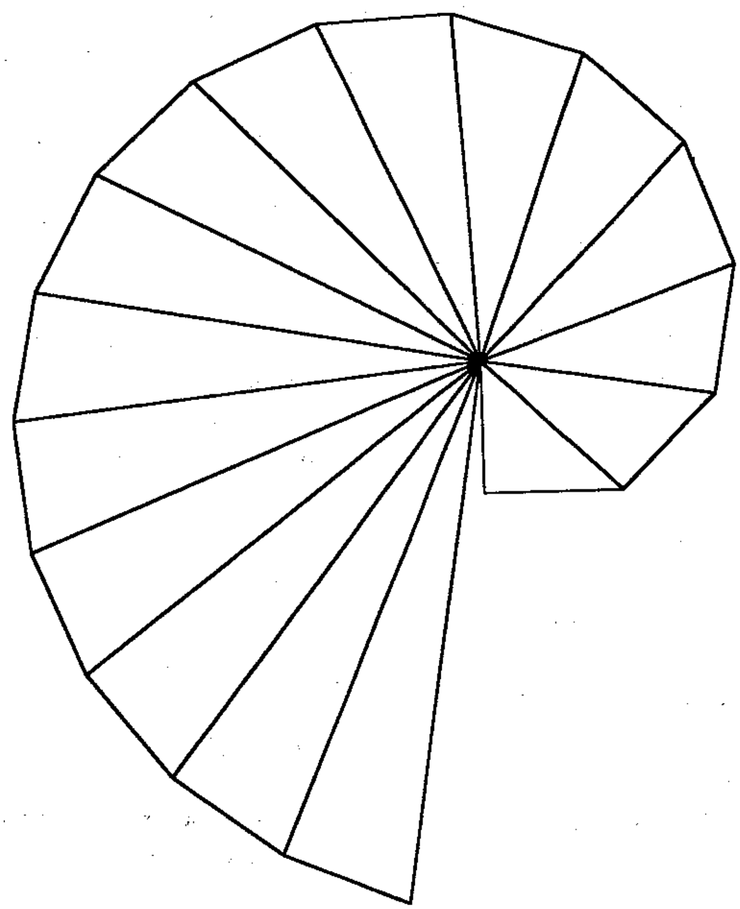
The Texas Mathematics Teacher



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The **TEXAS MATHEMATICS TEACHER**, the official journal of the Texas Council of Teachers of Mathematics, is published four times each year, in October, January, March, and May. Editorial correspondence and regular article manuscripts should be addressed to the editor, as listed above. Manuscripts for the *Voices from the Classroom, Student Voices,* and *Lone Star News* sections should be addressed to the appropriate Associate Editor.

Potential authors should adhere to the following guidelines:

(1) An article for Voices from the Classroom should be relatively short, and contain a description of the activity sufficient in detail to allow readers to incorporate it into their teaching, including a discussion of appropriate grade level and prerequisites for the lesson. Whenever possible, these articles should include camera-ready activity sheets that can be directly photocopied by classroom teachers.

(2) Manuscripts should be word-processed or neatly typewritten, double-spaced with wide margins on $8^1/2$" x 11" paper. No author identification should appear on the manuscript. Illustrations should be carefully prepared in black ink on separate sheets, the original without lettering and one copy with lettering added.

(3) Submit the original and four copies. If possible, please include a Macintosh or IBM $3^1/2$" diskette containing the manuscript.

(4) Include a cover letter containing the following information: author(s) name, address, affiliations, and phone number; intended level; and, if a disk is submitted, name and version number of computer word-processing or graphics packages used.

As soon as possible after refereeing, authors will be notified of a publication decision. Originals of articles not accepted for publication will be returned to the authors. Two copies of the issue in which an author's manuscript appears will be sent to the author automatically.

We also need

(1) **Referees** for articles! Interested mathematics educators, whether classroom teachers, supervisors, or collegiate personnel, are encouraged to send their names, addresses, and level(s) of interest (elementary, middle-school, secondary, and/or collegiate/teacher preparation) to the Editor, at the address above. An individual can expect to referee two or three manuscripts per year.

(2) Dates, times, and contact people for activities, workshops, and conferences that would be of interest to mathematics teachers.

(3) Interesting miscellanea for margin notes.

SUBSCRIPTION and **MEMBERSHIP** information is on the back cover.

TEXAS MATHEMATICS TEACHER

TEXAS COUNCIL OF TEACHERS OF MATHEMATICS

Affiliated with the National Council of Teachers of Mathematics

April 1996

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ON THE COVER: The 16 right triangles pictured have sides of length 1, $\sqrt{n}$, and $\sqrt{n+1}$ for $n = 1, 2, \ldots, 16$.

Classroom Champions

One of my favorite plaques hanging on my office wall was given to me by my high school colleagues. It calls me a Champion of the Classroom. I think that they gave it to me to honor me as a winner of an award, but I like to think of it in another sense. All teachers should be champions of the classroom.

Champions are defenders of a cause. In mathematics education our cause is a mathematics curriculum which is relevant to the society in which our students will live. In my opinion it must be based on discovery learning, technology and problem solving. Rigorous drill and practice alone will not prepare our students for the real world.

Champions may also be advocates for change. Changes in curriculum and teaching strategies must be made by the teacher in the classroom—they cannot be demanded from above. These changes must occur not only at the K-12 level but also in higher education and teacher preparation courses. Just as a champion must have trained for his match, teachers must be trained in technology and in new approaches to mathematics instruction. This requires that educators be given the time to learn these new methods and to work together to develop the curriculum appropriate for their students. Teachers must be willing to give some of their "free" time to learn these new techniques in summer institutes which are offered. We must also learn about the new Texas Essential Knowledge and Skills for mathematics grades K-12, help to disseminate information on the TEKS, and help to implement changes in our local curriculum.

Champions often fight for the rights of their constituents. Our constituents are our students. There is often no outside support for some of our students. Not every student has a computer at home or access to library facilities. Unless we restructure our classroom environment and our school day the chasm between those who have and those who have not will become much greater than it was in the day when success in the classroom depended only on having a sheet of paper and a pencil. We may need to provide longer class periods to provide students equal access to technology, to give them time to work cooperatively to solve problems, or to complete projects.

Champions are rewarded for their success. We may not be as financially rewarded as we would like, but every one of us has been rewarded by the smile of a student who understands and appreciates our efforts. That champion plaque is next to a post card I received several years ago from a woman who was my student 20 years ago. She had attended her child's open house at high school and felt compelled to send a note of thank you to a former teacher. These little rewards are what have kept me in the classroom for thirty years.

Diane McGowan
TCTM President

Gender Equity and the Multiple Choice Exam

Charles E. Mitchell
Tarleton State University

Providing an equitable instructional environment for all students should be a primary goal for all classroom instructors. Instructional strategies that are inherently biased against a segment of the population must be eliminated if all students are to realize their academic potential. The idea of being biased against a specific group of students, such as females, is no doubt an abhorrent one for most educators, yet gender bias may be so complicated and so poorly understood that actions and strategies that seem natural and are taken for granted could harbor subtle biases. After all, each teacher was raised in the same biased society, one that is still dominated in government and business by male leaders. In this article some of the previous research concerning gender bias will be reviewed with specific attention placed upon classroom action studies that teachers can use to examine the efficacy of employing multiple choice tests in evaluating mathematical achievement.

BACKGROUND

To educators familiar with the research studies of the past two decades, clear differences exist in the ways male and female students are inclined to solve mathematics problems. Undoubtedly these differences are the result of the ways males and females have been conditioned to respond to classroom instruction. For instance, females are inclined to choose lengthy, detailed solution methods that are more likely to convey an understanding of the nature of a problem (Macoby and Jacklin, 1974). Males are more inclined to quickly assess an item and estimate a solution (Hudson, 1986). Females are more inclined to draw pictures, charts or graphs in support of their solution methods (Fennema and Tarte, 1985). The differences in problem-solving techniques described above, that are more likely to be employed by females are desirable educational outcomes, yet each requires additional time. Add to this situation the tendency of females to be neater in their work than males (Macoby and Jacklin, 1974; Bridgeman and Wendler, 1991), and again more time is consumed by females. The serious disadvantage that females are more likely to face with lengthy examinations now becomes apparent.

Further evidence that the factor of time can distort females' accomplishments in mathematics was provided by Miller, Mitchell, and Van Ausdall (1994). In this study students were administered 30-minute SAT-type mathematics examinations. On one occasion the 30-minute time limit was strictly enforced. On another occasion, with the order of the timed and untimed examinations randomly varied across separate classes, the students were informed that they had as much time as they needed, and could even return to complete work on the examination at a later date if necessary. The scores of male students were significantly higher than female students on both administrations of the tests. However, the scores of female students significantly improved when time was removed as a factor, whereas the scores of male students did not. Most students completed the test in a normal 50-minute class when time was not a factor. In addition to the evidence suggesting that time constraints can create a biased environment, the results also suggest the possibility that other biases remain in the testing environment. Perhaps additional biases manifest themselves in the format of an examination itself.

THE ACTION STUDIES

In a series of action studies with fourth- and sixth-grade teachers working with their own classes, the teachers were asked to construct 20-question multiple-choice examinations using questions and distractors drawn directly from standardized examinations said to be appropriate for their children. In addition to the usual examination instructions, the children were instructed to show their work on worksheets. The time allotted for the children to work was based upon guidelines that accompanied the standardized tests. The examinations constructed by the teachers contained a sampling of standard computational items, questions addressing some elements of geometry, and a few problem-solving items.

RESULTS

The multiple-choice examinations for each class were scored traditionally by the students' regular classroom teacher and the penalty for guessing suggested by the test constructors was applied. In all classes the males averaged higher scores than the females, although not all differences in performance were statistically significant for each class.

After the initial scoring of the inventories the teachers were then asked to reevaluate the examinations using the student worksheets to award partial credit when appropriate. To introduce some measure of objectivity into the scoring of partial credit, the teachers awarded half-credit for an item whenever the written work suggested a valid solution method. A valid solution method was defined as one that would have produced a correct response if properly followed. The teachers were also instructed to eliminate credit whenever the written work did not support the student's response. This effort was designed to eliminate points gained by guessing. In effect, the multiple-choice tests were scored as a traditional exam in which students were provided with possible solutions. For the test items that did not involve complicated computations or multiple steps in the solution process, such as rounding off numbers, the teachers were asked to give the children the benefit of the doubt when scoring the items.

After the scores on the tests were adjusted for partial credit and the elimination of credit for guessing, the scores of males and females were analyzed a second time. In all classes the scores of female students were higher than the scores of male students.

After re-scoring the examinations the teachers were instructed to further analyze the children's written work and assess other differences in the children's performances. When re-copying an item from the test to a worksheet, boys were more inclined to omit some of the mathematical symbolism, such as plus or minus signs, or to mis-copy the item, than were the girls. The girls were more inclined to write out their responses in concrete form, e. g., 36 cookies, than were the boys. Girls provided evidence that they were more inclined to consider more than one method of solution, and to check a solution before moving on to the next item. It should be noted that each of these differences in the performance of males and females ostensibly make more demands on time for the females and are desirable educational outcomes.

DISCUSSION

The findings reported above were based upon action studies of teachers working in their own classrooms and were not subjected to formal statistical analyses designed with more carefully control certain variables. However, action studies can play an important role in the efforts of classroom teachers to informally examine the success of selected classroom activities. These action studies can be easily replicated by classroom teachers and each teacher can weigh the significance of the results. If future efforts reveal similar results, then teachers should strongly consider severely limiting the role played by multiple-choice tests in evaluating their children's knowledge of mathematics. When children are to be confronted with standardized testing involving multiple-choice examinations, naturally, the children should receive instruction pertaining to this format. However, when scores are reported to parents and children, care should be taken in determining the importance to be placed upon the scores. Certainly, if the scores are not in line with prior classroom performance, doubts should be expressed concerning the efficacy of the scores. Compounding the problems faced by educators is the tendency of girls to internalize poor scores more than boys. Girls are more apt to see poor scores as a reflection of their ability in mathematics (Rosser, 1989). Permitting female students to further victimize themselves by placing undue weight upon questionable results should be avoided at all costs.

CONCLUSION

Previous studies conducted during the past decade suggest distinct differences in the ways schools and society have conditioned males and females to solve mathematical problems. If females tend to be more cautious, deliberate problem solvers, then multiple-choice tests that ignore partial credit and over-emphasize luck are undoubtedly biased against females. In addition, penalizing students who take the time to estimate solutions, consider alternative solution methods, and check their solutions is counterproductive. The results of these action studies and previous research reports suggest that classroom teachers can and should take many steps to insure more equitable educational opportunities for all students.

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Stretching a Circle onto an Ellipse

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As many mathematics students suspect, every ellipse is a stretched circle. Your students may enjoy the verification of this fact. It will provide applications of some basic analytic geometry properties and provide an easily understood introduction to the notion of a *function from the plane onto itself.* This stretching (or compressing) process is described by determining a one-to-one correspondence **T** of the place $\mathbf{R}^2$ onto itself, such that the unit circle **C** ($x^2 + y^2 = 1$) becomes the ellipse **E** ($x^2/a^2 + y^2/b^2 = 1$). See Fig. 1.

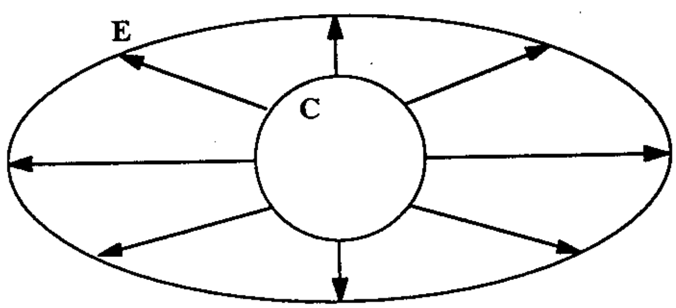

Figure 1

We will see that **T** is the composition of two linear stretches. The first linear stretch is the horizontal stretch $\mathbf{T_X}$: $\mathbf{R}^2 \to \mathbf{R}^2$ defined by $\mathbf{T_X}$ $(p,q) = (ap,q)$, as indicated in Figure 2. It is as if we stretched the plane by pulling of the X-positive and X-negative "edges" of the plane and moved point (p,q) to (ap,q). It is very important that students actually choose a value for a, say 5, and several specific points, like $(\sqrt{2}/2,-\sqrt{2}/2)$, and draw where the point was and where it is sent under the influence of $\mathbf{T_X}$.

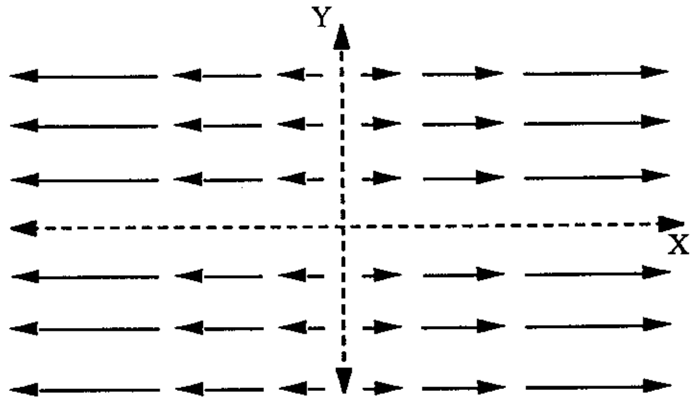

Figure 2

Following this horizontal stretch the linear vertical stretch $\mathbf{T_Y}$: $\mathbf{R}^2 \to \mathbf{R}^2$ is defined by $\mathbf{T_Y}$ $(p,q) = (p,bq)$, as indicated in Figure 3. Here we are pulling on the Y-positive and Y-negative "edges" of the plane and moving point (p,q) to (p,bq). Again, sketches using specific values should be made.

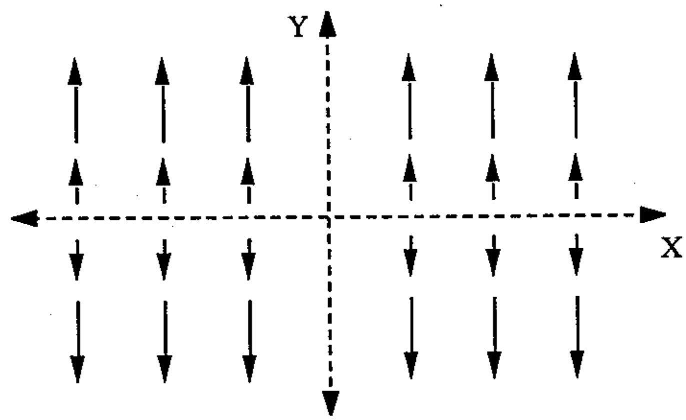

Figure 3

The composition, of the horizontal stretch followed by the vertical stretch, is $\mathbf{T} = \mathbf{T_Y} \circ \mathbf{T_X}$ given by $T(p,q) = (ap,bq)$. Now sketches should be made of the motion of specific points under this combination of horizontal and vertical moves. A reference to the students' physics class is in order here, since the vectors in Figure 4 are the resultant vectors of the horizontal and vertical vectors they have drawn in the first two stretches.

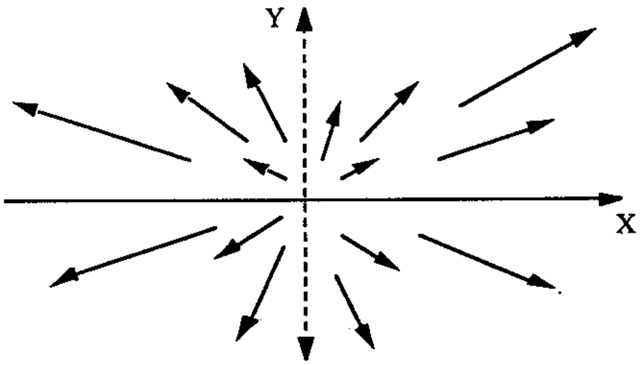

Figure 4

T stretches the unit circle to the ellipse. If (x_n,y_n) is the new point that the original point (x_o,y_o) on the unit circle is sent to under the function **T**, then $x_n = ax_o$ and $y_n = by_o$, and $x_o^2 + y_o^2 = 1$ becomes $x_n^2/a^2 + y_n^2/b^2 = 1$. Also for the point $(\sin t, \cos t)$ on the unit circle, the transformation **T** yields $x = a\cos t$ and $y = b\sin t$, which satisfies $x^2/a^2 + y^2/b^2 = 1$.

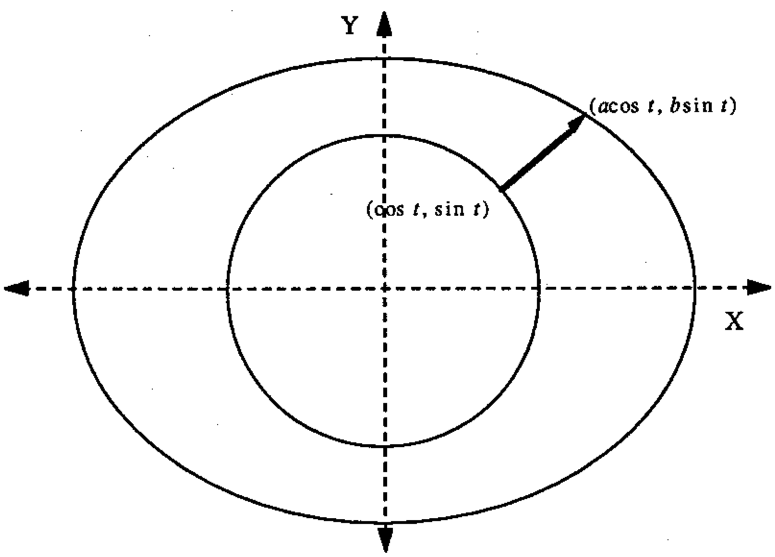

Figure 5

From Figures 4 and 5, **T** may appear to be a radial stretch of the plane, where points and their images are on the same ray from the origin. However, **T** is a radial stretch only if $a = b$. (i.e., circles stretch to circles only.) This can be observed by supposing the point (p,q), which is on the radial line given by $y = (q/p)x$, is moved to the point (ap,bq). Since (ap,bq) is required to be on this same radial line, by substitution $bq = (q/p)ap$, yielding $a = b$.

Although **T** is not in general a radial stretch, it can always be represented by a different composition $\mathbf{T} = \mathbf{T_L} \circ \mathbf{T_R}$, where $\mathbf{T_R}(p,q) = (ap,aq)$ is a radial stretch followed by a *correcting* linear vertical stretch $(b>a)$ or vertical compression $(a>b)$ $\mathbf{T_L}(x,y) = (x,(b/a)y)$. In this representation $\mathbf{T_R}$ radially expands the unit circle onto the circle of radius a, and then $\mathbf{T_L}$ linearly Y-stretches this new circle to the desired ellipse, as in Figure 6. Also see *Danny's Ellipse* in promotional materials from Key Curriculum Press.

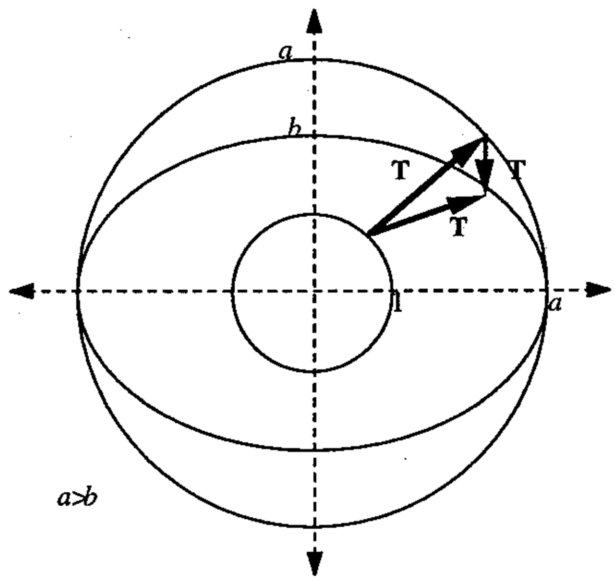

Figure 6

This revised representation of **T** provides a clear view of an ellipse as a "cylindrical" section. For $b>a$, the ellipse $x^2/a^2 + y^2/b^2 = 1$ is the intersection, in three space **X-T-Z**, of the cylinder $x^2 + t^2 = a^2$ and the plane $z = (\sqrt{b^2 - a^2} / a)t$, as in Figure 7. Since the variable y is parametrically defined by $y = (b/a)t$, $x^2 + t^2 = x^2 + (a^2/b^2)y^2 = a^2$ implies $x^2/a^2 + y^2/b^2 = 1$.

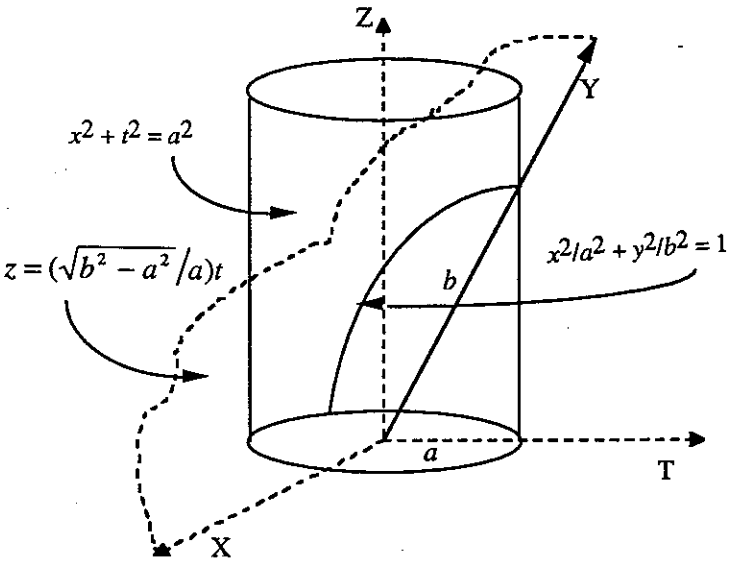

Figure 7

A concrete model of this function, T, could be made from a thin piece of translucent white latex, such as a latex glove. Draw a circle on it and pull the edges to form an ellipse.

A Statistical Analysis of the Pick 3 Texas Lottery

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INTRODUCTION

In a previous article (Lamb, et.al., 1994), we stated that analyzing statistical data has become an important part of the curriculum in our schools beginning with the elementary school level. Learning about means, modes, and medians along with standard deviations and other statistical methods can be rather dry, even when utilizing a computer for all the calculations. One way to get students interested in statistical methods to current and exciting events. Texas teachers now have three such events – the Texas Lotto, Texas Cash 5, the Texas Pick 3 Lottery. Our previous article cited above discussed the Texas Lotto Lottery. In this article, we will discuss the Texas Pick 3 Lottery.

THE RULES OF THE PICK 3 LOTTERY GAME

Currently, six times a week, a machine is used to select three balls numbered from 0 to 9 with repetitions allowed. Pick 3 Lottery players attempt to pre-select the winning numbers in order to win various amounts of money. Each Pick 3 playslip has five places called *playboards.* Each playboard contains the numbers zero through nine in three columns so that three numbers from zero to nine can be selected in order for any or all of the playboards. Provision is made for these numbers to be entered into more than one drawing by marking a multidraw number from 2 to 12. Players can win in the following ways:

1. Match all three of the numbers drawn in the same order – odds 1 in 1,000 – and win $500 if you paid $1 to play or $250 if you paid 50 cents to play.
2. Choose three numbers with two alike and match all three of the numbers drawn in any order – odds 1 in 333 – and win $160 if you paid $1 to play or $80 if you paid 50 cents to play.
3. Choose three different numbers and match all three of the numbers drawn in any order – odds 1 in 167 – and win $80 if you paid $1 to play or $40 if you paid 50 cents to play.

It is interesting at this point to note the mathematical expectation for each of the three ways to win if we pay $1 to play. For the first way, we can expect to win 500 times .001 or 50 cents. For the second way, we can expect to win 160 times 1/333 or 48 cents. For the third way, we can expect to win 80 times 1/167 or 48 cents. The mathematical expectations for each of the three ways to win when 50 cents is paid to play are 25 cents, 24 cents, and 24 cents respectively.

PROBABILITY OF WINNING

The probabilities of the preceding events occurring are calculated as follows. The probability of selecting all three numbers in the same order correctly is 1/10 times 1/10 times 1/10, or 1/1000. The probability of selecting three in any order correctly when two numbers are alike is 3/1000 since there are 3!/2! = 3 ways to arrange the three numbers. The probability of selecting three in any order correctly when the numbers are all different is 6/1000 since there are 3! = 6 ways to arrange the three numbers. This information is printed on the back of each Pick 3 playslip as "odds of winning." Recall the odds of winning are the probability of winning divided by the probability of losing, so the odds of selecting all three numbers correctly in the same order would be 1/1000 divided by 999/1000, or 1/999. However, since the denominators of the probabilities above are fairly large, the odds of winning are approximately the same as the probability of winning because .001 is approximately .001001, differing by only .000001. All of the above calculations should be useful in helping students understand probabilities and also in demonstrating the reason the Texas Pick 3 Lottery is a revenue producer for the state treasury.

RANDOMNESS OF THE LOTTERY

The remainder of this article examines the statistical behavior of the numbers chosen in 100 drawings in order to determine if the Pick 3 Lottery is "fair." That is, are the numbers, as chosen so far, truly random? Obviously, 100 drawings will not establish randomness. There are ways to demonstrate to students that as the number of drawings increase, certain measures of randomness also change. The methods considered in this paper are: frequency of the numbers chosen, mean, standard deviation, and the Chi-squared test to determine the fairness of the first 100 drawings. A GWBASIC computer program was used to tabulate the frequency of each number's occurrence and to calculate the probability of its recurrence. Averages and standard deviations were also computed to help determine whether or not the numbers were chosen at random.

PROBABILITY AND FREQUENCY OF NUMBERS CHOSEN

Theoretically, the probability $P(x)$ that any given number x will be one of the three numbers chosen from the set of ten is one minus the probability of not being chosen at all. The probability that a number will not be drawn is 9/10 which is one minus the probability that it will. The probability that a number will not be chosen when three numbers are drawn is 9/10 times 9/10 times 9/10. Thus the probability $P(x)$ that x will occur is:

$$P(x) = 1 - (9/10)(9/10)(9/10) = 1 - .729 = .271$$

Compare this theoretical probability with the actual probabilities of each number computed from the number of times it has occurred in the 100 drawings.

Table 1.
PROBABILITIES OF THE TEN LOTTERY NUMBERS BEING ONE OF THE THREE NUMBERS CHOSEN IN 100 DRAWINGS

0 HAS PROBABILITY	.22131
1 HAS PROBABILITY	.23811
2 HAS PROBABILITY	.33389
3 HAS PROBABILITY	.271
4 HAS PROBABILITY	.32624
5 HAS PROBABILITY	.20426
6 HAS PROBABILITY	.30292
7 HAS PROBABILITY	.28708
8 HAS PROBABILITY	.28708
9 HAS PROBABILITY	.22974

Since there have been 100 drawings at the time of this writing, theoretically, x should have occurred .271 times 100 or 27.1 times. Compare this theoretical frequency with the actual frequencies for each number in 100 drawings:

Table 2.
FREQUENCY OF OCCURRENCE OF THE TEN LOBBERT NUMBERS IN 100 DRAWINGS

0 OCCURRED 24 TIMES
1 OCCURRED 26 TIMES
2 OCCURRED 38 TIMES
3 OCCURRED 30 TIMES
4 OCCURRED 37 TIMES
5 OCCURRED 22 TIMES
6 OCCURRED 34 TIMES
7 OCCURRED 32 TIMES
8 OCCURRED 32 TIMES
9 OCCURRED 25 TIMES

Now observe the behavior of the frequency of each number in Fig. 1:

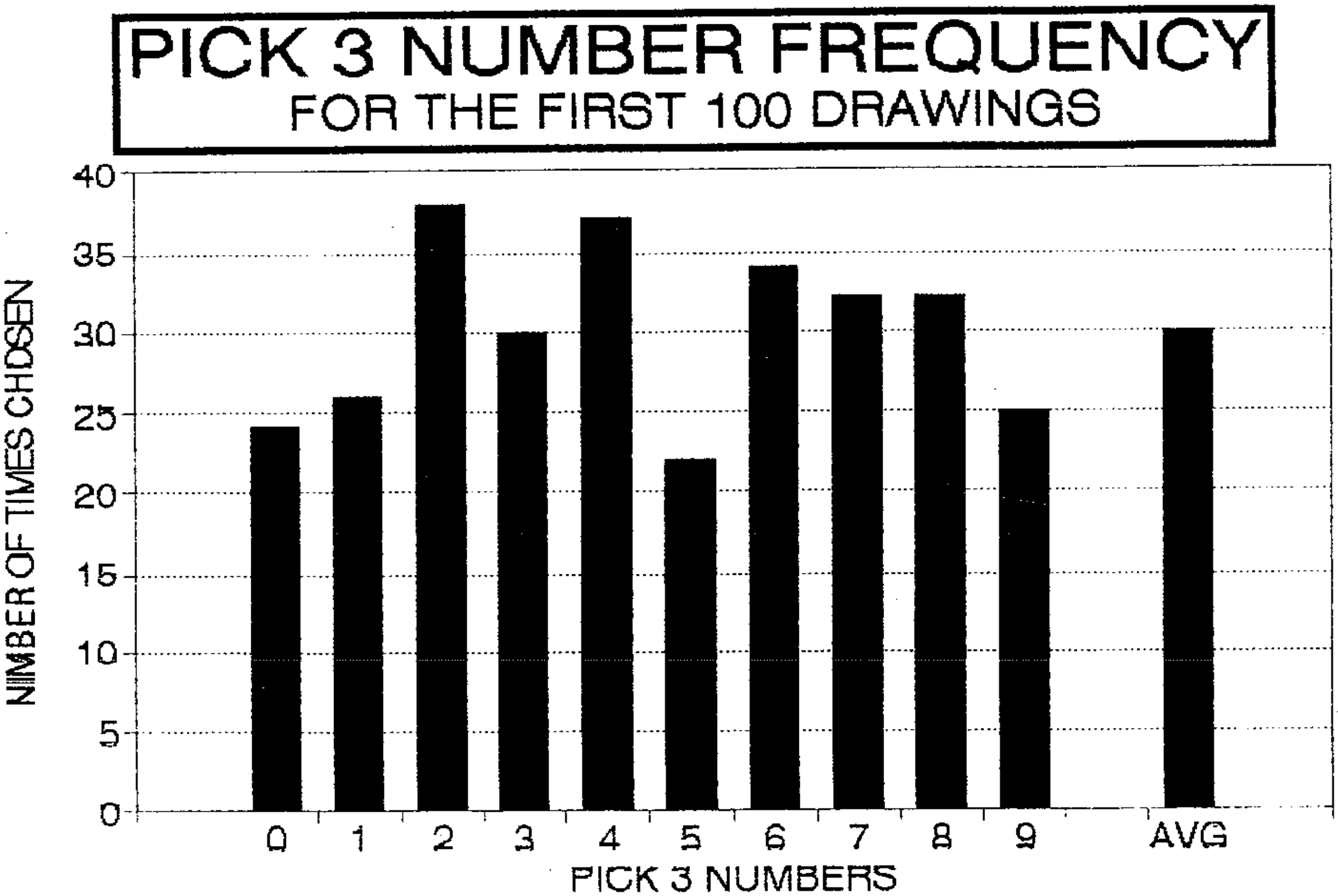


Figure 1

MEAN, STANDARD DEVIATION AND DISTRIBUTION OF NUMBERS CHOSEN

If the machine is choosing the numbers randomly, the average number chosen from the numbers 0 to 9 is 4.5 and the standard deviation is 2.87. The actual average number chosen by the Texas Pick 3 Lottery machine in 100 drawings is 4.53 and the standard deviation is 2.77.

When the Chi-square test is run on the data for the 100 drawings, the following results are obtained:

$$\begin{aligned} X2 = {} & (24-27.1)^2/27.1 + (26-27.1)^2/27.1 + \\ & (38-27.1)^2/27.1 + (30-27.1)^2/27.1 + \\ & (37-27.1)^2/27.1 + (22-27.1)^2/27.1 + \\ & (34-27.1)^2/27.1 + (32-27.1)^2/27.1 + \\ & (32-27.1)^2/27.1 + (25-27.1)^2/27.1 \\ = {} & 13.36. \end{aligned}$$

Since, according to a table of critical values of Chi-square[2], the Chi-square value needs to be at least 14.68 to indicate non-randomness with a probability of at least .9, we cannot say at this point that the number selections are non-random with an error of 10% or less.

Since the Pick 3 Lottery involves the order in which the numbers are chosen, we tabulated the ordered frequency of the ten Pick 3 numbers in 100 drawings. The following table shows how often the numbers occurred first, second and third.

Table 3.
ORDERED FREQUENCY OF THE TEN LOTTERY
NUMBERS IN 100 DRAWINGS

FIRST	SECOND	THIRD
0 OCCURRED 8 TIMES	0 OCCURRED 5 TIMES	0 OCCURRED 11 TIMES
1 OCCURRED 6 TIMES	1 OCCURRED 11 TIMES	1 OCCURRED 9 TIMES
2 OCCURRED 10 TIMES	2 OCCURRED 12 TIMES	2 OCCURRED 16 TIMES
3 OCCURRED 11 TIMES	3 OCCURRED 10 TIMES	3 OCCURRED 9 TIMES
4 OCCURRED 15 TIMES	4 OCCURRED 9 TIMES	4 OCCURRED 13 TIMES
5 OCCURRED 5 TIMES	5 OCCURRED 10 TIMES	5 OCCURRED 7 TIMES
6 OCCURRED 12 TIMES	6 OCCURRED 12 TIMES	6 OCCURRED 10 TIMES
7 OCCURRED 13 TIMES	7 OCCURRED 10 TIMES	7 OCCURRED 9 TIMES
8 OCCURRED 11 TIMES	8 OCCURRED 12 TIMES	8 OCCURRED 9 TIMES
9 OCCURRED 9 TIMES	9 OCCURRED 9 TIMES	9 OCCURRED 7 TIMES

Theoretically, each number should occur ten times in 100 drawings since the probability of occurrence is 1/10. Compare this theoretical frequency with the actual frequencies in the table above.

Figure 2 shows the ordered distribution of the numbers plus averages:

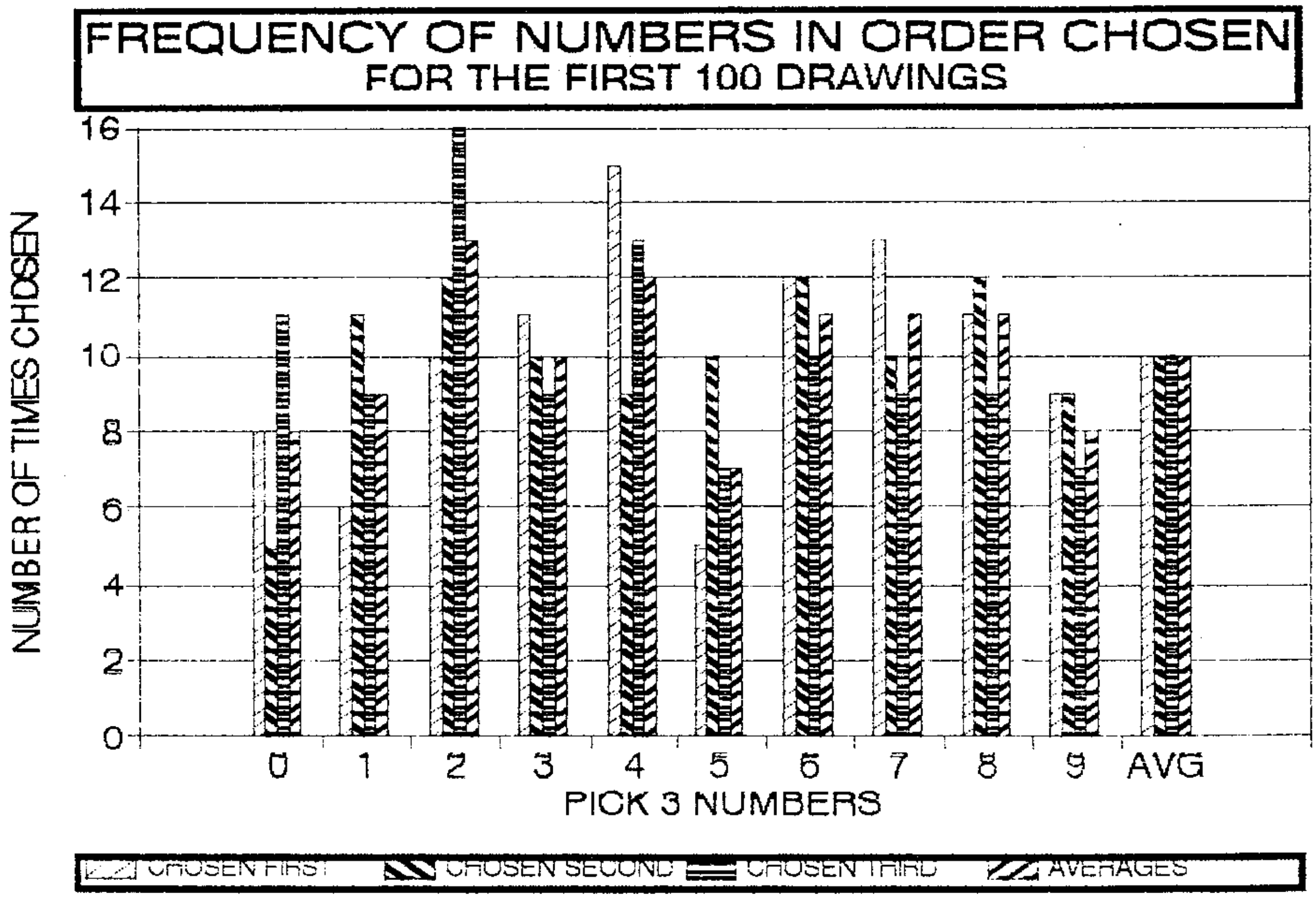


Figure 2

Note that even though the individual numbers seem to fluctuate quite a bit, the averages on the right are all 10 for the 100 drawings. It will be interesting to see if this trend continues in the future.

When the Chi-square test is run on the data for occurring first in the 100 drawings, the following results are obtained:

$$X^2 = (8-10)^2/10 + (6-10)^2/10 + (10-10)^2/10 + (11-10)^2/10 + (15-10)^2/10 + (5-10)^2/10 + (12-10)^2/10 + (13-10)^2/10 + (11-10)^2/10 + (9-10)^2/10 = 8.6.$$

When the Chi-square test is run on the data for occurring second in the 100 drawings, the following results are obtained:

$$X^2 = (5-10)^2/10 + (11-10)^2/10 + (12-10)^2/10 + (10-10)^2/10 + (9-10)^2/10 + (10-10)^2/10 + (12-10)^2/10 + (10-10)^2/10 + (12-10)^2/10 + (9-10)^2/10 = 4.$$

When the Chi-square test is run on the data for occurring third in the 100 drawings, the following results are obtained:

$$X^2 = (11-10)^2/10 + (9-10)^2/10 + (16-10)^2/10 + (9-10)^2/10 + (13-10)^2/10 + (7-10)^2/10 + (10-10)^2/10 + (9-10)^2/10 + (9-10)^2/10 + (7-10)^2/10 = 6.8.$$

Again, according to a table of critical values of Chi-square[2], the Chi-square value needs to be at least 14.68 to indicate non-randomness with a probability of at least .9. Since each of the Chi-square values above is less than 14.68, we cannot say at this point that the number selections in first, second, or third places are non-random with an error of 10% or less.

CONCLUSION

These are but a few of the ways one might choose to have students explore statistics using a class project to track and analyze the Texas Pick 3 Lottery. The process can be started at any drawing as if that drawing were the first.

Utilizing the Texas Pick 3 Lottery or the Texas Lotto Lottery as a teaching tool should provide significant material for student debate regarding random processes. Many other useful teaching techniques could be established that would give students a better understanding of the practical applications of probability and statistics.

REFERENCES

1. Lamb, John; Huffstutler, Ron; Brock, Archie; and Aslan, Farhad, "A Statistical Analysis of the Texas Lottery," *Texas Mathematics Teacher*, January, 1994.
2. Mendenhall, William and Beaver, Robert J., *Introduction to Probability and Statistics*, PWS-Kent Publishing Co., Boston, 1991, pp 670-671.

The following two classroom activities are published by the Texas Education Agency. Copies of the complete Guidelines for each grade may be purchased for $4.00 from the Publications Distributions Office. Texas Education Agency, 1701 North Congress Avenue, Austin, Texas 78701.

Guidelines for Teaching Grade 1 Mathematics

EE: 2C
Related EEs: 1A, 1B, 1C, 3B, 3C
Grade 1 TAAS Objectives: 1, 2, 10, 11, 12

OBJECTIVE

The student will use patterns to discover rules used to sort a set of numbers into two sets.

ACTIVITY

Belongs, Doesn't Belong

MATERIALS

Chalkboard, chalk

PROCEDURE

INTRODUCTION

1. Draw a line across the chalkboard and label the areas above and below the line:

   Belongs:

   Doesn't Belong:

2. Select a rule to separate numbers into two sets (or have a student select a rule). Rules could include: odd numbers, even numbers, factors of a number, prime numbers, composite numbers, multiples of 5s, etc. The aim of the game is for the rest of the players to determine what the rule is by calling out numbers. If the number belongs to the rule, it is written above the line. If not, it is written below the line beneath the last correct number. It is important to keep "doesn't belong" calls in line under the previous "belong" call, as the comparison between the two is often useful.

3. Some players will identify the rule after a few plays. Instead of calling out their guess at the rule, they call "Eureka!" They can then do one of two things: either keep quiet until the rest of the players have identified the rule or, better still, test their rule by suggesting numbers that they feel sure do or do not belong. Example of game with the rule "is an even number":

Belongs:	2	4	10
Doesn't Belong:	3	7	21

4. Beware of difficult, nonmathematical rules like, "The numbers in my phone number."

EXPLORATION:

- Do we have any useful information?
- What patterns have you found? How did you find a pattern?
- Is there more than one pattern? If so, can you find a relationship between the two patterns?
- What strategies can you use to discover patterns?
- What kind of guesses do you think give the most information?
- What happens to your strategies as more guesses are made?
- What guesses can you make to test your rule?
- Did finding patterns make finding a rule easier? Why?

EXTENSION:

- Create a new pattern and have a partner discover the rule.
- Introduce a special sequence of numbers such as the Fibonacci sequence.

SUMMARY

- Were all the strategies in the class the same? Did any strategies have specific advantages?
- How do you know when you have found a pattern?
- Do you see any relationships between the patterns?
- How did you organize your guesses?
- What did you decide was a good sequence of guesses to make?
- What kind of shortcuts did you use to find the rule?
- How did you test your conjectures?

ASSESSMENT

QUESTIONS:

- How would you change your strategy for the next time? Why?
- (See also summary questions.)

OBSERVATIONS

- Were the students thinking about guesses and developing strategies or guessing randomly?
- Were the students organizing their data?

TASKS:

- Write a summary statement of what you learned about making guesses to find the rule.
- Develop another rule for a new game. Share with the class.
- Make a list of all the number properties you learned and what other properties you know about.

Guidelines for Teaching Grade 3 Mathematics

EEs: 5B, 5C, 5D
Related EEs: 1A, 1D, 1E
Grade 3 TAAS Objectives: 1, 4, 11, 13

OBJECTIVE

The student will develop a sense of measurement as a description of a particular characteristic of an object in order to communicate information about that object. In addition, the student will generate physical references for standard measurement units by comparing the properties and characteristics of objects in the local environment to given measures.

ACTIVITY

Measurement Scavenger Hunt

MATERIALS

For use with both English and metric units, a variety of measuring devices such as balance scales and masses, tape measures, trundle wheels, graduated cylinders, rulers, spring scales, measuring cups and spoons, stopwatches; a list of measurements to find objects to fit; large sheets of newsprint, each labeled with a particular measurement, on which groups can post names or pictures of the objects they find to fit each measurement.

PROCEDURE

INTRODUCTION

1. Post on the bulletin board, blackboard, or overhead transparency a list of measurements; e.g., 1 foot, 1 inch, 1 meter around, 1 decimeter, 1 minute, 1 centimeter, 100 grams.
2. Have the students discuss what they know about these measurements; for example, what kinds of things each might measure, what the characteristic is that is being measured, or what the unit of measure itself might look like.
3. Challenge each group of four to find something in the classroom to fit each given measurement. Label a sheet of newsprint with each measurement and have each group post their objects on the appropriate charts (by writing names or drawing pictures). Encourage each group to find examples that are different from the examples of the other groups.
4. Discuss the items found by each group and the strategies they used in finding and testing items.

EXPLORATION:

- What tools can you use to do each measurement?
- Can you use some tools more often than others?
- Would any tool fit every kind of measurement?
- Does your measurement always have to be exact?
- How do you know when you are close enough?
- How do you know that the object fits the measurement?
- Why did you use this tool and not that one?
- Is there another tool you could have used to make this measurement?
- If you use another tool (for example, the ruler instead of the tape measure) will you get the same result? Why or why not?
- How can you use the information on the charts to get more ideas about what to investigate?

EXTENSION:

- Identify a measurement not on the list and make a chart of items for it.
- Group the measurements that use the same kinds of tools.
- Select the list of objects from one of the charts and discuss ways in which all the objects in the list are alike. Are there any characteristics they all share?

SUMMARY

- What did you need to know to do these measurements?
- Did you need any new information to make the measurements?
- Why did you use the measurement tool you used for ________?
- Were some tools more effective than others for measuring? Why? How did you determine whether they were more effective or not?
- Which tool did you like the best? Why?
- Which tool did you like the least? Why?
- How did your group decide which objects to try?
- Did you have to try many things to find a measure? Did what you tried help you in your next guess? Why or why not?
- Which measurement was easiest for your group to find? Why do you think that was so?
- Which measurement was hardest for your group to find? Why do you think that was so?
- Was there any measurement you didn't find? What objects did you try in looking for it?
- Did the items found by other groups and posted on the charts help your group? How?
- What measurements surprised you? Why?
- How are all the things on this list alike? How are they different?
- What does *measurement* mean?
- What did you learn from this activity that you didn't know before?
- How could you use what you have learned in another situation, like at home or while shopping?

ASSESSMENT

QUESTIONS:

- If you had to measure (object) which tool would you use? Why?
- (See also summary questions.)

OBSERVATIONS:

- Were students actively participating?
- Were students making measurements appropriately?
- Were students making appropriate suggestions for objects to measure?
- Were students using appropriate instruments for each type of unit?
- Were students using knowledge about measurement units?

TASKS

- Make a class definition for measurement (to write in your journal or display on a language chart).
- Keep a scrapbook of measurements that you see in the newspaper, in magazine articles, or advertisements. Match them with the kinds of measuring tools that would be used.

Please cut out your TCTM membership card which is on the back cover.

The Cissoid of Diocles: An Inquiry in Three Parts

G. T. Springer
Alamo Heights High School
San Antonio Texas

The cissoid of Diocles is usually encountered in its polar form, $r = a\sin\theta\tan\theta$, somewhere in a precalculus text. Although streamlined and easy to graph on a graphing calculator in this form, the curve is all but stripped of its original, intended utility. The Greeks described the cissoid as a locus of points at the intersection of a secant and a chord of a circle. In Figure 1, a circle D has been drawn with diameter AH and tangent line AF. From F, a secant segment is drawn to H. This secant intersects the circle at G and chord GM is drawn parallel to the tangent. On the other side of D, a chord equal in length and parallel to GM is drawn (NL). This chord intersects our secant at O. This point, O, is a point on the locus of the cissoid. As F moves up and down the tangent line, chords GM and NL remain equidistant from D and the point O traces out the cissoid, as in Figure 3.

PART ONE:
What is the parametric equation of the cissoid as it is described above?

1. Begin with the polar equation, $r = 6\sin\theta\tan\theta$. Plot the graph of this polar equation. Notice that the graph is a reflection through a vertical line of the cissoid described above.

2. In Figure 2, the tracer is on a point P whose coordinates are shown. The angle, θ, is shown as T=40°. Write the coordinates of P as expressions containing constants and the trigonometric functions of 40°. Show that the expressions you write simplify to approximately the values shown.

3. Rewrite your expressions for the coordinates of P in terms of a and θ, so that they may represent any point on a cissoid whose polar equation is $r = a\sin\theta\tan\theta$. The expressions you wrote can be transformed into parametric equations for the cissoid, simply by writing $x = f(t)$ and $y = g(t)$, where $f(t)$ and $g(t)$ are the expressions you wrote. Substitute t for θ, because it is more customary in this form to use t.

4. Our parametric equation still doesn't fit the original description. We must reflect our graph to get the graph we want. Notice that the reflection is through a vertical line, so the y-values won't change. This means only our $x = f(t)$ needs revision. Make the necessary change. Then plot the graph and show that it contains the point on the tracer in Figure 3 below.

5. Write general parametric equations for any cissoid in terms of a and θ. What role does the value of a play in terms of the definition of the cissoid?

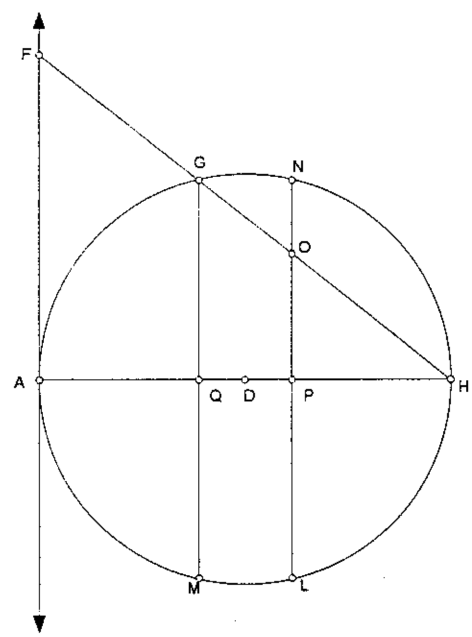


Figure 1

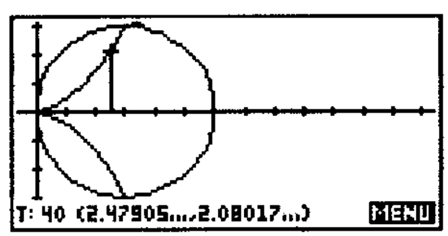


Figure 2

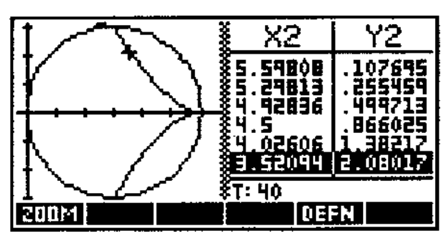


Figure 3

PART TWO:
Why were the Greeks interested in the cissoid?

Refer to Figure 1 as you answer the following questions.

1. Using similar triangles, $\frac{HQ}{QG} = \frac{HP}{?}$.

2. Using geometric means, $\frac{HQ}{QG} = \frac{QG}{?}$.

3. Therefore, $\frac{HQ}{QG} = \frac{QG}{?} = \frac{HP}{?}$.

4. But, QA = HP, QG=PN, and HQ=AP; with this information, write a continued proportion involving four segments that share point P as an endpoint.

5. Use your continued proportion to write a system of two equations, each of which has NP as its left member. Discard the radical equation.

6. Solve your system for AP.

7. Show that your proportion is equivalent to saying $\frac{AP}{PO} = \frac{HP^3}{PO^3}$.

8. Measure the appropriate distances in Figure 1 to the nearest mm. How closely do the results agree with the proportion above?

9. Now notice that the ratio of AP to PO is approximately 2:1. Suppose that a cube is built whose edges are all as long as OP and we wish to build another cube whose volume is twice the original. What length would we use for each edge of the second cube?

PART THREE:
The History

Eratosthenes wrote that the inhabitants of the Greek isle of Delos were suffering from a plague and asked their oracle how they might end this scourge. The oracle said that they would be delivered from this menace if they could double the size (volume) of a certain altar. The cissoid represents Diocles' attempt to solve not only this problem, but the general problem of how to build a solid whose volume has a certain ratio to a given similar solid. We know these ratios now as cube roots.

1. Discuss what difficulties Diocles must have faced when he tried to apply his curve to the problem of doubling the volume of a given cube. To see the difficulties, use only the cissoid and the given proportions to find the length of a cube that is double the volume of a cube whose edges each have a length of 1.5 units.

2. Now find a cissoid such that it helps you find the volume of a cube that is three times the volume of a cube whose edges each have a length of 8 units.

3. Go back and reconsider your answer to #1 in terms of your adventures answering #2 and #3.

4. Use the distances you measured in Part Two to approximate the cube root of two. Write the ratio first and then show that is approximates the desired cube root.

5. For what else is Eratosthenes known?

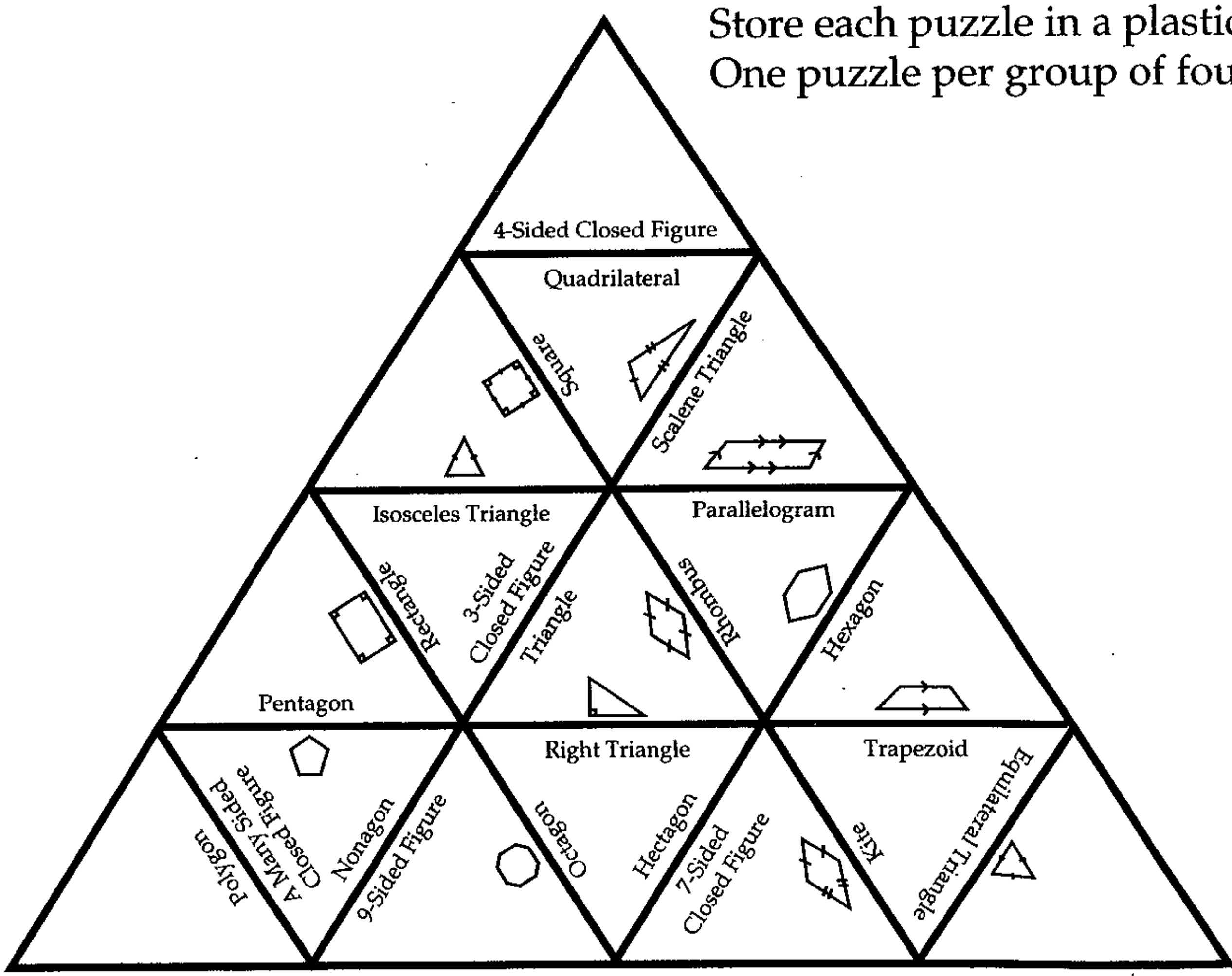
6. What does the word "cissoid" mean? How does it apply to this curve? Shade in the portion of the graph in Figure 2 that matches your understanding of the meaning of the word "cissoid."

G.T. Springer is a mathematics teacher at Alamo Heights High School in San Antonio, Texas. He was honored as one of the Texas Secondary Presidential Awardees for 1995.

Polygon Puzzle

This puzzle was developed by Master Teacher Linda Shaub, James Bowie High School, Austin, Texas. It is one of the training tools she used in her polygon lesson for the National Training Teacher Institute in Austin in February. She demonstrated the effective integration of video technologies into hands-on mathematics and science instruction.

Cut out the triangles.
Store each puzzle in a plastic bag.
One puzzle per group of four.



CLASSROOM HINTS From Texas South Plains Council of Teachers of Mathematics

FRACTION PRACTICE

Use a die to make fractions for addition and subtraction practice. The first roll of the die determines the numerator of the fraction. The second roll of the die determines the denominator. A third roll sets up the numerator of a second fraction with the fourth roll of the die making the denominator of that second fraction. For example : first roll-3, second roll-2, third roll-5, and fourth roll 6 results in

$$\frac{3}{2}+\frac{5}{6}.$$

The student adds the fraction. To subtract fractions the larger fraction would always be the minuend. The activity could be varied by using two dice on each roll.

Ruta F. Finstein
Dunbar Junior High School
Lubbock Independent School District

TAAS STUDY TIP

Ask your students to keep a small spiral notebook. The students write down and memorize decimal/fraction/percent equivalence, perfect squares, square roots, Pythagorean triples, or anything else that you think they might need. Ask them to look at these spirals before they go to bed each night. Quiz them often on these concepts. Instruct them to write down anything they have memorized before they start to take the TAAS test.

Vivian Russell
Frenship High School
Frenship Independent School District

ARKANSAS JOINT CONFERENCE ON THE TEACHING OF SCIENCE AND MATHEMATICS

Little Rock, Arkansas, November 7-9, 1996
Creating Math and Science Links

Speaker proposals must be submitted by May 15. For further information on the conference contact Judy Trowell, Mathematics Director, Arkansas Statewide Systemic Initiative, 114 East Capitol, Little Rock, Arkansas, 72201-3818, Phone 501-324-9300 FAX 501-324-9308

Encourage your students to contribute games, computer or calculator programs, geometric or algebraic activities, or original problems to the journal.

Encourage membership in TCTM
Share the membership form on page 42 with a friend.

Six-Dinner Sid

Objective: Students will construct a visual pattern with six letters.

Materials: *Six-Dinner Sid* by Inga Moore
10 x 10 blank grid for students
10 x 10 blank transparency grid

Procedure:

1. Read the story to students.
   - Younger students will enjoy just listening to the story.
   - Older students will find the story amusing but may need a mathematical focus while listening. Suggestions for a focus include: What types of mathematics does this story bring to mind? What do you think the authors purpose was in using Aristotle Street and Pythagoras Place? How many times is the word 'six' used?
2. Remember it wasn't easy being 6 different people's pet. Sid had 6 different names to remember and 6 different ways to behave. His 6 names were: *Scaramouche, Bob, Mischief, Sally, Sooty*, and *Schwartz*. His 6 different behaviors were: *silly, rough and tough, naughty, smooch, swanky,* and *do a job*. Remembering that as Bob he had a job and that he was *naughty* as *Mischief* seemed easy, it was remembering the behaviors for *Scaramouche, Sally, Sooty*, and *Schwartz* that was difficult. To help himself he remembered these clues:
   - His longest name and his behavior with the longest name did NOT go together.
   - His behavior as Sally sounds like his name.
   - When he smooched he wasn't Scaramouche but his name did have two O's.

   Can you tell what behavior went with which name?
3. While you show this 5x5 matrix and questions on the overhead, have the students copy and label it.

behavior / name	silly	rough & tough	smooch	swanky
Scaramouche				
Sally				
Sooty				
Schwartz				

4. If this is the first time for students to use a matrix for solving logic problems, they will need to be guided. Read the first clue. Mark eliminations with an X and confirmations with a . If students are comfortable with using a matrix, the activity may be completed independently.
5. What behavior did Scaramouche use? [swanky]
6. Let's see what patterns the word 'swanky' will have on a 10 x 10 grid. Starting with the cell in the upper left-hand corner of a blank 10 x 10 grid, print each letter of the word SWANKY. Continue printing the word without skipping any cells.

S	W	A	N	K	Y	S	W	A	N
K	Y	S	W	A	N	K	Y		

7. What is the 6th letter in the word SWANKY? [Y] Place a marker on or shade the cell with the 6th letter in the word SWANKY.
8. Do you see a pattern? [Yes, diagonals.] Do you see a pattern in the columns? [Yes, every other column has the letter **Y**. In each of these columns the pattern is: **Y** N W **Y** N W **Y** N W....] Do you see a pattern in the rows? [The number of **Y**'s in each row forms a pattern, 1,2,2,1,2,2,1,2,2,.....] Do you see any other patterns? [Answers will vary.]
9. If the chart were extended down, could you predict where another **Y** would be located? [Yes, use the pattern **Y** N W **Y** N W or locate a **Y** move down 1 cell and to the right 2 cells to locate another **Y**.]

MAKING MATH MEMORABLE

This activity and the activities on pages 20-26 are part of the ESC Region XIII Making Math Memorable Staff Development Module written by Mary Alice Hatchett, the TCTM 1995 Leadership Award winner. This first activity requires that students read Six-Dinner Sid by Inga Moore and is appropriate for elementary students. The module extends activities from kindergarten through secondary mathematics.

Can you tell what behavior went with which name?

	silly	rough & tough	smooch	swanky
Scaramouche				
Sally				
Sooty				
Schwartz				

- His longest name and his behavior with the longest name did NOT go together.
- His behavior as Sally sounds like his name.
- When he smooched he wasn't Scaramouche but his name did have two O's.

S	W	A	N	K	**Y**	S	W	A	N
K	**Y**	S	W	A	N	K	**Y**	S	W
A	N	K	**Y**	S	W	A	N	K	**Y**
S	W	A	N	K	**Y**	S	W	A	N
K	**Y**	S	W	A	N	K	**Y**	S	W
A	N	K	**Y**	S	W	A	N	K	**Y**
S	W	A	N	K	**Y**	S	W	A	N
K	**Y**	S	W	A	N	K	**Y**	S	W
A	N	K	**Y**	S	W	A	N	K	**Y**
S	W	A	N	K	**Y**	S	W	A	N

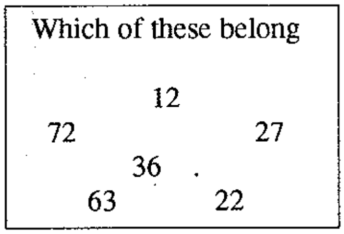
The 6iest of them ALL

Objective: Students will determine if a number is divisible by 6.

Materials: shoulder band
Which of these belong? transparency
Venn diagram

Procedure:

1. Place this diagram on the overhead:



Record student responses on the chalkboard or chart paper.

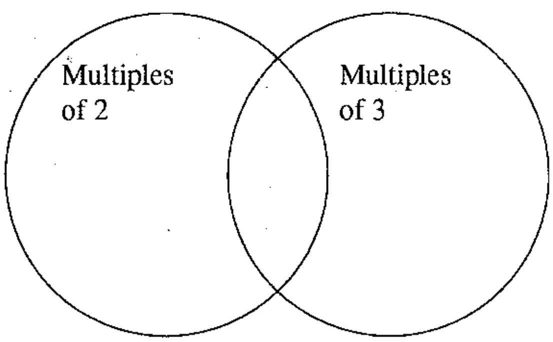
Be sure to solicit reasons for selection and conditions of selection.

[72, 36, 22, & 12 belong because (reason) **they are all even** (condition), **even numbers end in a 0,2,4,6, or 8 and they can be divided by 2 and not have a remainder.**

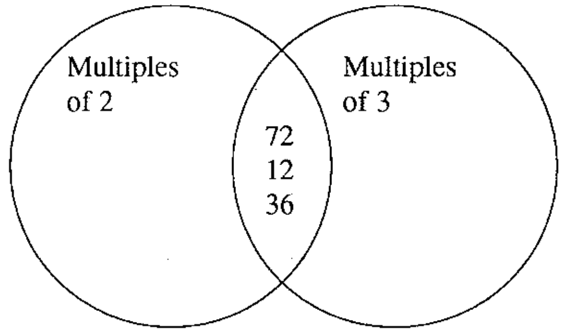
Other possible responses:

- 12, 36, & 27 belong because the ones place has a greater face value than the tens place.
- 72, 63, 36, & 27 belong because they are all multiples of 9.
- 72, 12, & 36 belong because they are all multiples of 6.
- 72, 12, 27, 36, & 63 belong because they are all multiples of 3.

2. Ask students to draw and label two overlapping circles like:



Into each circle write the numbers that meet that characteristic.



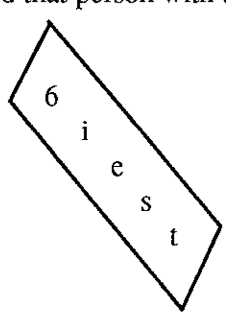
Why are 72, 12 and 36 placed where they are? [they are multiples of both 2 and 3.) Are they also multiples of anything else? [Yes, 6.]

3. If divisibility rules for 2 and 3 have not been verbalized, do so now.
   A number is divisible by 3 if the sum of its digits is a multiple of 3

4. Is 7,254 divisible by 6?
   Is it divisible by 2? How do you know? [It's even.]
   Is it divisible by 3? How do you know?
   7 + 2 + 5 + 4 = 18, a multiple of 3 [3x6=18]
   How about 4,472? [Yes, it's even and a multiple of 3.]
   How about 4,527? [No, it's not even.]

5. Try some 'personal' numbers. Which of these are divisible by 6?
   - The year you were born?
     1974 is even & 1 + 9 + 7 + 4 = 21, is a multiple of 3.
   - Your height in inches.
   - The number of years you have been teaching
   - Your telephone number.
   - Your social security number.
   - Your house number.
   - The number of letters in your full name.
   - Your driver license number.

6. ASK:
   How many have at least 1 'personal' number that is divisible by 6?
   How many have at lease 2 'personal' numbers that are divisible by 6?
   How many have at lease 3 'personal' numbers that are divisible by 6?
   How many have at least 4 "personal' numbers that are divisible by 6?
   [Continue until the 6iest person(s) is found]
   Reward that person with a 6iest shoulder banner.



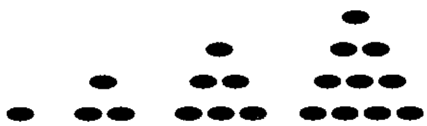
Hexagonal Numbers

Objective: Students will use the technique of finite differences to determine functions of consecutive figurate numbers.

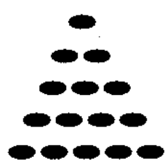
Materials: isometric dot paper
counters
overhead pattern blocks (for teacher)
100 chart

Procedure:

1. Place a triangle pattern block on the overhead.
   ASK: What type of *figure* is this? [triangle]
2. Build this sequence on the overhead as students build with counters:



   ASK: What type of *figure* is being build [triangle]
   How many counters in each figure? [1,3,6,10]
   [Label each figure as the count is reported.]
3. Predict the number of counters needed to build the next *figure*. [15]
   Build it:



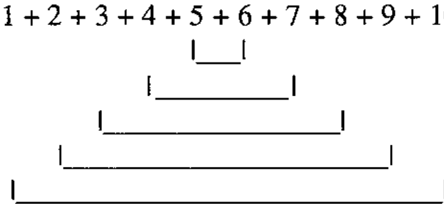
   ASK: These numbers have a special name, what do you think it might be? [TRIANGLE NUMBERS]
   Are these numbers on the 100 chart? [yes]
4. Cover or mark these triangle numbers on the 100 chart. [1,3,6,10, & 15]
   Look at the number of UNCOVERED spaces between each triangle number. [1 space, 2 spaces, 3 spaces, etc....]
5. Predict the number of spaces to the NEXT triangle number. [5 spaces]
   ASK: What is the next triangle number? [21]
   If 1 is the first triangle number and 3 is the second triangle number, what is 21? [The SIXTH triangle number]
   The sequence of uncovered spaces of are all multiples of ___ ? [1]
6. ASK: Have you ever heard of other numbers that are named after a figure? [square numbers]
7. Cover the first SIX square numbers on the 100 chart. [1,4,9,16,25,36]
   Look at the number of UNCOVERED spaces between each square number. [2,4,6,8,10]
   The sequence of uncovered spaces of are all multiples of ___ ? [2]
8. Another way to record and investigate these results is with a function table (After all, most of us don't carry a 100 chart around with us!).
   DRAW on the overhead:

triangle numbers

n	***T***	
1	**1**	(1)
2	**3**	(1 + 2)
3	**6**	(1 + 2 + 3)
4	**10**	(1 + 2 + 3 + 4)
5	**15**	(1 + 2 + 3 + 4 + 5)
6	**21**	(1 + 2 + 3 + 4 + 5 + 6) (or the sum of the counting numbers from 1 to *n*)
.		
.		
10		(so the tenth triangle number would be: 1+2+3+4+5+6+7+8+9+10)

9. Carl Friedrich Gauss at the age of 11 in 1787, found a easy way to find the sum of consecutive numbers. Pair the first and last, the second and next to last, etc. Find the sum of each pair.

1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 + 10



This results in 5 pairs (or 10/2) of 11 (94 10 + 1).
The sum of 1 to 10 then is 5 x 11 = 55
of (10/2) x (10 + 1) = 55
or in general (n/2) x (n+1) or $\frac{n(n+1)}{2}$

or written another way $\frac{1}{2}n^2 + \frac{1}{2}n$

10. ASK: What would the **100th** triangle number be?
   [(100/2) (100+1) = 50 x 101 = 5050]

11. Now lets look at a SQUARE number sequence:

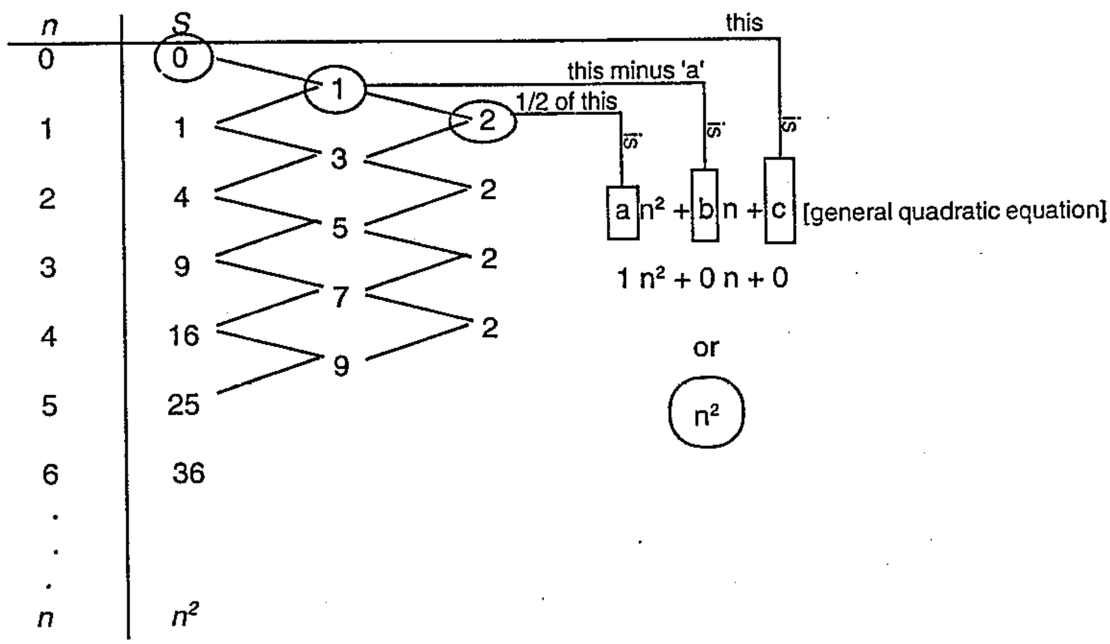
n	S	
1	1	(1)
2	4	(1 + 3)
3	9	(1 + 3 + 5)
4	16	(1 + 3 + 5 + 7)
5	25	(1 + 3 + 5 + 7 + 9) or (5/2)(9 + 1)
6	36	(1 + 3 + 5 + 7 + 9 + 11) or (6/2)(11 + 1)
.		
.		
.		
n	n^2	

Notice that (9+1) is a multiple of 5
and (11 + 1) is a multiple of 6.
What is

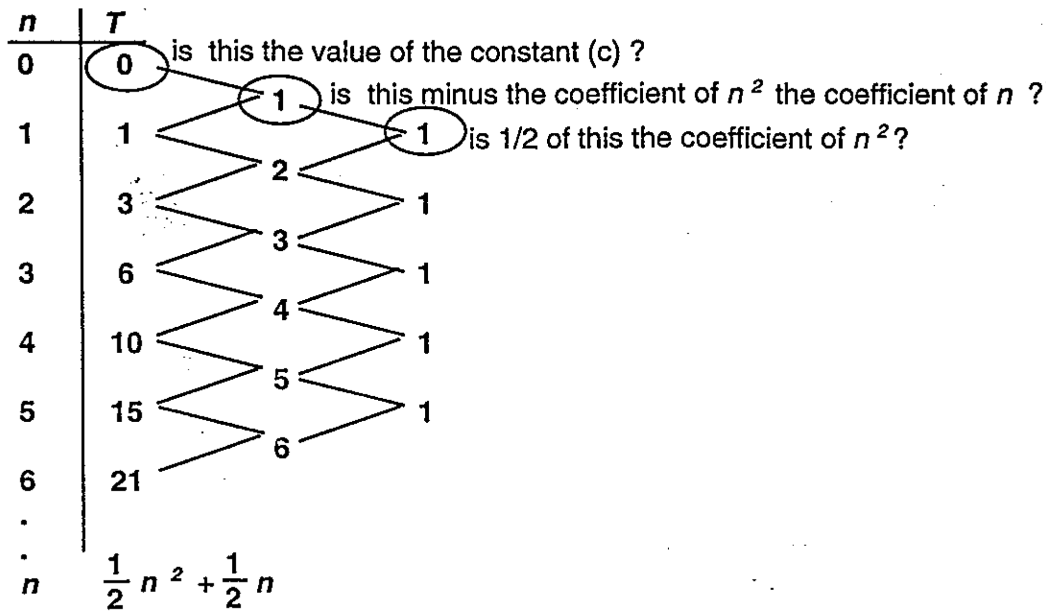
$$\left(\frac{5}{\cancel{2}_{1}}\right)\left(\frac{\cancel{10}^{5}}{1}\right)$$

or 5 x 5
or 5^2
or n^2 in general.

12. Another way to look at a SQUARE number sequence:



13. Go back and see if this hold true for a TRIANGLE NUMBER sequence.

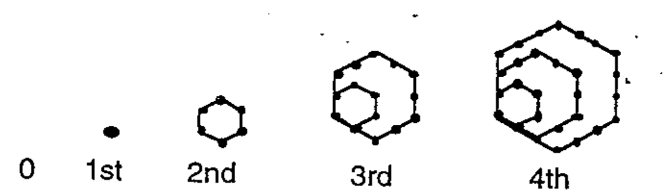


14. Write on the overhead as you say:

SEQUENCE
PATTERN
GENERAL RULE

By subtracting successive terms in a sequence we have found a new sequence. If we keep subtracting, we may get a common difference. From these two differences we have discovered a technique, a problem solving tool, for finding rules about number sequences.

15. Let's apply this knowledge to a SIX figure, a HEXAGONAL NUMBER sequence.
16. First draw the first few figures (using isometric dot paper helps, start in the middle of the paper so that you have room to build out)



17. Cover these numbers on the 100 chart. Look at the sequence of the number of uncovered spaces. [4,8,12] They are all multiples of 4.
18. Predict the 5th HEXAGONAL NUMBER.
(The 4th hexagonal # + the next multiple of 4 + 1 = the 5th hexagonal #.)
(28 + 16 + 1 = 45)

19. Next build a table:

n	H		
0	0		
		1	
1	1		4
		5	
2	6		4
		9	
3	15		4
		13	
4	28		
5			
6			
.			
.			
.			
n			

What connection does this number have to your findings on the 100 chart? [The number of uncovered spaces are multiples of 4.]

What's the rule ? [$2n^2 + (-1)n + 0$]

or

$2n^2 - n$

or

$n(2n - 1)$

20. Use the rule to find the **SIXTH** HEXAGONAL NUMBER. [6(2•6-1) = 6(11) = 66]
21. Can you tell the **100th** HEXAGONAL NUMBER? [19,999]
22. We have gone through how to find the general rule for any sequence which has a pattern that results in a common difference after the second subtraction. This shows that the general rule, or *nth* term, will be a <u>second degree</u> (quadratic) expression since the common difference came in the <u>second</u> subtraction. This is the technique called ***finite differences***. This technique DOES NOT lead to the solution of all sequence problems, nor is it always the best approach to a sequence problem. It is however, a very handy **problem solving tool** with which students will be fascinated.

Making Six

Objective: Students will 'count on' while making a transition from concrete to abstract numbers.

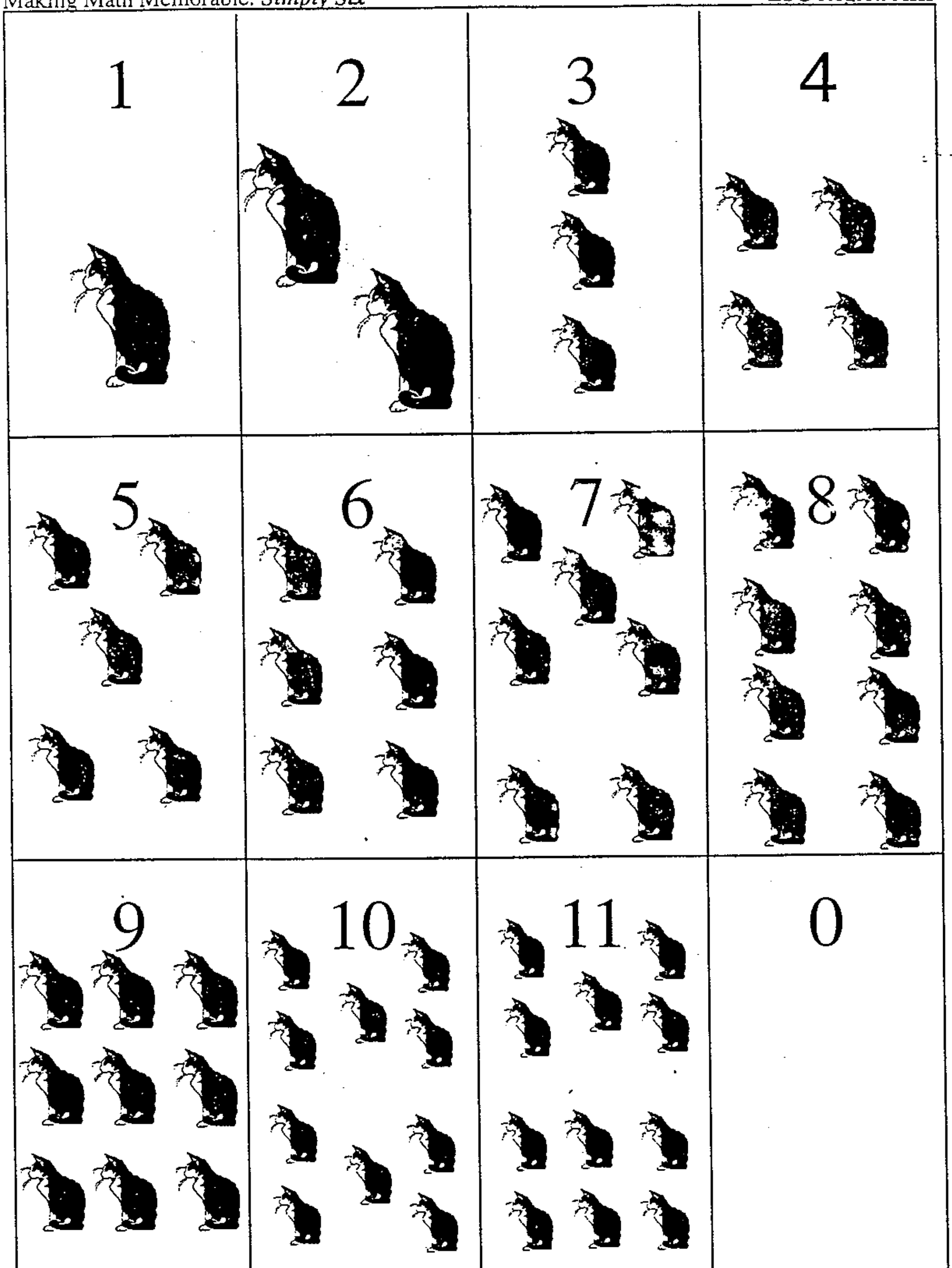
Materials: 28 cards: four each of the zero to six inclsive for each student (Making each set a different color helps with storing complete sets.)
3 minute timer

Procedure:

1. Have students sit in small groups (2-4 students)
2. Explain the procedures.
   EACH PLAYER:
   - Shuffle the cards and deal 8 cards face-up.
   - Place the rest of the cards facedown in a 'draw' pack.
   - Find 2 face-up cards that add to six.
   - Say the successful combination, "four and two makes six."
   - Place those 2 cards in a discard pile.
   - Replace the 2 empty places with 2 cards from the 'draw' pack.
3. No one starts until the group is told to turn over the timer.
4. If a student finishes before the timer is finished, they should stand.
   TEACHER NOTE:
5. Once all the cards from the 'draw' pack have been turned up, all the cards should have a match.
6. If any cards are left then at least 1 mistake has been made and a search through the discard pile should find it.

Extension:

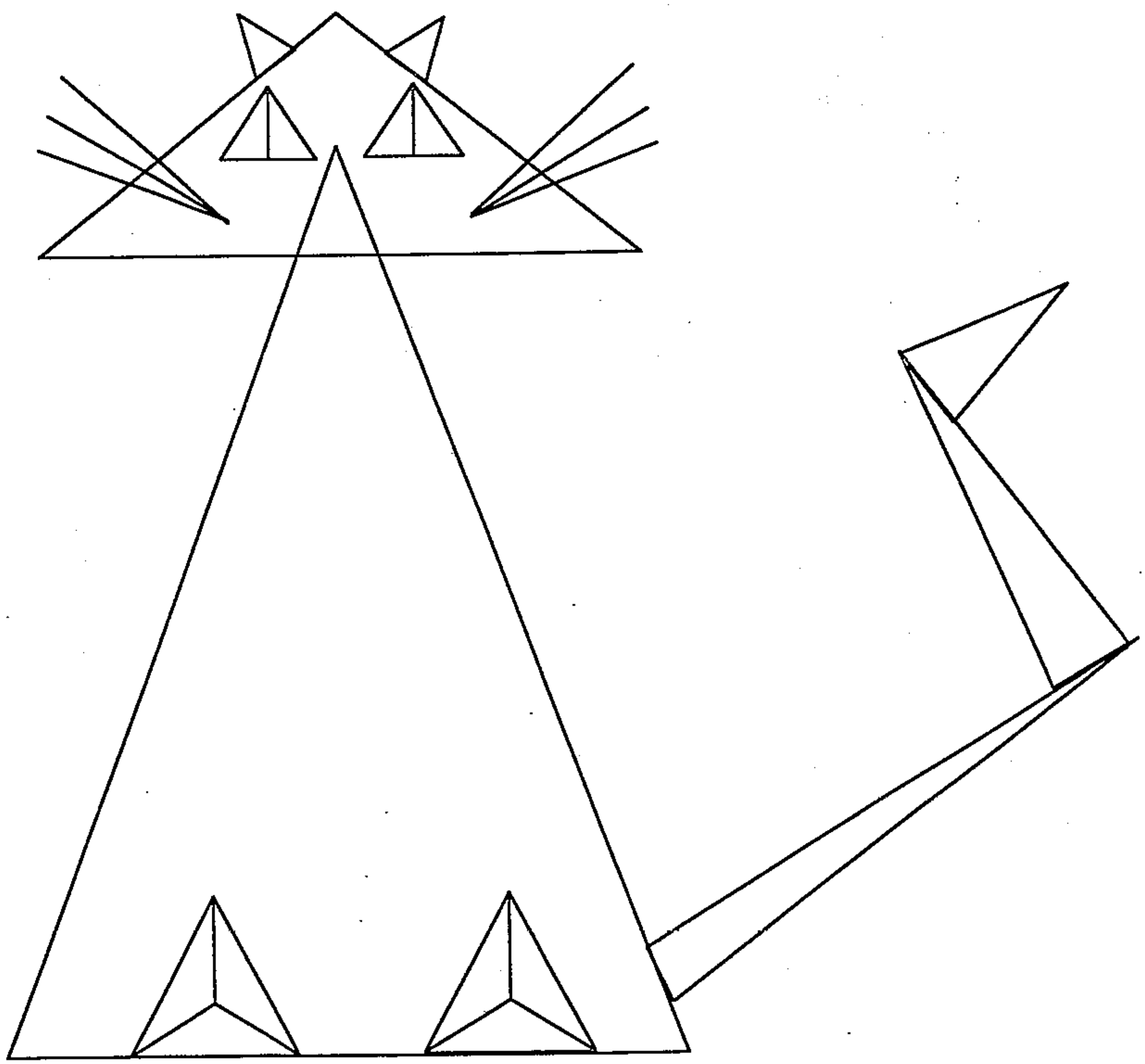
- Go to a 2 minute timer.
- Add in the 7's and find sums of 7; add in the 8's and find sums of 8; ..... ; remove the 1's and find sums of 13; remove the 1's & 2's and find sums of 14; ..... [keep at least 28 cards in play]



Make Six

FOUR COPIES

How many triangles are in the cat?



Measurement and Geometry

Ratios in Regular Polygons

Math Concepts

- fractions
- decimals
- linear measure
- ratio
- proportion
- segments
- polygons
- congruence
- similarity

Materials

- Math Explorer™
- **Ratios in Regular Polygons** recording sheets
- rulers and pencils

Overview

Students will use linear measurement and calculators to investigate the ratios between corresponding parts of regular polygons.

Introduction

1. Have students draw several triangles, compare their triangles with those of other students, and look for any similarities among all the triangles.

   Note: There should be very few similarities.

2. Next, have students draw several equilateral triangles, compare their triangles with those of other students and look for similarities.

   Note: They are all the same shape but different sizes.

3. Have students do the same experiment with rectangles, and then squares.

   Note: The rectangles come in all shapes; the squares are all the same shape but different sizes.

4. Introduce the term *similar figures* to mean "having the same shape but not necessarily the same size."

5. Give students the picture of several different-sized squares (see page 87). Have students measure the length of the diagonal and the perimeter of each square, record their findings on the recording sheet, and look for patterns.

6. Have students record the same data for other regular polygons of several different sizes and look for patterns. Regular hexagons, pentagons, and octagons are on page 87.

This activity is from Uncovering Mathematics with Manipulatives and Calculators Levels 2 & 3 by Jane Schielack and Dinah Chancellor. Although this activity was developed for use in the elementary grades, it could easily be adapted for use in middle school and high school geometry lessons. Reprinted with permission from Texas Instruments Incorporated.

Ratios in Regular Polygons (continued)

Collecting and Organizing Data

While students generate data for the different sets of similar figures, ask questions such as:

- How are all of these squares (or hexagons, pentagons, etc.) alike?
- How are you measuring the diagonals?
- How are you measuring the perimeters?
- How do you know your measurements are reasonable?
- Does it matter if you measure in inches or centimeters? Why or why not?
- What patterns do you see? Why do you think those patterns are occurring?

How can you use division with the calculator to help you look for patterns?

How can you use [F↔D] on the Math Explorer to help you look for patterns?

How can you judge if what you see on your calculator is reasonable?

How can you use the calculator and the patterns you see to help you predict measurements?

Analyzing Data and Drawing Conclusions

After students have made and compared several sets of measurements, have them discuss their results as a whole group. Ask questions such as:

- Did your data turn out exactly like everyone else's? Why or why not?
- What patterns do you see in your data?
- How are the diagonals and the perimeters of squares related to each other? Of regular pentagons? Of regular hexagons? Of regular octagons?
- From the patterns in your data, what conjectures can you make about measurements in similar figures?

What operations or keys did you use on the calculator to help you find patterns in this activity? Why did you choose those operations or keys?

How did you determine if your calculator results were reasonable?

Continuing the Investigation

Have students:

- Look for relationships between measurements of other parts of similar figures; for example, perimeter and area.
- Investigate similar figures other than regular polygons; for example, nonsquare rectangles that are the same shape, scalene triangles that are the same shape, etc.

Name:

Ratios in Regular Polygons

Recording Sheet

Collecting and Organizing Data

Polygon investigated:______________________________

Measurement of Perimeter	Measurement of Diagonal	Ratio of Perimeter to Diagonal	Ratio in Decimal Form

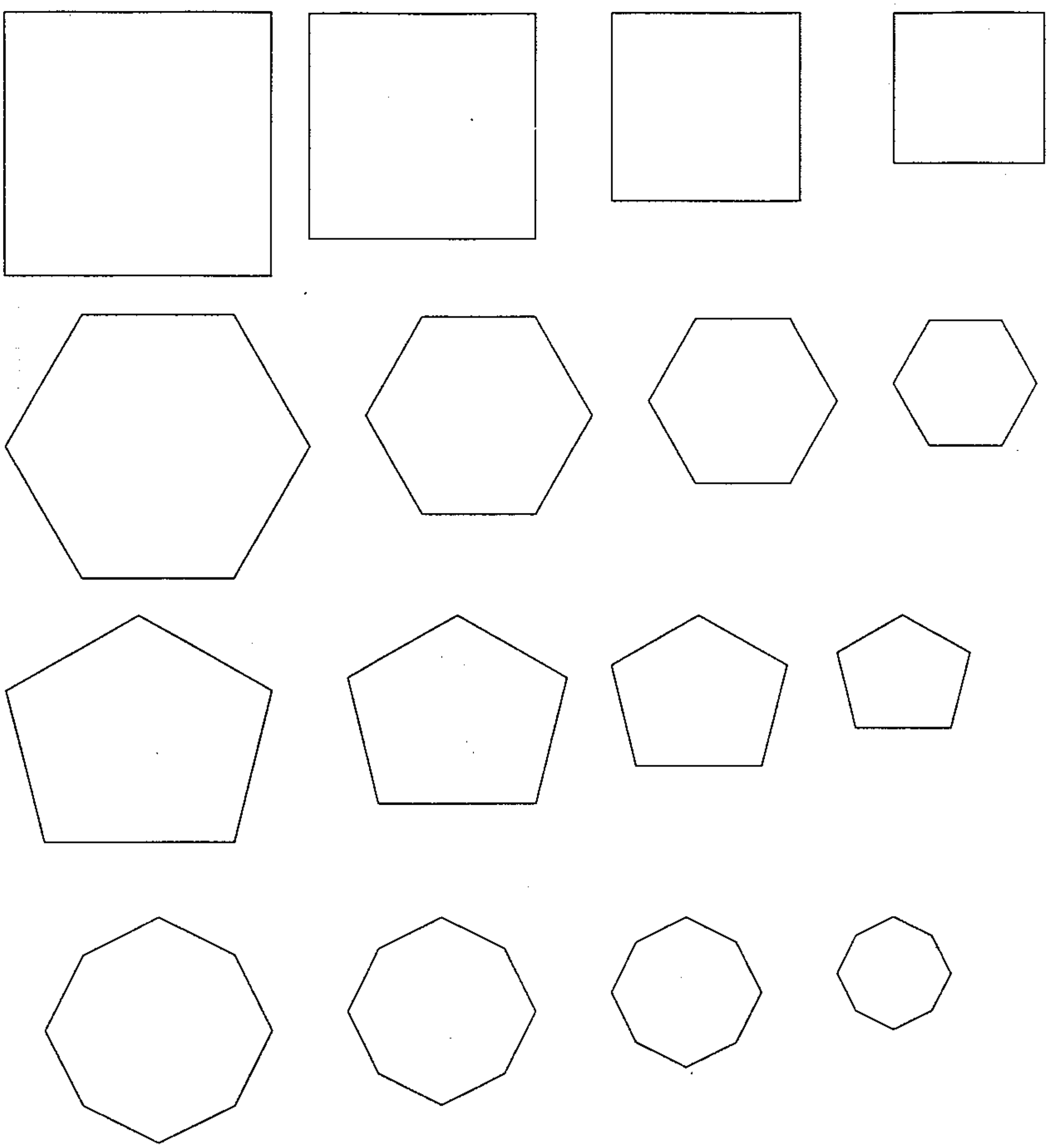
Analyzing Data and Drawing Conclusions

What we noticed about the ratios of the different-sized polygons:

Questions we thought of while we were doing this activity:

Ratios in Regular Polygons

Regular Polygons of Different Sizes



You are invited to a

Conference for the Preparation of the Secondary Mathematics Teacher

A Team For The Future

OCTOBER 3-5, 1996
Inn at Lake Travis, Austin, Texas

For the purpose of

- Strengthening communication and collaboration among higher education and secondary mathematics educators.
- Increasing awareness of secondary mathematics teaching issues
- Providing for discussion and implementation of the Texas Essential Knowledge and Skills for mathematics.
- Enhancing the preservice course for secondary content, methodology and cognitive issues.
- Previewing the TexTEAM Algebra Institute

Conference participants will consist of TEAMS of

- university or college representative from mathematics
- university or college representative from mathematics education
- a practicing secondary mathematics teacher
- a school administrator (district coordinator/facilitator, principal, superintendent, or department chairperson) from the university's area.

The Texas Statewide Systemic Initiative

For more information contact :

Pam Alexander
Rte 4 Box 5212
Nacogdoches, TX 75962
email: palexander @ sfasu.edu
Office phone: (409) 560-0903
Home phone: (409) 468-3805

Diane McGowan
4511 Langtry Lane
Austin, TX 78749
email: dmcgowan @tenet.edu
Office phone: (512) 414-2338
Home phone: (512) 892-4416

Texas SSI

What is the Texas SSI? The Texas Statewide Systemic Initiative is a major initiative of The Charles A. Dana Center for Mathematics and Science Education at The University of Texas at Austin. Though the SSI is located at the university, we are not a university project. Instead, the SSI is supported partially by grants from the National Science Foundation and the Texas Education Agency. The SSI is dedicated to providing local communities with the necessary tools to implement contemporary, rigorous, and engaging mathematics, science, and technology education for all their children. The SSI operates through broad-based leadership teams known as Action Teams that reflect the geographic, political, and ethnic diversity of Texas.

There are three big ideas of the Texas SSI: access, resources, and activists. Access is at the heart of the work of SSI. The major challenge for systemic reform is to find ways to be successful with every student. We believe this is a systems problem and not a kid problem. Thus, the major focus of the SSI is to change the system. An example of our work in this area is in algebra reform Traditionally, algebra has been a gatekeeper at the high school level for students. The SSI is actively working on changing this trend through the work of the Algebra Action Team.

This team, comprised of exemplary teachers, was formed to address the problem of access to algebra for all students in Texas. In July 1992 the State of Texas eliminated all remedial courses from the high school mathematics curriculum. This means that all students must pass algebra in order to graduate from high school. The Algebra Action Team was formed to address this issue and believes the solution lies in effecting change in mathematics from pre-kindergarten through ninth grade. The Action Team plans to write a position paper on what algebra course content should be in the 21st century for Texas students and to develop a "consumer guide" to algebra instruction that recommends effective strategies for teaching all students. The action team also plans to provide a resource book of professional development opportunities that reflect the effective strategies and to address the critical question of teaching schedules for algebra, i.e. the 90-minute block, the two-year course, double period, and other alternatives.

We at the SSI also recognize the importance of resources. We work with a knowledgeable staff with diverse experiences and we have connections to state and national networks in mathematics and science. The SSI attracts funding for innovation and is working to influence policy and public opinion.

The SSI is charged with delivering high quality mathematics for students in Texas and believes this is made possible by activists committed to making a difference. We are mobilizing large numbers of mathematics and science teachers, supporting conversation and collaboration, and are focusing on pivotal state and local issues such as algebra reform.

In addition to the work we do on algebra, the SSI also is working on issues such as the Texas Essential Knowledge and Skills (TEKS) and the professional development of teachers. The SSI is the contractor for the Mathematics and Science TEKS curriculum frameworks. When approved by the State Board of Education in late 1996, the TEKS will represent standards-based curriculum policy in mathematics and science and will be a powerful tool of the accountability system to influence classroom practice.

Based on research and feedback from hundreds of Texas mathematics faculty members, an SSI action team drafted "Guidelines for the Mathematics Preparation of Prospective Elementary Teachers." This document is receiving strong statewide support from mathematicians as well as mathematics educators who teach the relevant college-level preparatory courses.

The SSI not only is making progress through its action teams, but also ensures that there are connections among teams. For example, the Algebra Action Team has connected with the Mathematics TEKS Algebra/Geometry subteam and the Eisenhower Algebra Institute development team to align the work of the SSI in algebra. Connections will be made with the Professional Development Team to incorporate what is learned about effective professional development strategies into the publications and institutes in algebra. Also, the algebra work will be connected to the Mathematics Preservice Team to influence the content and pedagogy of college-level algebra courses for the preparation of teachers.

Mathematics Eisenhower Program in Texas Takes on a New Look

Jacquelyn Jimenez
TEXTEAM Coordinator

After several months of transition, the Texas Mathematics Staff Development Program is back on track and in Austin at The University of Texas at Austin's Charles A. Dana Center for Mathematics and Science Education, operating as a project of the Texas Statewide Systemic Initiative in Mathematics, Science, and Technology Education. The program has also changed its name to Texas Teachers Empowered for Achievement in Mathematics—TEXTEAM.

The program is part of the state level discretionary Dwight D. Eisenhower Professional Development Act, Title II, Part B. There are currently 37 modules covering various strands of mathematics education for grades PK-12. The program began in 1986 and has continued to grow every year. There are approximately 500 trainers across the state and we have trained more than 32,000 teachers with a cumulative module participation level of more than 53,000 module sessions. Modules range from twelve to thirty clock hours and are presented throughout the year and across the state.

In the coming year, we will be offering grant opportunities to support local professional development efforts. We will also host our annual University Forum in May. This forum provides university mathematics and mathematics education faculty an opportunity to participate in the program and to inform them of the current techniques being used by teachers in the classroom to ensure that preservice teachers are getting the most effective education possible.

Development of week-long institutes for grades 1-2, 3-5, 6-8, high school algebra, and high school geometry connecting good mathematics teaching with improved TAAS and End-of-Course performance is just about complete. Two rounds of training of trainers sessions will take place January through April 1996, for all institutes except for Geometry which will be ready for presentation in the summer. It is likely that some of the existing modules will be replaced with these new institutes. Other modules which can be used as supplementary to or in place of the institutes will remain in effect and continue to be revised as necessary.

If you would like more information on TEXTEAM or its programs, including descriptions of the modules and institutes, contact Jackie Jimenez at 512-471-5223 or e-mail at jjimenez @mail.utexas.edu.

Presidential Awards for Excellence in Science and Mathematics Teaching

1995 AWARDEES

The national winners in the National Science Foundations program to recognize excellence in the teaching of mathematics have been announced. The awardees in secondary and elementary were honored at week of activities in Washington, D.C. in March.

SECONDARY AWARD

JIMMIE RIOS, Kirkpatrick Middle School, Fort Worth, Texas , teacher of mathematics grade 6 and algebra

Jimmie has been a video demonstration teacher for the PBS Middle School Mathematics Project and Texas Cable Teacher of the Year. He has served on the NCTM Committee for the Comprehensive Mathematics Education of Every Child and the PBS Mathematics Advisory Committee. He made many staff development presentations to promote the NCTM standards and effective teaching practices.

ELEMENTARY AWARD

POLLY HAYNES, Kyle Elementary School, chapter I Math Improvement Grades 1-3

Polly has been a Chapter 1 Math Improvement Teacher since 1985. She has designed math lab activities to meet the growing needs of her campus. She has used At-risk adults to serve as tutors in her math lab. She is author of Money Math which teaches the beginning concepts of money for grades K-2. She has designed staff development presentations including Mathematics is Not a Quiet Place and Manipulating Our Vision, a Hundred Ways to Problem Solve.

National Teacher Training Institute Teacher Award

To support teachers utilizing and sharing what they learn at a National Teacher Training Institute one Austin-area NTTI participant is selected each year to receive the Texaco/Corporation for Public Broadcasting NTTI Teacher Award of $1000. Wayne Gable, Langford Elementary, Austin ISD first-grade teacher, was awarded the 1996 National Teacher Training Institute Teacher Award. Wayne was the 1990 Elementary Presidential Awardee and is one of the elementary mathematics editors of the TCTM journal. The NTTI award is presented to a teacher who is exemplary in strategies to effectively integrate video technologies in classroom mathematics and science instruction or in the training of teachers. Wayne was described by a colleague as "a skilled learning leader, knowledgeable about designing developmentally appropriate instruction and consistently implementing the very best teaching practices." He has served as a Master Teacher for three of the institutes. His lessons are also published in the January 1995 issue of Teaching. The fourth annual National Teacher Training Institute for Mathematics, Science and Technology was held over two days in Austin in February with more than 200 K-12 educators in attendance. NTTI is sponsored in Austin area by CURL-TV, the Region XIII Education Service Center, the College of Education at the University of Texas at Austin, Huston Tillotson College, and St. Edward's University. Other NTTI sites in Texas are in Dallas and in Corpus Christi. The NTTI is based on a teachers teaching teachers model. Teachers play a crucial role in the development and training process of the Institute; at the core of NTTI are the design and modeling of strategies and lessons by locally recruited master teachers. These master teachers are chosen for their math and science expertise as well as their proficiency in the interactive use of instructional video and associated technologies in the classroom. They serve as liaisons between the station and the education community—providing peer support for their districts and spreading the word about public television's wealth of instructional services and resources. For more information on this program educators may call NTTI in Austin at 512-475-9050.

Disney and McDonald's Mathematics Teacher of the Year

Cindy Boyd, a high school mathematics teacher from Abilene, has been honored by the Disney and McDonald's Teacher Awards program as the Mathematics Teacher of the Year. She received an expense-paid trips to Disney World and to Washington, D.C. and a $2,500 check for her school. Cindy is well-known for her staff development presentations, her active involvement in mathematics education in Texas, and her innovative and enthusiastic approach to mathematics teaching. She currently serves as NCTM Services Committee Representative for the Southern Region-2 , chairperson of the Algebra Task Force, and a member of the committee to develop the Texas Essential Knowledge and Skills for algebra. She has also been honored as an Outstanding Mathematics Educator by the Texas Academy of Science in 1995 and a Texas Presidential Award state winner in 1994 and 1995.

For more information on the awards, contact The Walt Disney Company and McDonald's Present The American Teacher Awards, P.O. Box 9805, Calabasas, CA 91372.

T^3-Teachers Teaching with Technology

TEACHING WITH TECHNOLOGY (T^3) HEADQUARTERS MOVES TO TEXAS

T^3 is a training program for K-12 teachers of mathematics presented by teachers like yourself. The T^3 movement began with Professors Bert K. Waits and Franklin Demana of The Ohio State University in 1987 when the first precalculus (C^2PC) summer institutes were held. In recent years, the program has expanded to include 12 different institutes that address the use of calculators in elementary, middle and high school mathematics classes. The goal of each institute is to provide teachers with knowledge of the latest Texas Instruments calculators appropriate for the grade level or subject they teach. During the institute, teachers receive hands-on experience and classroom activities that will enable them to effectively integrate what they've learned into their own lessons.

In 1990, Texas became one of the first states outside of Ohio to sponsor T^3 Institutes. Over the past eight years, 2500 Texas teachers have attended T^3 Institutes. In October 1994 the Teachers Teaching with Technology (T^3) program headquarters moved from The Ohio State University to The University of Texas at Arlington. Bonnie McNemar, who was instrumental in bringing the first T^3 institutes to Texas, now serves as the national T^3 program coordinator. She is assisted by Renee Hartshorn, formerly associated with T^3 at The Ohio State University. The 1995 Summer Institute Program delivered 211 institutes in 42 states to over 6,000 teachers. During the summer of 1996, the T^3 program will offer institutes in 47 states at some 200 locations including at least ten in Texas! For full details on all offerings, contact the T^3 office.

Teachers Teaching with Technology (T^3)
Department of Mathematics
The University of Texas at Arlington
Box 19408
Arlington, TX 76019
e-mail: t-cubed@ti.com
Web site: http://www.ti.com/calc/docs/t3.htm

E. Glendadine Gibb Award TCTM Leadership Award Affiliated Group Award

TCTM began an awards program in 1995 to honor those who have contributed to the enrichment of mathematics education in Texas and in the nation. The first awards were presented at the CAMT banquet on August 4, 1995 in San Antonio. Dr. Iris Carl was presented the E. Glenadine Gibb Achievement Award. This award is named in honor of Dr. Glenadine Gibb, who was the first Texan to be president of the National Council of Teachers of Mathematics and was a professor of mathematics education at the University of Texas at Austin.

Mary Alice Hatchett, Region XIII consultant, was awarded the first Texas Council of Teachers of Mathematics Leadership Award. Mary Alice was nominated by the Austin Area Council of Teachers of Mathematics. She was honored for her contributions to the mathematics teachers of Central Texas and the state.

The Affiliated Group Membership Improvement Award will be presented this year for the first time to the Texas affiliated group which can demonstrate the greatest improvement in member enrollment from 1995 to 1996.

Applications for these awards are included in this edition of the journal.

Prentice Hall Senior Scholarship Application

The application for the Prentice Hall TCTM scholarships for graduating seniors is included in this journal. Please copy and nominate a graduating senior who plans to become a secondary mathematics teacher or an elementary teacher who will focus on mathematics.

A $2000 donation has again been presented by Simon and Schuster, the parent company of Prentice Hall and the publishing operation of Viacom, Inc.

Reports from the Local Councils

Reports are included from the councils who responded to a call for information on the local affiliated NCTM groups. If your council is not included, it is because no information was sent. If you would like to have information from your council included in this column, please send the information by August 15 to Diane McGowan, 4511 Langtry Lane, Austin, TX 78749-1674 or e-mail dmcgowan @ tenet.edu.

The **Austin Area Council's** spring conference was held March 2 at McCallum High School in Austin. Over 150 educators participated in sessions on probability, discrete mathematics, and calculators. Region XIII Making Math Memorable Team (Mary Alice Hatchett, Linda Shaub, Wayne Gable, and Karen Lindig) presented mathematical concepts extending from kindergarten to grade 12. One of these activities is included in this edition of the journal. Dr. James W. Hunt, Southwestern University, Georgetown, was the luncheon keynote speaker with a presentation on using unifix cubes to teach number bases. The next meeting of the council will be in May.

The **Greater Dallas Council** of Teachers of Mathematics fall meeting at the Professional Training Center of

Carrollton-Farmers Branch ISD featured guest speaker Dr. Bert Waits of the University of Texas at Arlington and Ohio State University. The topic presented was "The TI 92- the Next Revolution" The Wm. McNabb Mathematics Competitions are hosted by GDCTM at Plano High School. The fall exams were November 11, grades 9-12 and December 2, grades 7-8. The spring exams will be on May 4, 1996 for grades 7-8 and grades 9-12.

The spring meeting of the GDCTM will be the Annual Student Awards Banquet, Thursday May 16, 1996. The awards will be presented to the student winners of the fall and spring competitions.

The **Rio Grande Council** annual RGCTM conference was held on December 2 at Mercedes High School. Specific information on the activities was not provided.

The **Texas South Plains Council** plans its spring meeting on April 27. For more information contact Bill Armstrong, Monterey High School, 3211 47th Street, Lubbock, 79413, Lubbock 9413, 806-766-0700, email billa@tenet.edu.

Calendar

April 25-28, 1996	National Council of Teachers of Mathematics 74th annual meeting, San Diego
April 27, 1996	Texas South Plains Council spring meeting
May 4, 1996	Greater Dallas Council Wm. McNabb Math Competitions, Plano High School
May 9, 1996	Austin Area Council of Teachers of Mathematics spring meeting at Holt Rinehart Winston headquarters, Austin
May 16, 1996	Greater Dallas Council Annual Student Awards Banquet
August 1-3, 1996	Conference for the Advancement of Mathematics Teaching, Dallas

CAMTERSHIP APPLICATION

Six $100 "CAMT"erships will be awarded to first-year teachers who are members of TCTM. The money is intended to help cover expenses associated with attending CAMT, and to encourage new teachers to attend CAMT. Two CAMTerships each will be awarded to teachers in grades K - 4, 5 - 8, and 9 - 12. Winners will be determined by random drawing of names, and will be notified by June 20. Winners will be asked to work for two hours at registration or NCTM material sales, and will be TCTM's guest at our breakfast, where the checks will be presented. GOOD LUCK!!!

Name____________________ Phone ____________________

Home Address____________________ City, zip ____________________

School____________________ Grade(s) taught ____________________

School Address____________________ School Phone ____________________

Principal's Name ____________________ Are you a member of TCTM ? __________
Note: If you are not a member of TCTM, you may enclose $10 with this application to apply for membership.

Are you completing your first year of teaching?__________

What are your teaching responsibilities? ____________________

____

Send your completed application by **May 30** to
Diane McGowan , 4511 Langtry Lane, Austin, TX 78749-1674

Copy this ballot, vote, and mail by May 30

TEXAS COUNCIL OF TEACHERS OF MATHEMATICS
1996 BALLOT

Vote for one in each category by placing an X in the space beside the name. Vote for the Regional Director in your Educational Service Center region. The directors for Northeast and Northwest regions will be elected in 1996. Mail your ballot to Pam Wisdom no later than MAY 30.

Pam Wisdom
3508 Gary Drive
Plano, TX 75023

NORTH WEST REGIONAL DIRECTOR:
(ESC 9, 11, 14, 16, 17 only, please)

_________ Cathy Dacy
Abilene ISD

_________ Edith Hays
Texas Woman's University

NORTH EAST REGIONAL DIRECTOR:
(ESC 6, 7 , 8 ,10, 12 only, please)

_________ Olene Brame,
Washington Arts High School
Dallas ISD

_________ Carole Lipton,
Dealey Montessori, Dallas

VICE PRESIDENT FOR ELEMENTARY:

_________Amy Craig
Canutillo ISD, El Paso

_________ Mary Jane Smith
Fort Bend ISD

SECRETARY:

_________ Ginger Doss
Katy ISD

_________ Carol Williams
Abilene Christian University

AFFILIATED GROUP MEMBERSHIP IMPROVEMENT AWARD

NAME OF AFFILIATED GROUP_________________________________

PRESIDENT_________________________________

ADDRESS _________________________________

NUMBER OF MEMBERS IN 1994-1995 SCHOOL YEAR ________

NUMBER OF MEMBERS IN 1995-1996 SCHOOL YEAR ________

PERCENT OF INCREASE FROM 1993 TO 1995_________

Send this completed form along with a membership role for each of the indicated years by June 15 to Diane McGowan, 4511 Langtry Lane, Austin, TX 78749-1674

The award to the group with the highest percent of improvement will be prsented along with $50 at the TCTM breakfast at CAMT.

TEXAS COUNCIL OF TEACHERS OF MATHEMATICS PRIVATE

MATHEMATICS SPECIALIST SCHOLARSHIP

Amount: $1000 or $500

Application Deadline: June 15, 1996

Eligibility: Any student who graduates in 1996 from a Texas High School - public or private - and who plans to enroll in college in the Fall of 1996 to pursue a career in mathematics teaching either as a mathematics specialist in elementary school or as a secondary school teacher with certification in mathematics.

Return all materials in one envelope to:

Diane McGowan
4511 Langtry Lane
Austin, TX 78749

NAME: ____
Last First Middle

Address:____
Number and Street Apt. Number

____
City Zip Code

Phone Number: (________) - ______________________

Birth date: ______________________________

Social Security Number: ___ ___ ___ ___ ___ ___ ___ ___ ___

High School(s) Attended:

What college or university do you plan to attend? If you are awarded this scholarship, TCTM's treasurer will send a check directly to the business office of the college. We need the college's complete address.

To apply, enclose the completed application with each of the following in the same envelope and mail to Diane McGowan at the address listed above. **YOU MUST INCLUDE 3 COPIES OF ALL REQUIRED MATERIALS.**

1. List High School Activities including any leadership positions on a separate sheet,
2. Official High School Transcript,
3. Letter of recommendation from a TCTM member,
4. An essay describing your early experiences learning mathematics and any experiences explaining mathematics to your classmates or friends. This essay must be no more than two pages, double spaced.
5. An essay telling why you want to be a mathematics specialist in elementary school or a mathematics teacher in middle or high school. This essay must be no more than one page, double spaced.

CAMT MEMBER PARTICIPATION FORM

CAMT REGISTRATION DESK

Times Needed:

July 31, Tuesday evening - (5:00 - 9:00)
Diane McGowan in charge

August 1 , Wednesday a.m. - (7:00 a.m. - 12:00 noon)
Northeast region (ESC 6, 7 , 8 ,10, 12) Frances Thompson in charge

August 1, Wednesday p.m. - (12:00 - 4:00 p.m.)
Northwest region (ESC 9, 11, 14, 16, 17) Cindy Boyd in charge

August 2, Thursday a.m. - (7:00 a.m. - 12:00 noon)
Southwest region (ESC 1, 15, 18, 19 , 20) Nora Munguia in charge

August 2, Thursday p.m. - (12:00 - 4:00 p.m.)
Southeast region (ESC 2,3,4,5, 13) Evelyn Dixon in charge

August 3, Friday a.m. (7:30 - 10:00 a.m.)
Dallas-Fort Worth non-TCTM members

NCTM MATERIALS SALES - PEOPLE NEEDED THROUGHOUT THE CONFERENCE

CAMT MEMBER PARTICIPATION

Name ____

Home Address ______________________________ ESC region ______

City, zip ________________________ Phone ________________

School, District, or Professional Affiliation ________________________

__________ Enclosed find my $5.00 check for the breakfast reservation.

__________ I can help at registration or NCTM materials booth.

I would like to help (please indicate your three choices in order of preference)

Note: If you cannot help during the indicated time for your region, you may help at any time. A two hour time period would be appreciated. We willl try to assign you your preferrred times.

________________ (day) from ____________ to ____________.

________________ (day) from ____________ to ____________.

________________ (day) from ____________ to ____________.

Please indicate times when you cannot work due to speaker or presider duties.

Tickets to the breakfast and confirmation of your registration or NCTM materials booth assigment will be mailed to you at home on or about July 20.

Send this form no later than July 1 to: Diane McGowan , 4511 Langtry Lane, Austin, TX 78749-1674

Glenadine Gibb Achievement Award
APPLICATION

This award will be presented at the CAMT luncheon to a person who has contributed to the improvement of mathematics education at the state and/or national level.

Information about the person nominating a candidate:

Name ____

Home Address ____

Home phone ______________________ Business phone ______________________

Are you a member of TCTM? _______ NCTM? _______

Information about the person being nominated:

Name ____

Home Address ____

Home phone ______________________ Business phone ______________________

Is the nominee a member of TCTM? _________ NCTM? ___________

Please include an essay of no more than one page double spaced to indicate why this person should be honored for his or her contribution to the improvement of mathematics education at the state and/or national level.

Include the following information about the professional activities of the nominee:

- local , state, and national offices held
- local, state, and national committees on which nominee has served
- staff development activities
- involvement at the state or national level in TCTM or NCTM.
- any activities which have promoted the improvement of mathematics education in Texas and the nation.

Send the completed application and essay by June 15 to
Diane McGowan, 4511 Langtry Lane, Austin, TX, 78749-1674

TCTM LEADERSHIP AWARD
APPLICATION

This award will be presented at the CAMT luncheon to a person who has contributed to the improvement of mathematics education at the local level.

Information about the of Affiliated group nominating a candidate:

Name of Affiliated Group ______________________________

Name of President of the Affiliated Group ______________________________

Home Address ______________________________

Home phone ______________________________Business phone______________________________

Are you a member of TCTM?_______ NCTM?_______

Information about the person being nominated:

Name ______________________________

Home Address ______________________________

Home phone ______________________________Business phone______________________________

Is the nominee a member of TCTM?________NCTM__________

Please include an essay of no more than one page double spaced to indicate why this person should be honored for his or her contribution to the improvement of mathematics education at the local level. Include the following information about the professional activities of the nominee

- affiliated group math council offices held
- affiliated group math council committees on which nominee has served
- description of staff development presentations or innovative lessons.
- comments on how the nominee has encouraged involvement in your local organization
- activities which have contributed to the improvement of mathematics education in your area.

Send the completed application and essay by June 15 to
Diane McGowan, 4511 Langtry Lane, Austin, TX, 78749-1674

Texas Council of Teachers of Mathematics

Last Name	First Name	School	(Leave Blank)

Street Address	City	State	Zip

Dear Teacher,

To ensure continuous membership, please print your name, zip code,and school above. Enclose this card with your check for $10.00 for one year payable to T.C.T.M. and mail to:

Barbara Polnick
Treasurer
#3 Ridgeway Rd., Woodgate Place
Conroe, TX 77303

____ Renewal ____ New ____ Change of Address

Circle Area(s) of interest: K-2 (STEAM) 3-5 (STEAM) 6-8 9-12 COLLEGE

Cut on dotted line

Journal contributions must be mailed by August 1 to be included in the next journal.

Please note that the TCTM board voted to increase the dues to $10 to support the journal, government relations activities, CAMTerships, student scholarships, leadership conference, and the continued involvement of TCTM in the mathematics activities in Texas and the nation. This change is effective on November 1, 1995.

Cut out your TCTM membership card.
Please note the expiration date on your mailing label.
Renew your membership before that date.

TEXAS COUNCIL
OF
TEACHERS OF MATHEMATICS

Member 1995-1996

NAME ______________________________

TEXAS MATHEMATICS TEACHER
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