of triangle GDE from the area of trapezoid ABEF instead of the actual area of EDC, one is making an error amounting to the difference in the area of EDC and EDG which is the area of EGC. Now EGC and GCB share a common base and have the same altitude of length 6, so they have the same area. Also, the area of EDG is the same as GHB since they are congruent.

Thus by subtracting only the area of triangle EDG instead of the area of triangle DCE, the student left an excess of area in the form of triangle EGC. Recall that this area is the same as the area of triangle GCB which is the difference between the areas of ABCDEF and ABGDEF.

Therefore, in effect, she added the area of triangle GCB to the area of ABGDE and obtained the correct answer that would have been found by subtracting the area of triangle CHB from ABHDEF. Thus by subtracting the wrong value for the area of triangle EDG, the student cancelled the error made by assuming that BC passed through E which means that in this case, two wrongs do make a right.

REFERENCES

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Octagon-Square Combinations on Familiar Number Tables

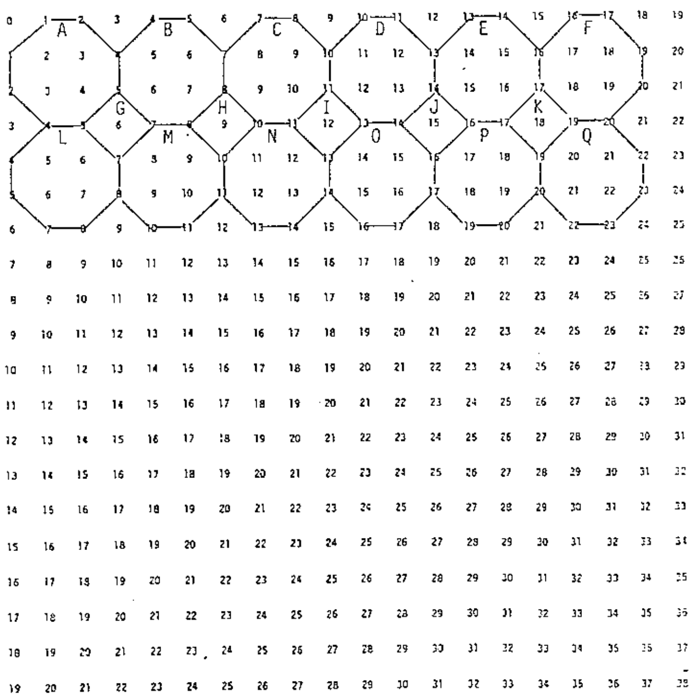
David R. Duncan and Bonnie H. Litwiller
Professors of Mathematics, University of Northern Iowa, Cedar Falls, Iowa

Number patterns often occur in geometric settings where they are not expected. We shall present polygonal combination activities on the extended addition, subtraction, and multiplication tables. These activities result in surprising number patterns.

Activity 1:

Figure 1 is an extended addition table with octagons and squares drawn upon it. Polygons A-B-G-M-L form an "octagon-square combination." Another combination is B-C-H-N-M.

Figure 1



For each octagon-square combination, perform the following steps. We illustrate using octagons A, B, M, and L, and square G.

1) Find the sum of all the numbers which lie in the interiors of the four octagons; call this number I. (I = (2 + 3 + 3 + 4) + (5 + 6 + 6 + 7) + (8 + 9 + 9 + 10) + (5 + 6 + 6 + 7) = 96)
2) Count the number of numbers which lie in the interiors of the four octagons; call this number C. (C = 4 + 4 + 4 + 4 = 16)
3) Find the average; that is, find I ÷ C; call this number A. $(A = \frac{96}{16} = 6)$
4) Find the number which lies in the interior of the square; call this number S. (S = 6)
5) Compare A and S. (A = S = 6)

Table 1 reports the results of our computations.

Table 1

Octagon-Square Combination	I	C	A	S
A-B-G-M-L	96	16	6	6
B-C-H-N-M	144	16	9	9
C-D-I-O-N	192	16	12	12
D-E-J-P-O	240	16	15	15
E-F-K-Q-P	288	16	18	18

Observe that in every case the average of the interior numbers of the four octagons is equal to the interior number of the square. Draw other octagon-square combinations and check to see that the pattern holds.

Activity 2:

Figure 2 is an extended subtraction table with octagon-square combinations drawn upon it. Perform steps 1 through 5 of Activity 1. Does the pattern hold in this case?

Figure 2

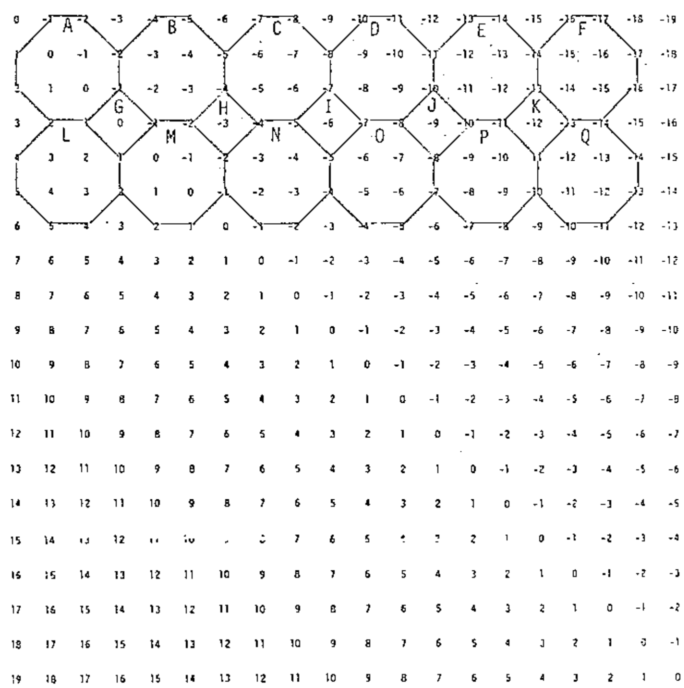


Table 2 shows the results of our calculations.

Table 2

Octagon-Square Combination	I	C	A	S
A-B-G-M-L	0	16	0	0
B-C-H-N-M	−48	16	−3	−3
C-D-I-O-N	−96	16	−6	−6
D-E-J-P-O	−144	16	−9	−9
E-F-K-Q-P	−192	16	−12	−12

Again observe that pattern holds; that is, the average of the interior numbers of the four octagons is equal to the interior number of the square. Draw other octagon-square combinations and check to see that the pattern holds for each example.

Activity 3:

Figure 3 is an extended multiplication table with some octagon-square combinations drawn upon it. Notice that the octagon-square combinations do not have to start at the upper left corner of the table. Perform steps 1 through 5 of Activity 1. Does the pattern which holds for the extended addition and subtraction tables hold for the extended multiplication table?

OCTAGON-SQUARE COMBINATIONS, continued from page 8

Figure 3

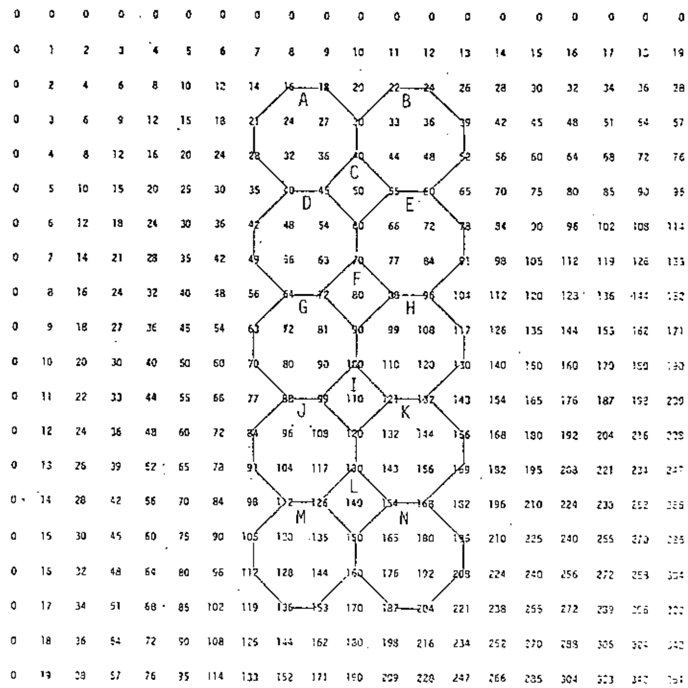


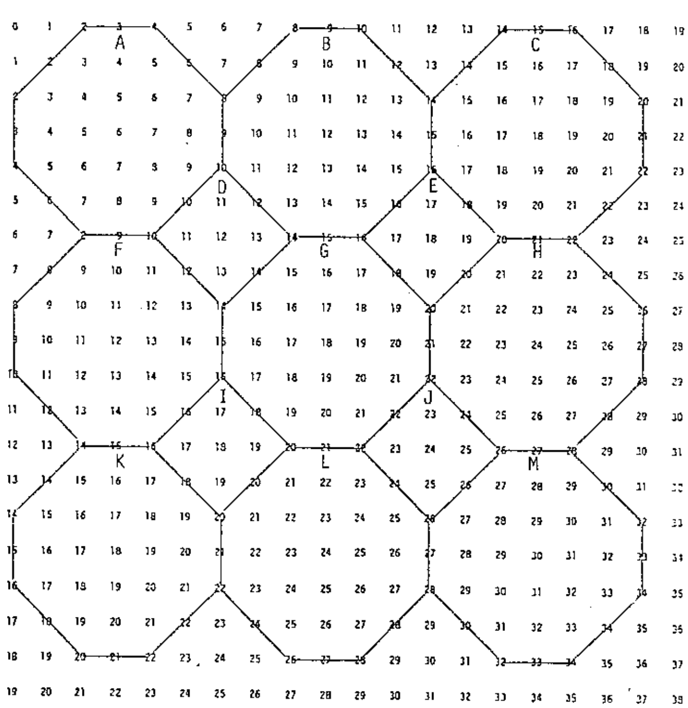
Table 3 reports the results of our computations.

Table 3

Octagon-Square Combination	I	C	A	S
A–B–C–E–D	800	16	50	50
D–E–F–H–G	1280	16	80	80
G–H–I–K–J	1760	16	110	110
J–K–L–N–M	2240	16	140	140

The same pattern holds. Draw other octagon-square combinations and check to see that the pattern holds for each example. Does a pattern hold if "larger sized" octagonsquare combinations are drawn on the extended addition, subtraction, and multiplication tables?

Figure 4



Activity 4:

Figure 4 is an extended addition table with larger octagon-square combinations drawn upon it. (See Figure 4). For each octagon-square combination:

1) Find the sum of all the numbers which lie in the interiors of the four octagons; call this number I.
2) Count the number of numbers which lie in the interiors of the four octagons; call this number C.
3) Find the average, that is, I ÷ C.
4) Find the sum of all the numbers which lie in the interior of the square; call this number S.
5) Count the number of numbers which lie in the square; call this number N.
6) Find the average; that is, S ÷ N.
7) Compare I ÷ C and S ÷ N.

Table 4 reports the results of our computations.

Table 4

Octagon-Square Combination	I	C	I ÷ C	S	N	S ÷ N
A–B–D–G–F	1008	84	12	60	5	12
F–G–I–L–K	1512	84	18	90	5	18
G–H–J–M–L	2016	84	24	120	5	24
B–C–E–H–G	1512	84	18	90	5	18

Observe that I ÷ C = S ÷ N; that is the average of the interior numbers of the four octagons is equal to the average of the interior numbers of the square.

Activity 5:

Figure 5 is an extended subtraction table with octagon-square combinations drawn upon it. Perform steps 1 through 7 of Activity 4. Does the same pattern hold?

Figure 5

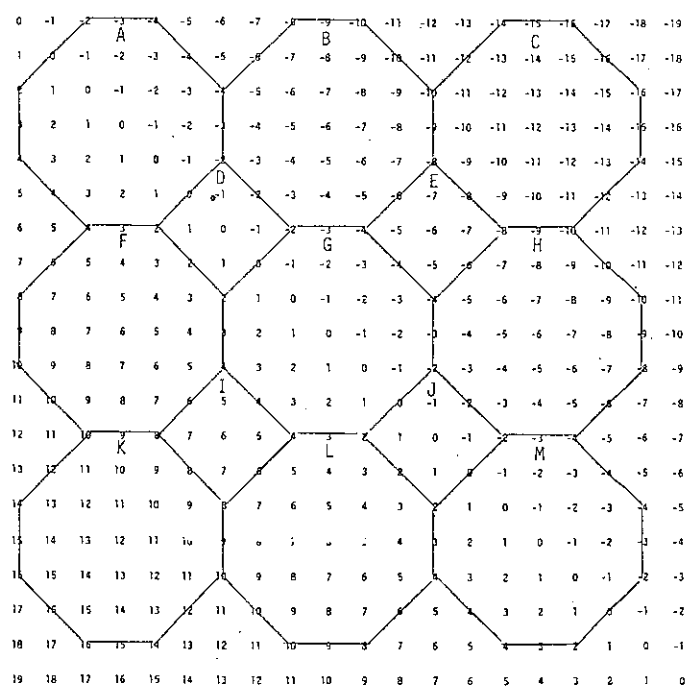


Table 5 shows the results of our calculations.

Table 5

Octagon-Square Combination	I	C	I ÷ C	S	N	S ÷ N
A–B–D–G–F	0	84	0	0	5	0
F–G–I–L–K	504	84	6	30	5	6
G–H–J–M–L	0	84	0	0	5	0
B–C–E–H–G	–504	84	–6	–30	5	–6

See page 13

Questioning in the Mathematics Classroom

William L. Blubaugh, The University of Texas at Austin

The level of student alertness and mental activity in a mathematics classroom is frequently determined by the questioning technique used by the teacher. The types of questions should be determined by (a) the nature of the learners within the classroom, (b) the nature of the subject matter, and (c) the objective of the teacher in the questioning strategy.

Good questioning is an art and it is one of the most important elements of good teaching. Questions should be used to promote a students' feelings of success, to achieve learning, to review performance, to evaluate progress, and to assist in controlling misbehavior (Cooney, Edward, & Henderson, 1983).

It is very easy to get into a questioning rut by asking only knowledge level questions and beginning classroom questions with a particular phrase such as "What is . . ." followed by such statements as:

(a) $2 + (-3)$;

(b) $4x^w y^3$ when $x = 2$ and $y = -3$;

(c) the midpoint of the segment having endpoints (0,-1) and (5, 2.6);

(d) $\sin^2 x + \cos^2 x$; or

(e) the derivative with respect to x of $4x^3$.

For young learners or learners who are exposed to content for the first time, a combination of knowledge, comprehension, and application questions such as those illustrated below are appropriate. The level of questions identified by Bloom in 1956, are arranged from lowest to highest cognitive level. Verbs that are commonly associated with each level of question are also listed.

Knowledge:

(a) State the Pythagorean Theorem.
(b) What is the formula for the area of a rectangle?

Verbs associated with knowledge questions include:
define, what, describe, list, name, and state.

Comprehension:

(a) In the formula for the area of a rectangle (A = LW), what does the letter "L" represent?
(b) Identify the hypotenuse of the triangle ABC.

Verbs associated with comprehension questions include:
explain, identify, extrapolate, interpret, and reorder.

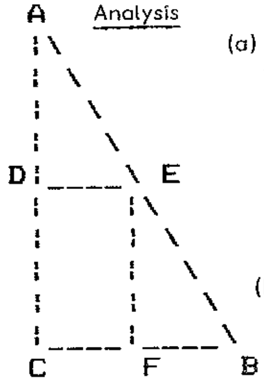
Application:

(a) Determine the area of a rectangle having length of 8 and width of 5.
(b) Use sigma notation to express 7+10+13+16+19.

Verbs associated with application questions include:
determine, plan, use, solve, construct, and apply.

After exposure to new material for a couple of days, knowledge, comprehension, and even application questions can become boring to students who are high achievers. A blend of analysis and synthesis questions becomes appropriate.

Analysis



(a) Suppose triangle ABC is a right triangle with right angle C and with its legs measuring 10 and 24. If segment DE is parallel to side BC, segment EF is parallel to side AC, and D is the midpoint of segment AC, then give the more descriptive name of the quadrilateral CDEF and determine its area.

(b) Compare a secant with a tangent of a given circle.

Verbs associated with analysis questions include:
differentiate, compare, classify, and categorize.

Synthesis:

(a) Create a chart which indicates the relationships among the various types of quadrilaterals.
(b) Considering methods for calculating the distance between two points in a plane, suggest a method for calculating the distance between any two points in space.

Verbs associated with synthesis questions include:
create, hypothesize, suggest, arrange, and relate.

Questioning Objectives

One objective of a questioning strategy is to elevate the level of thought process required of each student. This strategy should also provide a deeper understanding of the particular mathematics topic of study.

Questioning strategy should also encourage students to elicit informative responses which otherwise would have been presented by the teacher. They should be carefully thought out and presented in a non-threatening manner.

Questions asked of students should be sufficiently difficult to arouse an effort and create a modestly challenging atmosphere. A question should not be repeated by the teacher unless it is inaudible. One should either have another student repeat the question or ask the same question but in a rephrased form (Posamentier & Stepelman, 1986).

Consider the following when asking questions:

(a) Encourage students to comment on the answers of classmates.
(b) Tactfully curb aggressive students (no individual or small group of students should dominate).
(c) Personalize questions (people like to be addressed by their name).
(d) Give students time to think and respond to your questions. An average of one second is given in the typical classroom, five to six seconds is preferred.
(e) Good questions should be purposeful, clear, brief, natural, thought-provoking, limited in scope, and adaptable to the level of the class (Groisser, 1964).

Youth are accustomed to a variety of stimuli outside the classroom, but they also need a variety of stimuli within the classroom. Such stimuli can be provided through good questioning strategy. Consider beginning questions with "What do we need to determine to . . .," "What values are required . . .," or "How should we . . . ." Beginning questions with "Why," "What happens if," "To what extent," "How," and "Under what circumstances" also promotes higher levels of thinking. A good balance of factual and thought-provoking questions is recommended.

Self-Observation

Questioning techniques are improved when the teacher listens to his/her own questions with a critical ear. It usually requires several lessons with pre-planned questioning techniques in order to become natural in challenging students with the appropriate type of questioning. The time devoted to improving questioning techniques, however, is time well spent!

REFERENCES

Bloom, B. S. (1956). Taxonomy of educational objectives: Cognitive Domain. New York: David McKey Company, Inc.

Cooney, T. J., Edward, J. D., & Henderson, K. B. (1983). Dynamics of teaching secondary school mathematics. Prospect Heights, Illinois: Wavel and Press, Inc.

Groisser, P. L. (1964). How to use the fine art of questioning. Teachers Practical Press, Inc.

See page 12

STUFF Strategic Tactics Ultimately For Fun

SAME OLD STUFF!

Dear MMT's (Marvelous Math Teachers)

March has marched, April has pitter-pattered and May is near. Thanks for nothing, at least not much. See you in September.

The stuffed STUFF staff,
Bettye & Judy

P.S. Send Summer Stuff to Bettye Hall, 3830 Richmond, Houston, TX, 77027.

PRIMARY

Are you having trouble with the "greater than/less than" relationship? Try this idea.

Make a set of numeral cards (0-10) and cubes (wood, folded tag, etc.) labeled 0-5 on the faces.

Lay out the cards in order as if on a number line. Roll the two cubes. Take one cube, match it to the corresponding numeral card. The other cube is used to tell the number of cards greater than the one being matched. The child moves the second cube the correct number of cards to the right. The answer is where the second cube lands.

To work on the concept of less than, color one cube red (labels 0-5) and one cube blue (label 5-10). Have pupils match the blue cube (after rolling) with its numeral card and move the red cube to the left to find the position for how many less.

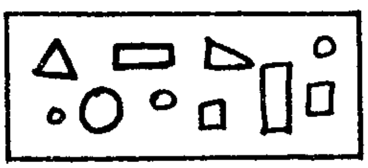
PRIMARY

Here is an activity that primary grade children can do.

A simple geometric puzzle can be made as follows:

(1) roll out some clay to form a rectangle about 12 x 18 inches, trim the edges to make the rectangle symmetrical.

(2) draw various sizes of circles, rectangles, triangles, squares on the clay. Be sure to leave at least an inch of clay as a margin.



(3) cut out the figures with cookie cutters or a knife. Trim the cut out figures slightly so that they are smaller than the holes from which they were cut.

(4) with wet fingers smooth the edges of the holes and the geometric cutouts. Let the frame and the parts dry thoroughly.

(5) if shapes do not fit easily into the holes after drying, use coarse sandpaper on the sides.

(6) paint the puzzle after drying.

(7) when the paint is dry, glue the frame only to heavy cardboard of the same size. Puzzle is now ready for use. If pieces should break, they may be glued back together. Backing the figures with pieces of tag will add strength.

ELEMENTARY

Dr. Lola May suggests playing the following game to sharpen skills and hide the drill. She calls it "Clues".

I

a) there are 7 numbers
b) all are odd
c) the sum is 13

II

a) there are 4 numbers
b) none are even
c) the sum is 24

Children will enjoy being the detectives who try to solve the mystery using the clues. Could you solve the two above?
Answers: I (7, 1, 1, 1, 1, 1, 1)
II (17, 3, 3, 1) or (15, 5, 3, 1) or many others.
This can be expanded for Middle School use.

INTERMEDIATE/MIDDLE

Try these decimal fraction ideas.

Teach demonstration

Notch Cards. Prepare notched tag as below. Cover the upper card with acetate or laminate so different numerals can be written with a crayon. The lower card should be marked with a decimal point. By moving the numeral (upper) card to the right or left of the decimal point, the value of the number displayed changes in multiples of ten. This offers practice in reading decimal numerals.

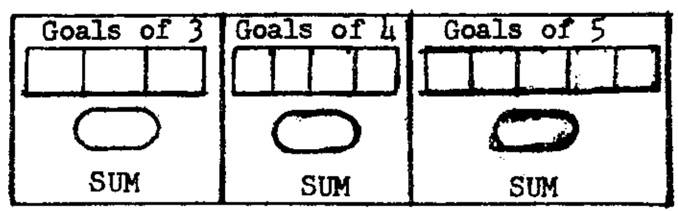
Magic Squares. Have you ever thought to construct these using decimal fractions?

.8	1.8	.4
.6	1.0	1.4
1.6	.2	1.2

MIDDLE SCHOOL

NUMERO

Materials: Pair of numbered cubes, goal-recording sheet as shown:



Rules: Each child is given a goal-recording sheet. A goal is selected from the possible list of 3, 4, or 5 digit sums:

Largest even (3 digit)
Largest odd (4 digit)
Smallest even (3 digit)
Smallest odd (4 digit)
Largest odd (3 digit)
Largest even (5 digit)
Smallest odd (3 digit)
Smallest even (5 digit)
Largest even (4 digit)
Largest odd (5 digit)
Smallest even (4 digit)
Smallest odd (5 digit)
Largest multiples of 2 (3, 4, or 5 digits)
Largest multiples of 3 (3 or 4 digits)
Smallest multiples of 2 (3 digits)

STUFF, continued from page 11

The cubes are rolled. After the cubes are rolled the players may record the number attained in any of the places selected for the particular goal. Once the numbers are recorded in the boxes, they may not be erased. After the given number of rolls of the cubes for the goal selected are completed and the numbers recorded in the boxes, the player closest to the goal wins. Only one number is recorded for each roll of the cubes.

The goals of least difficulty are the ones containing the fewest number of digits. As the number of digits increases, the difficulty also increases. Variations of the game are developed as the teacher or class invents new goals such as three highest prime numbers, etc.

SENIOR HIGH

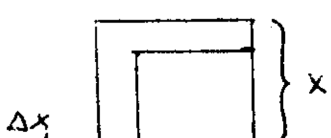
WHO OWNS THE ZEBRA?

1. There are five houses, each a different color and inhabited by men of different nationalities, with different pets, drinks and cigarettes.
2. The Englishman lives in the red house.
3. The Spaniard owns a dog.
4. Coffee is drunk in the green house.
5. The Ukrainian drinks tea.
6. The green house is immediately to the right (your right) of the ivory house.
7. The Old Gold smoker owns snails.
8. Kools are smoked in the yellow house.
9. Milk is drunk in the middle house.
10. The Norwegian lives in the first house on the left.
11. The man who smokes Chesterfields lives in the house next to the man with the fox.
12. Kools are smoked in the house next to the house where the horse is kept.
13. The Lucky Strike smoker drinks orange juice.
14. The Japanese smokes Parliaments.
15. The Norwegian lives next to the blue house.

Now, who drinks water?
And who owns the zebra?

SENIOR HIGH

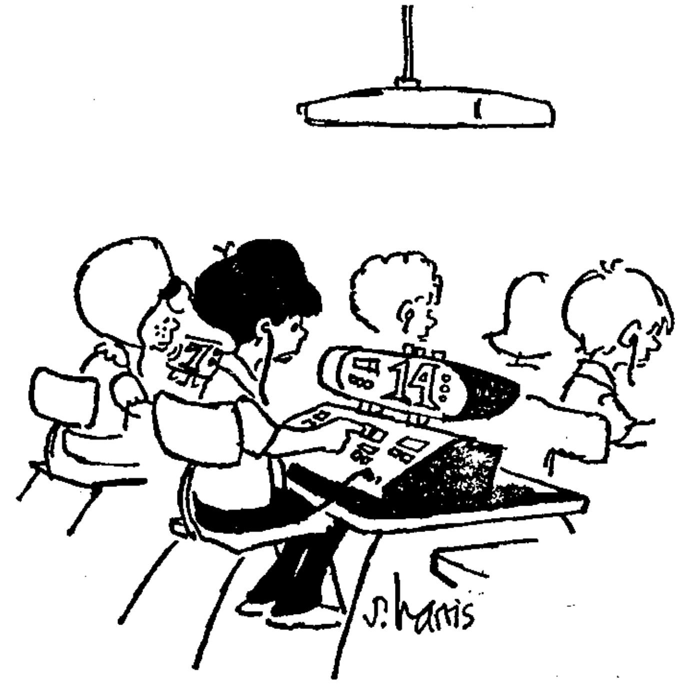
A technique I employ is the use of real-world objects to illustrate concepts. At times, food is a motivating demonstration tool. A few weeks ago, in Calculus, the class was discussing how to find the values of increments. Specifically we worked a problem that asked to find ΔA, the change in area, if the sides of a square are decreased by Δx. We found algebraically that $\Delta A = -2x\,\Delta x + (\Delta x)^2$. In order to make this expression more meaningful for the students, I produced a square-shaped cake. I then cut off Δx units from the sides of the cake as shown in the figure below.



ΔA is clearly the part of the cake that was cut off. Students partitioned the discarded part of the cake quite easily into rectangles, and obtained the same ΔA expression by computing the areas of rectangles. Now that we clearly visualized ΔA, we all made sure that we commenced to internalize the true flavor of the concept. Isn't mathematics delectable?

Thanks to (this issue's winner)

Marsha Hurwitz
Duchesne Academy
10202 Memorial
Houston, TX 77024



"You are wrong. The correct answer is 14. You are a stupid kid."

We have often given ideas for games, puzzles, and other motivational gimmicks in this newsletter. Do not lose sight of their purpose. Games can be and should be fun. In mathematics they can assist with the motivation for learning and for drill and practice reinforcement. They should be used with these purposes in mind. Frequently these kinds of activities lend themselves to pupils recording data or discussing outcomes learned; i.e., strategies to win, patterns discovered, etc. Plan seminars with your game-players as a follow up activity. It can be a diagnostic experience! The use of games should be a learning experience, not just entertainment.

QUESTIONING continued from page 10

Posamentier, A. S., & Stepelman, J. (1986). Teaching secondary school mathematics. Columbus, Ohio: Charles E. Merrill Publishing Company.

CULTURAL PLURALISM

A. DEFINITION
B. BASIC ELEMENTS
   1. Cultural diversity.
   2. Membership in the common life of the community (pol., econ., ed.).
   3. Interaction among groups.
   4. Relative parity and equality.
   5. Agreement that the continuation of cultural diversity is a positive value.
C. C-TYPES
   1. Green's Typology
   2. Gordon's Typology
   3. Newman's Typology
D. GOALS
   1. Development of common goals.
   2. Lessening of cultural conflict.
   3. Sharing of status.
   4. Sharing of power.
E. OPPOSITES
   1. Separatism.
   2. Amalgamation.
   3. Assimilation.
F. STAGES
   1. Awareness
   2. Knowledge
   3. Understanding
   4. Communication
   5. Acceptance
   6. Resolution
   7. Functionality
   8. Commitment

OCTAGON-SQUARE COMBINATIONS,

continued from page 9

The same pattern holds; that is, the average of the interior numbers of the four octagons is equal to the average of the interior numbers of the square.

Activity 6:

Figure 6 is an extended multiplication table with octagon-square combinations drawn upon it. Perform steps 1 through 7 of Activity 4. Does the same pattern hold for the extended multiplication table that holds for the extended addition and subtraction tables? Again notice that the combinations do not have to begin at the upper left corner of the table.

Figure 6

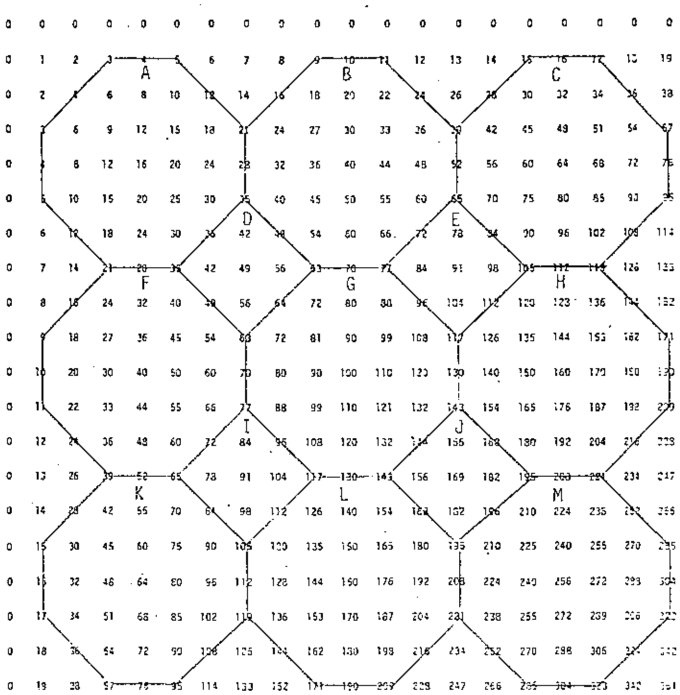


Table 6 reports the results of our computations.

Table 6

Octagon-Square Combination	I	C	I ÷ C	S	N	S ÷ N
A-B-D-G-F	4116	84	49	245	5	49
F-G-I-L-K	7644	84	91	455	5	91
G-H-J-M-L	14196	84	169	845	5	169
B-C-E-H-G	7644	84	91	455	5	91

Yes, the same pattern holds on the extended multiplication table as on the extended addition and subtraction tables.

Another pattern may be observed for Activities 4, 5, and 6; that is, the sum of the four center numbers of the four octagons divided by 4 equals the center number of the square. For example in Figure 6, using A-B-D-G-F, (16 + 40 + 100 + 40) ÷ 4 = 49. Check this for other octagon-square combinations on all these extended tables.

Also note that in Activities 1, 2, and 3, there is just one number in the interior of the square. If this interior number is considered to be its own average, then Activities 1 through 6 all yield the same pattern.

Challenges:

1. Draw other polygon combinations upon the extended addition, substraction, and multiplication tables and look for number patterns.
2. Construct algebraic proofs of some of these conjectures.

CHILDREN'S MUSEUM NEEDS TEACHERS/PRESENTORS

Do you enjoy working with children? Are you looking for part-time paid employment? The Children's Museum of Houston is presently coordinating their summer '87 and fall '87 workshop series. Creative individuals and teachers of science, art, math, social studies, crafts, music, etc. are needed to serve as presentors and to conduct 1 to 3 hour workshops for children.

Presentors are paid on the Museum provides funds for consummable materials - make and take workshops are encouraged. If you or a friend is interested in being part of the exciting activities of the Children's Museum, then here is what you need to do:

1. Decribe the workshop in writing. Include the age of the children, the size of the group, the workshop objectives, an outline of specific activities, and the approximate cost of materials per child.

2. Submit a brief statement outlining your previous experience with children. Please include the names and phone numbers of two individuals who can serve as references.

3. Provide information on how often you would be willing to conduct the workshop; i.e., once a week, twice a month.

4. Mail your proposal to:

Coordinator of Community Programs
Children's Museum of Houston
3201 Allen Parkway
Houston, TX 77019

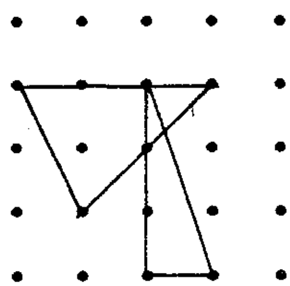
The Children's Museum, founded in 1980, is dedicated exclusively to meeting the educational and cultural needs for children. We offer participatory exhibits representing the broad subject areas of science, technology, history, culture, and the arts, that encourage children to explore, investigate and learn by doing. Our past workshops have involved children in making kites, dolls, masks, terrariums, and puppets; in dramatic cooking, and gardening, activities; and in the exploration of basic light, sound, color, and Texas history concepts.

Geogrid Puzzles

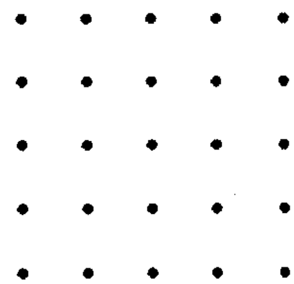
Sketch the figures on the grids

Rules

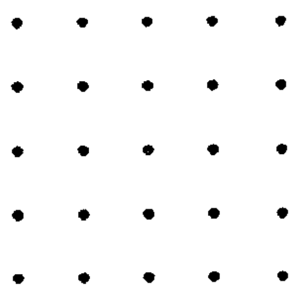
Vertices must be at points of the grids.
Points of intersection may be anywhere.



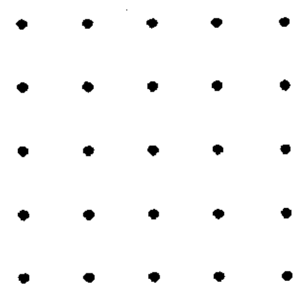
Two triangles that have exactly 3 points in common



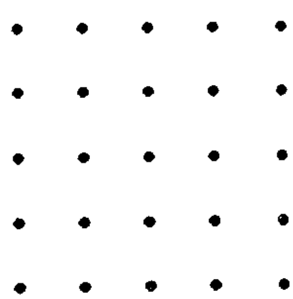
Two triangles that have exactly 4 points in common



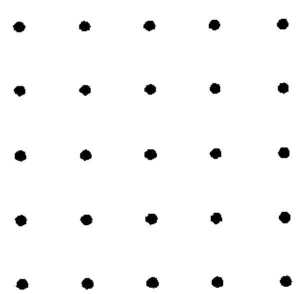
Two triangles that have exactly 5 points in common



Two triangles that have exactly 6 points in common



Two squares that have exactly 4 points in common



Two pentagons that have exactly 4 points in common

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