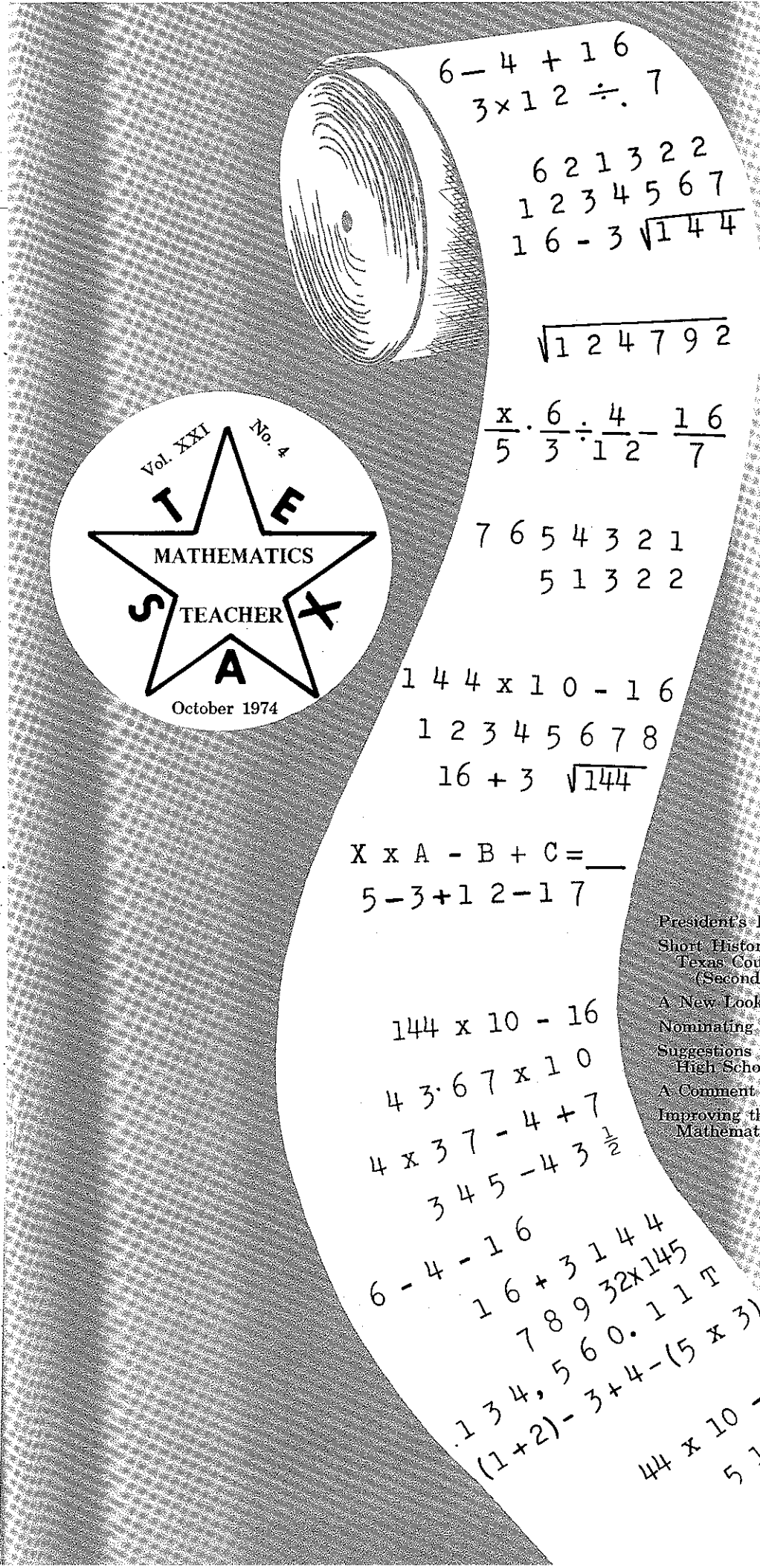

Vol. XXI No. 4

TEXAS MATHEMATICS TEACHER

October 1974

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TEXAS MATHEMATICS TEACHER is the official journal of the Texas Council of Teachers of Mathematics. The views expressed are the contributor's own and are not necessarily those of the publisher or the editor. All manuscripts and correspondence about this publication should be addressed to Mr. J. William Brown, *Texas Mathematics Teacher*, 100 So. Glasgow Drive, Dallas, Texas 75214.

TEXAS MATHEMATICS TEACHER is published quarterly by the Texas Council of Teachers of Mathematics. Payment of membership fee of $3.00 entitles members to all regular Council Publications.

President's Message

It's good to be "back in the swing" again! Everyday, as opportunities present themselves, we should each one be cognizant of the influence we may have on boys and girls and youth and be sure that this influence points toward preparing these young people to be productive members of society.

Many things are happening in mathematics across the state. Check the dates published in this journal and in the *Texas Outlook* and take advantage of opportunities for personal professional development. The state mathematics meeting is scheduled November 21-23, 1974 in Austin. Plan now to attend.

Rising costs in paper and printing have necessitated an increase in the membership dues. The dues, now $5.00 per year, goes mainly to support the cost of producing the journal. The favorable comments we have received from you help us to know you want the journal to continue. In order to do this, more income is necessary. Many of our book company friends are assisting us by purchasing advertising in the journal. Please notice their ads and express your appreciation to them as you see the representatives.

The metric system will be with us—sooner than we anticipate, perhaps. The fact that the house bill was rejected simply indicates that bill as written was not satisfactory. Another bill will be presented and may provide less phase-in time than previously anticipated. We are urged to assist in preparing for the use of metric measurement. Continue to move forward with your classes in this area.

It has been my pleasure to serve as you president these two years. It is impossible to "keep things moving" in mathematics across the state unless you assist by corresponding with us through this journal. We encourage you to write to our editor and share the mathematics happenings in your area.

I'd like to express my personal thanks to the executive committee who has helped in so many ways. We pledge our continued support to the incoming president, Bill Ashworth, and his executive committee.

See you in Austin in November!

Dates and Items to Remember

1. 21-23 November 1974—Austin, Texas: Conference for the Advancement of Mathematics Teaching; this is the state mathematics meeting. Be sure to come!!!

2. 17-18 October 1974—Memphis Area Council of Teachers of Mathematics will host the Memphis Meeting of NCTM at the Southern Peabody Hotel.

3. 23-26 April 1975—NCTM 53d Annual Meeting, Denver Colorado

4. You are invited to participate in the 1975 high school mathematics contest sponsored by the Mathematical Association of America and the National Council of Teachers of Mathematics. For information and entry forms, write to: Dr. James R. Boone, Regional Chairman of High School Mathematics Contest, Department of Mathematics, Texas A&M University, College Station, Texas 77843.

SHORT HISTORY OF TEXAS COUNCIL OF TEACHERS OF MATHEMATICS

(SECOND OF THREE INSTALLMENTS)

In six years the Texas Council of Teachers of Mathematics became a strong organization and a strong influence on the teachers of mathematics in Texas. In October, 1958, the Texas Council acted for the first time as one of the co-sponsors for the annual conference for the Advancement of Science and Mathematics Teaching which was held in Austin.

The 1958 meeting was held in Fort Worth. The speaker was Dr. Glenadine Gibb of Iowa State Teachers College. Dr. Gibb also addressed the Arithmetic Section, and Dr. W. T. Guy of the University of Texas was the speaker for the Mathematics Section.

The President's Report at this meeting noted that two issues of the Texas Mathematics Teacher had been published with Kenneth Mangham of San Angelo as the editor. Other information in the President's Report noted that the total membership of the Texas Council of Teachers of Mathematics was three hundred and sixty-eight (368).

Officers who served during 1958-59 were President Mozelle Schulenberger, Cleburne; First Vice-President Keene C. Van Orden, San Angelo; Second Vice-President Dr. Frances Flournoy, Austin; Secretary-Treasurer Ruby K. Jones, Odessa; and Publications Editor Kenneth Mangham, San Angelo.

The Texas Council of Teachers of Mathematics met in San Antonio for the November, 1959, meeting. Dr. Herbert F. Spitzer, State University of Iowa, gave the address at the luncheon and the Arithmetic Section. A committee from the Texas Mathematics Study Commission presented the program at the meeting of the Methematics Section.

The officers elected to serve in 1959-60 were as follows: President Keene C. Van Orden, San Angelo; First Vice-President Dr. Frances Flournoy, Austin; Second Vice-President Elva A. Lerret, Fort Worth; Secretary-Treasurer Ruby K. Jones, Odessa; Publications Editor J. William Brown, Dallas.

At the meeting in Corpus Christi in 1960, the following officers were elected to serve in 1960-61: President Dr. Frances Flournoy, Austin; First Vice-President Elva A. Lerret, Fort Worth; Second Vice-President J. B. Lowe, Amarillo; Secretary Ruby K. Jones, Odessa; Treasurer George A. Hunt, Odessa; Publications Editor J. William Brown, Dallas. Dr. William T. Guy, University of Texas, Austin, was elected to serve as Director of the National Council of Teachers of Mathematics. Mozelle Schulenberger was elected as Representeative and Keene C. Van Orden was elected to serve as Southwestern Regional Representative.

At the meeting in Houston in 1961, the following members were elected to serve as officers for the year 1961-62: President Elva A. Lerret ,Fort Worth; First Vice-President J. B. Lowe, Amarillo; Second Vice-President Maurine Aldrich; Secretary Ruby K. Jones, Odessa; Treasurer George R. Hunt, Odessa; Publications Editor J. William Brown, Dallas. Mozelle Schulenberger was elected to serve as NCTM Representative, and Keene C. Van Orden was elected to serve as Southwestern Regional Representative of NCTM.

The Texas Council of Teachers of Mathematics met in Austin in 1962. The officers who served in 1962-63 were President J. B. Lowe, Amarillo; First Vice-President S. George Shropshire, Wichita Falls; Second Vice-President Raoul Munoz, Jr., Houston; Secretary Ethlene Collins, Houston; Treasurer George R. Hunt, Odessa; Publications Editor J. William Brown, Dallas. Mozelle Schulenberger, Cleburne, served as Representative for NCTM; and Keene C. Van Orden, San Angelo, served as Regional Representative for NCTM.

In 1963 the Texas Council of Teachers of Mathematics met in Fort Worth. The officers who served in 1963-64 were as follows: President Raoul Munoz, Jr., Houston; First Vice-President W. K. McNabb, Dallas; Second Vice-President Jessie McClain, Houston; Secretary Ethlene Collins, Houston; Treasurer George R. Hunt, Odessa; Publications Editor J. William Brown, Dallas; NCTM Representative Mozelle Schulenberger, Cleburne; Southwestern Regional Representative Keene Van Orden, San Angelo.

On December 26-28, 1963, the National Council of Teachers of Mathematics met in San Angelo, Texas.

The officers of the Texas Council of Teachers Methematics for 1964-65 were President W. K. McNabb, Dallas; First Vice-President Lois Reynolds, Spring Branch; Second Vice-President Edith Moreland, Houston; Secretary Lois Crawford, Dallas; Treasurer George Hunt, Odessa; Publications Editor J. William Brown, Dallas; Parliamentarian Natalie Divan, Beaumont; NCTM Representative Mozelle Schulenberger, Cleburne; Southwestern Regional Representative Keene C. Van Orden, San Angelo.

The Texas Council of Teachers of Methematics, in conjunction with the Committee of Affiliated Groups of the National Council of Teachers of

(Continued on Page 9)

Junior High School . . .

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A NEW LOOK AT AN OLD PROBLEM

ROBERT K. BLOMSTEDT

Teacher Center Project Director
Texas A & I University

There are always problems in education. One problem, like taxes, seems constant. This problem, the inadequacy of teacher preparation for the teaching of elementary school mathematics, is deserving of a high rating on any listing of priority items in need of concentrated correctional efforts. At a time when the results produced by "modern matematics" after several years of implementation in the classrooms are being scrutinized and criticized, it is essential that the area of the degree of preparation and competence of the teacher be examined anew. Observations and research related to this topic produce some rather significant findings.

Numerous references to this particular problem are found in the *Arithmetic Teacher*. Francis J. Mueller, in the January, 1968, issue, quotes studies by Grossnickle, by Ruddell, by CUPM, by Creswell, and by Reys to support the claim that the preparation of elementeary teachers is deficient for teaching mathematics. He contends that the CUPM studies show a lack by teacher training institutions in implementeing even minimmal CUPM recommendations, that the Reys study shows that teachers are dissatisfied with their training, and that the Creswell study indicates that even after extensive in-service efforts, many teachers scored less on tests in mathematics than sixth grade student in their own schools. Melson, in the January, 1965, issue, and Smith, in the March, 1967, issue, support this claim of deficient training. Brousseau in April, 1971, quotes studies that indicate teachers do not have a clear understanding of what is attempted to be accomplishcd in thc total elementary school mathematics program; and Kipps, in the February, 1970, issue, contends that teacher training in geometry is very sparse.

In addition to these studies, if achievement is used as a singular criterion, a recently completed study by the Texas Education Agency with sixth graders in Texas, indicates a severe deficiency in the attainment of certain basic mathematics objectives. The study also reveals numerous differences in what public school teachers and the mathematics experts consider to be basic.

Blomstedt, in the June, 1970, issue of the *Texas School Board Journal*, reviewed his study in which he found that eighty-seven percent of the one-hundred-fifty teachers surveyed had no more than three semester hours of college training in any kind of "modern mathematics" courses and that approximately one-third had none. Experientially, he has also found, in teaching university mathematics methods courses, that only about three percent of his students specialize in mathematics, that only approximately thirty percent have had any prior university courses in mathematics, and that attitudes toward mathematics generally ,are poor among these prospective teachers. Results of a pretest administered by him to teachers of migrant children, in a recent migrant institute, produced a mean score of seventy-six out of a possible one-hundred on fifty verbal problems taken from fifth and sixth grade Texas adopted textbooks, and a mean score of forty-one out of a possible one-hundred on twenty-four basic "modern math" concepts and skills. Such findings tend to make one more "sympathetic" to the Popham study findings.

Popham, in the June, 1971, issue of the *Phi Beta Kappan*, concluded that experienced teachers may not be more proficient than people off the street in promoting behavior changes in learners. Bausell and Moody, in the January, 1973, issue of the same journal, quote the Popham studies and state that colleges and universities exist to influence the public schools which, in turn, should influence the achievement of students. They claim that this is not satisfactorily being done.

In many Texas institutions of higher education, prospective elementary teachers are given a choice in foundations studies of six semester hours of mathematics or foreign language. In conjunction with the NCATE study, begun in 1970 at A & I University at Kingsville, a recommendation was made that two courses be jointly designed by the mathematics and education departments to meet specific needs of elementary education majors. These courses were designed to be offered by the mathematics department. To this date, only one such course has been offered beginning in 1973-74. In addition to this request for change, the elementary education staff voted to request that the choice between mathematics or foreign language be eliminated and require that all prospective elementary teachers complete six hours in mathematics. A year later, no action has been taken on this request. Apparently, other institutions move equally slowly in implementing academic change. Twelve years after the original CUPM recommendations for training of teachers to teach mathematics were issued, some institutions of higher education have made little progress toward implementation, much less the more recent CUPM goals.

In view of these and similar findings, is it not perhaps time that the Texas Council take a more determined stand on this issue? Do not the findings quoted tend to make competency based teacher education an increasingly palatable strategy?

Nominating Committee Report

The nominations for the Texas Council of Teachers of Mathematics are:

Vice-President Representing Junior School

Mrs. Evelyn Bell, Supervisor of Mathematics, Ysleta Independent School District

(Evelyn Bell is a native El Pasoan who received Bachelor and Master Degrees from the University of Texas at El Paso. She has 16 years of experience in the education profession, having taught mathematics, grades 7-12, and for the past five years has been supervisor of mathematics in the Ysleta Independent School District. Recently she was elected to a two-year term as president of the Greater El Paso Council of Teachers of Mathematics.)

Secretary

Mrs. Irene Hendley, Teacher, El Paso

(Irene Hendley attended Texas Western College, University of Delaware, and the University of Maryland; has done graduate work at the University of Texas at El Paso. Her teaching experience includes 7 years as Junior High Mathematics Teacher, 2 years kindergarten, and 3 years elementary school.)

Mrs. Josephine Langston, Teacher, Richardson Independent School District

(Josephine Langston received her B.A. Degree from Henderson State College, Arkansas. She has been teaching in the Richardson Independent School District for 14 years; there she is sponsor of Mu Alpha Theta and the Future Teachers of America. She is a very active member of the Greater Dallas Council of Teachers of Mathematics and has served the organization as chairman of various committees. Her professional affiliations include TCTM and life membership in NCTM.)

Treasurer

James H. Rollins, Associate Professor, Department of Education, Curriculum and Instruction, Texas A&M University.

Parliamentarian

Kenneth Owens, St. Mark's School of Texas, Dallas, Texas

(Kenneth Owens received his B.A. Degree from Baylor University and his M.A.T. Degree from Michigan State. Following his teaching at Waxahachie Independent School District, he has taught at St. Mark's School of Texas, Dallas, for 17 years. He has participated in the In-Service Programs for TEA teaching in various school systems. He is a very active member of the Greater Dallas Council of Teachers of Mathematics and has served the organization both as vice-president and as president for two terms; also, he belongs to the TCTM and NCTM.

Respectfully submitted,
EVELYN ROBSON,
Chairman Nominating Committee
Anita Priest
Annie Mary Fortner

SUGGESTIONS FOR TEACHING A HIGH SCHOOL REMEDIAL CLASS

By ANTHONY MAFFEI
Columbia, S.C.

Teaching a remedial course to high school students is usually not an average teacher's primary preference. Most teachers naturally prefer the better motivated classes. When a teacher finds before the beginning of the school year that he will have such a class, he might likely be concerned about his ability to teach them. Because of the background of these students, such classes tend to have more discipline and learning problems than the average classes. As a result, it is not uncommon for a teacher to prepare himself intellectually and psychologically with the latest learning devices and the proper discipline techniques for working with such students. Although these methods are necessary, they are by no means sufficient. The important field of personal interrelationships between student and teacher must be included. This type of communication is essential for all levels of classes in our growing technological society, especially for the slower classes who need the time, patience, and understanding of a teacher who listens as well as teaches.

Such an idea was carried out at Dreher High School in Columbia, S.C., in the fall of 1972 under the advice and backing of its principal, James Wilsford, assistant principals, Henry Young and Ruth Woodruff, and the entire mathematics department. The program called for two teachers, Jim Chandler and this writer, to be in a specific class of about 30 remedial mathematics students so that each of them would receive some form of individual help from a teacher as he walked around the classroom, as well as a sympathetic ear and possible advice to any type of suggestion, complaint, or personal problem the student had.

Since reading from the text presented difficulties, varied problems of importance were prepared and illustrated on individual worksheets which were collected at the end of each period. About 15 minutes at the beginning of each class was devoted to chalkboard demonstrations of these problems. The worksheets made the students responsible for a specific task and it gave the teachers and opportunity to get to those who were not working. Students were graded on the completion of their worksheets as well as teacher-made tests using at times almost identical problems from the worksheets. Marks were determined by the student's progress as well as his attempt at helping himself learn. There were no failures recorded at the end of the school year mainly because most students were willing to work to their levels of capacity, which generally was determined by the teacher's individual sessions. Also, the absence of failures was due to an implicit desire by the teachers to stress the positive aspects of learning so that the psychological and social stigmas associated with failure, which especially accompanied students of this level, would be reduced. Realizing themselves that they were capable of passing, it was not uncommon during marking periods to find some students working for and achieving higher grades than they had previously received. Their success seemed to have made them important in their own eyes as well as those of their peers.

Although the discipline line was drawn on occasions, the teachers and administrators totally concurred at the end of the year that the project was successful in terms of the learning accomplished under this setting. The teachers' ability to get around to listen and to help each student produced some surprising findings. Some students showed ingenuity in doing certain problems, which caught the teachers' eyes. Also, many students gave evidence in conversations of sound reasoning that would probably go unrecorded due to the verbal and reading requirements of conventional testing. Without de-emphasizing the importance of reading skills, the need for other non-reading forms of testing was seen by the teachers.

The experiment of placing teachers in a "human" class setting proved to be a fruitful learning experience for these teachers and students. Perhaps, a teacher in a similar situation could work with about 15 remedial students so that they could be helped, heard, and appreciated. In the long run, such a practice will hopefully humanize

A COMMENT ON BINARY OPERATIONS

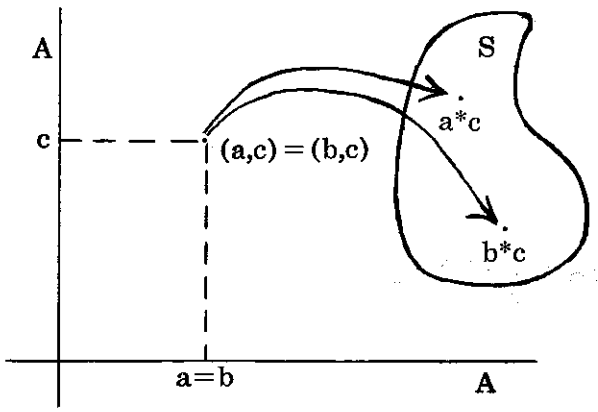
JAMES R. BOONE
Department of Mathematics
Texas A & M University

We accept and our students accept the fact that the same number can be added to both sides of an equation and that both sides of an equation can be multiplied by the same number. These operations are so generally accepted as valid, that their validity has degenerated to folklore. What do we answer when a student asks, "Why?"? This question has been asked in my classes in theory of arithmetic for elementary education majors. I do not propose the following discussion as a method

our changing and involved educational scene and will make teaching and learning more rewarding. for teaching, but rather as a basis for teachers to create methods applicable to their students.

Recall that a *function*, f, from a set X into a set Y, denoted f: $X \to Y$ may be considered as a correspondence from the elements of X, to the elements of Y, which satisfies the condition that each element of X is assigned to a unique element in Y. That is, a function is a correspondence which is not one-of-many. A *binary operation on a set A* is a function from AxA into a set S. The cartesian product of a set A with itself is denoted AxA and is the set of all ordered pairs (p,q) where p and q are elements of A.

Let * (star) be a binary operation on a set A. The ordered pair (p,q) in AxA is assigned to a unique object, denoted by p*q. Let a,b and c be elements of A, where $a \neq b$. ($) Assume $a*c \neq b*c$. Then * has assigned the ordered pairs (a,c) and (b,c) to two different objects. (This is depicted in the diagram which follows.) Since a=b, (a,c) = (b,c). Thus the orderd pair (a,c) (= (b,c)) has been assigned to two different objects in S. Accordingly, * is not a function. Hence * is not a binary operation. This is a contradiction. Thus the assumption ($ that $a*c \neq b*c$ is false. Hence the negation of ($) is true, that is a*c=b*c.



Recall that a (cardinal) number m is the property which is common to all sets in the equivalence class generated by a set M (which contains m elements) under the matching relation on the class of all sets. Two sets are matched if they can be put in a one-to-one correspondence with each other. For example, "threeness" is the property which is shared by all sets in the equivalence class generated by {a,b,c} under the matching relation. We can denote "threeness" with the symbol n({a,b,c}) or for convenience with the number symbol 3. That is $0=n(\emptyset)$, $1=n(\{a\})$, $2=n(\{a,b\})$, $3=n(\{a,b,c\})$ and so on. Addition and muliplication for whole numbers is then defined as follows: if a and b are whole numbers and A and B are sets such that a=n(A), b=n(B) and $A \cap B = \emptyset$, $a+b=n(A \cup B)$ and $a \cdot b = n(A \times B)$. Say $2=n(\{p,q\})$ and $3=n(\{r,s,t\})$, then $2+3=n(\{p,q,r,s,t\})=5$ and $2 \cdot 3 = n(\{(p,r), (p,s), (p,t), (q,r), (q,s), (q,t)\}) = 6$. Thus the "2 apples and 3 apples are 5 apples" approach is consistent with the set theoretic definition of addition. As the set of whole numbers is enlarged to include the negative integers, the rational numbers and finally the irrational numbers the binary operations are appropriately extended to the real numbers.

Since addition and multiplication are well-defined binary operations on the set of real numbers, by the property established above, we have: if a,b, and c are real numbers and a=b, then $a+c=b+c$ and $a \cdot c = b \cdot c$.

I would like to illustrate how we use the properties of adding and multiplying the same number to both sides of an equation in the following examples. To determine the truth set of the open sentence x—2=5, we *can* add 2 to both sides of the equation, $(x-2)+2=5+2$, and obtain x=7. Similarly, for 2x=6 we *can* multiply both sides by 1/2 and obtain, $(1/2)\ 2x = (1/2)6$. Thus, x=3.

Short History of Texas Council of Teachers of Mathematics

(Continued from Page 4)

Mathematics, sponsored three regioinal meetings in 1964. The meetings were planned to acquaint teachers and administrators with the newest in the teaching of mathematics. The meetings were held in Dallas, Houston, and San Antonio.

The officers who served in 1965-66 were President Lois Reynolds, Spring Branch; First Vice-President Maxine Shoemaker, Austin; Second Vice-President Edith Moreland, Houston; Secretary Lois Crawford, Dallas; Treasurer George Hunt, Odessa; Publications Editor J. William Brown, Dallas; Parliamentarian Paul Forester, San Antonio; NCTM Representative Mozelle Schulenberger, Cleburne; Southwestern Regional Representative Keene C. Van Orden, San Angelo.

The workshops which were held in various Texas cities in 1964-65 were dicontinued in 1965-66 because of lack of funds.

The Texas Council of Teachers of Mathematics continued to grow in membership. In 1964-66 workshops were held in various cities in Texas to bring the teachers up to date on the new text books. The teachers were faced with the problem of "bridging the gap" between the old and new mathematics. The Texas Council of Teachers of Mathematics is faced with problems, but the teachers are striving to solve those problems as they meet them. Meeting and solving those problems have tended to unite the matematics teachers in Texas into one group with a single purpose—the improvement of mathematics teaching in Texas.

IMPROVING THE HIGH SCHOOL MATHEMATICS PROGRAM

DARNELL RHEA
Supervisor of Mathematics
Alachua County, Florida

The Senior High School Mathematics Program flow chart shows the scope and sequence for a projected exemplary high school mathematics program which includes the traditional subjects and new electives. Notice the algebra I, algrebra II, geometry sequence as opposed to the algebra I, geometry, algebra II sequence prevalent today. The algebra I, algebra II, geometry sequence is based on the view that students should receive immediate reinforcement of the concepts learned in algebra I without waiting a year or more. In addition, many geometry concepts are easier to develop if the student has a stronger algebraic background. The algebra II course, on the other hand, does not require much more geometry than that usually acquired before taking algebra I.

Serious consideration should be given to a deemphasis of geometry as a full year course. The question is "Should everyone learn it?" Even a cursory study of college catalogs will show little or no use in college work for much of the current high school geometry content. Perhaps the needs of 99 percent of the students would be better met if geometry were a one semester course emphasizing geometrical properties and relationships with less emphasis on two-column proof. For students desiring to pursue a more indepth study of geometry, a second semester of advanced geometry could be offered. The majority of the students finishing one semester of geometry would continue on with advanced algebra. This extra semester of algebra will undoubtedly be much more valuable to the student in college and later life than two semesters of geometry.

While teaching algebra, teachers must be careful not to become too structured. One example of overstructureness is the excessive and prolonged use of symbols to indicate the operation performed in each step in a solution.

For example:	Prob.	$3X+4=13$
	S_4	$3X+4-4=13-4$
	C.T.	$3X=9$
	D_3	$\frac{3X}{3}=\frac{9}{3}$
	C.T.	$X=3$

The use of the symbol, Prob., S_4, C.T., D_3, etc., should almost never be carried past the first 6-9 weeks of instruction in algebra I. It can be demonstrated that students often learn to apply the symbols while at the same time being unable to explain satisfactorily what it is that was done. The purpose of the symbols, such as S_4 and C.T., is to show the student that the solution to an algebraic problem should be found one step at a time with each step having only one "legal" operation. The reason for the one operation per step is to decrease errors. Accordingly, once a student demonstrates a mastery of the algebraic procedure, further use of the operation symbols is unnecessary and more harmful to the student than beneficial.

Concerning the terminology used in the High School Mathematics Program Sequence flow chart, the term "general mathematics" has long since outlived its usefulness and has become detrimental to the students assigned to a course with that title. Furthermore, the term "general mathematics" fails to indicate the exploratory nature of the course needed by the students taking such a course; the teacher must *explore new* avenues to enable the lower ability mathematics students to bridge the gap of understanding which the old methods have quite demonstratively failed to accomplish. Hence the title of this new course is *Exploratory Mathematics* and it completely replaces the old "general mathematics" course in methodology, content, and name.

Regarding class size, it is common knowledge that it is much easier to have reasonably good results with a class of 30 students in an algebra III—trigonometry class than it is to have reasonably good results with a class of 30 students in an Exploratory Mathematics course. Accordingly, since all students are equally important in the eyes of the teaching profession, to counterbalance this difference, smaller classes of 15-20 students should be provided in the Exploratory Mathematics course with the advanced courses taking a heavier load.

The use of the term "Pre-Algebra" as the title of a course involving integers, exponents, and radicals is a misnomer to say the least. *Any* course preceding algebra should be called "*Pre*-algebra." Accordingly, the title of the course should be either *Introduction to Algebra* or *Introductory Algebra.*

Throughout the chart one can see the emphasis placed on a *Consumer Mathematics* course (note: a student takes the consumer mathematics course only once). A good consumer mathematics course should be available to each and every student to take *at any time in the student's high school mathematics program,* even if the course is for only one semester. Each student should be strongly encouraged to take the consumer mathematics course, perhaps to the point of having the course required for graduation. The course for advanced mathematics students may be different from that offered for other students.

On the right side of the chart is a sequence of *Technical Algebra and Geometry* courses which need to be developed. This sequence is for students preparing for technical vocational work, such as "electronic technician." The sequence should be

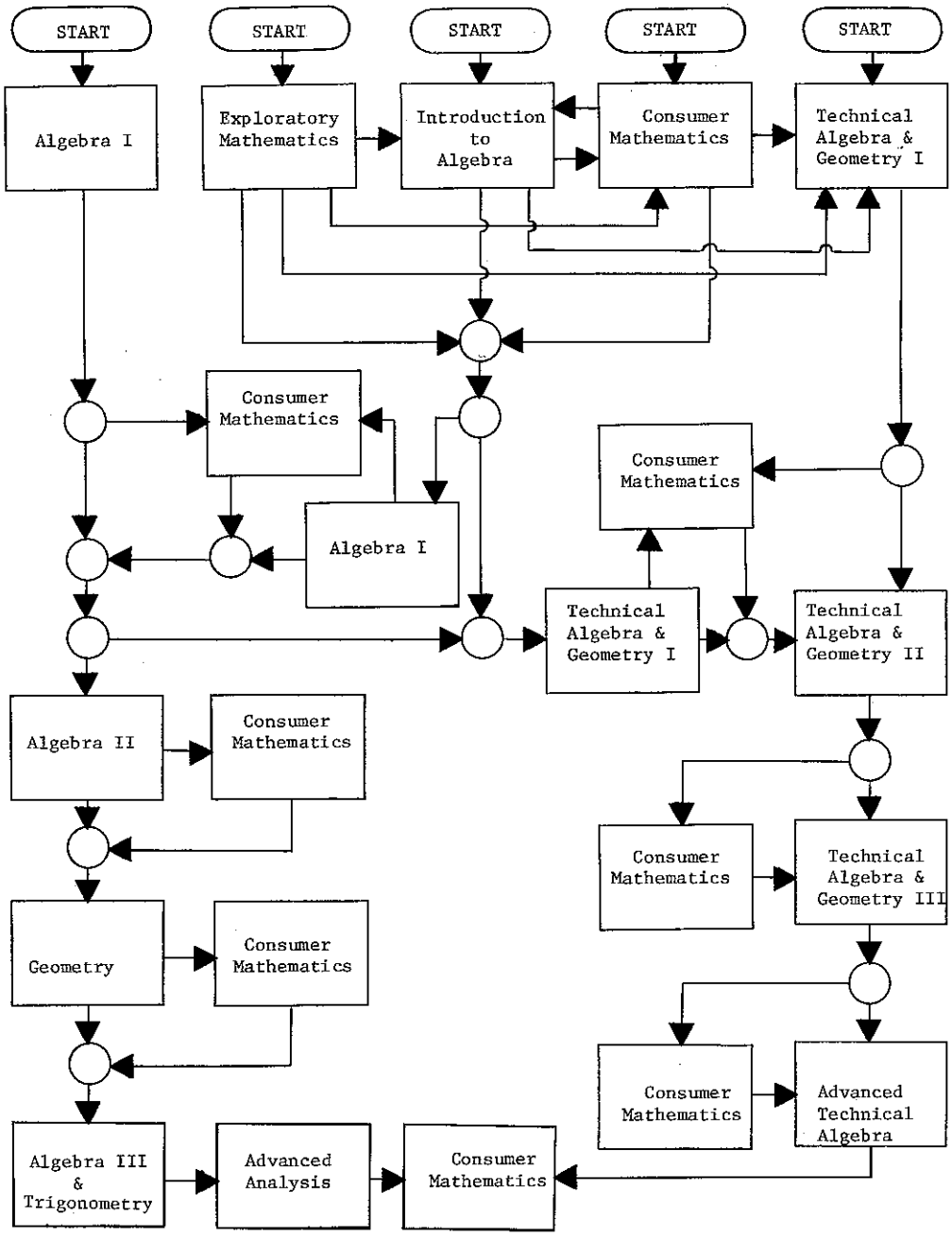
available to all students, girls and boys, desiring technical preparation, whether or not the student is enrolled in a vocational high school. The level of work required in the technical sequence should be as high as that required in the college preparatory sequence. The major differences are that the technical sequence will emphasize practical applications of algebraic and geometrical properties, have little or no proof, and less symbolization.

What about the length of courses? Nowadays, if a student has failed to master the first semester of algebra I, for example, he still moves on to the more advanced work of the second semester rather than repeating the first semester. Granted, the ideal situation may be to have a highly individualized program so that students may vary greatly in achievement and still be in the same class. However, not many schools come close to having a situation of this type. Therefore, almost all courses should be broken down to one semester blocks which may be repeated.

Suggestions for Electives in Mathematics

Creative Machematics
History of Mathematics
Game Strategy
Flow Charting and Programming
Mathematics and Ecology
Probability and Statistics
Logic

THE SENIOR HIGH SCHOOL MATHEMATICS PROGRAM SEQUENCE



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