THE ALBERTA TEACHERS' ASSOCIATION

MATHEMATICS COUNCIL

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EDITORIAL

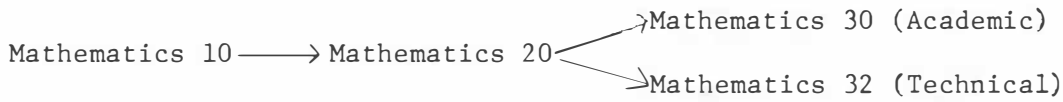
A New Senior High Mathematics Curriculum?

The editors take no credit for having initiated the thoughts presented in this article, but for what they are worth we pass them along as we understand them. We are not in a position to identify the originators of the proposals; we can only assure you that "important people" are thinking about them.

There appears to be a great deal of concern in Alberta at the moment about the content of the senior high school mathematics curriculum. Next year the new authorizations come into effect in Mathematics 30. In the following year we will see a change in Mathematics 31 along the lines of calculus, linear algebra or probability. Also in this same year, students will be coming from the new junior high school programs into Grade X and it is possible, if not probable, that the senior high school programs will need to be revamped for these students. All this indicates that not all of the problems of the new mathematics are behind us yet.

As if we have not enough problems already, we have been hearing rumors of a proposed change, not in the content but in the structure of the Alberta mathematics curriculum. The plan consists of three programs.

A. Three-year Academic Program for students in the top 40 percent group of the Grade X class. Most of these students will prepare themselves for entrance into university or technical school. The most important factor is that these students demonstrate talent in mathematics. The sequence would be as shown by the diagram.



Certain students may be advised or required to take Mathematics 31 in addition to the above.

B. Four-year Academic Program for the medium 35 percent of the Grade X mathematics students. This program would be identical to Program A with the exception that it would require four years rather than three to complete it. The final year would again involve a choice of Mathematics 30 or Mathematics 32, and possibly Mathematics 31 for some. The students enrolled in this program would be selected solely on the basis of their performance in mathematics, not on their occupational choices. It is presumed that many of the students would go on to the unarticulated technologies, apprenticeships or certain areas in universities.

C. General Mathematics Program for students in the remaining 25 percent of the Grade X class. This program would provide a common mathematics course only in Grade X, and many of the students would not study mathematics beyond this level. In Grade XI there would be special courses for business education and some of the apprenticeship areas.

Editors' Comments: The above proposal has the basic theme that 75 percent of the students will study the same mathematics, some for three years and some for four years. This demands, then, a course that is potentially of benefit to 75 percent of those entering senior high school. Can such a course be designed? Many think it can; some think it cannot.

Another assumption is that the difference between "good" and "average" students can be provided for by spending a longer time on the same material. Is this reasonable? If so, should the length of the mathematics course for "average" students be four years and for the "good" three years? Some observers feel that three years should be the allotment for the "average" and less time for the better students.

The most important point in the proposal is that decisions are to be made on the basis of mathematical talent, not vocational choice. Is there any merit in the scheme? Some people, including the editors of this *Newsletter*, think there is. What are your opinions?

A JUNIOR HIGH SCHOOL MATHEMATICS CLUB IN ACTION

By Marcy Herchek

Editors' Note: Mrs. Herchek is a teacher of mathematics in Allendale Junior High School, Edmonton; a coordinator of mathematics serving several schools; treasurer of the MCATA; and chairman of a committee of the Council compiling information for use of those interested in organizing a mathematics club in a school.

In September, 1966, the members of a Grade IX class (9C) at Allendale Junior High School decided to form a mathematics club. During a class period a discussion was held on how to form such a club. From it emerged three decisions:

1. Membership would be limited to 9C.
2. Meetings would be held each Thursday after school for one hour.
3. A committee was formed to gather information regarding the organization and formation of a mathematics club.

At the first meeting, the committee members reported from materials they had found. These materials were books from lending libraries and a paper on mathematics clubs prepared by N.A. Rebryna (head of the Mathematics Department of the Harry Ainlay Composite High School, Edmonton).

A discussion followed, resulting in the following:

- A club was formed by 20 students of 9C as members.
- Membership was limited to 9C for the time being, with a decision to review the situation in January, 1967.
- Officers were elected.
- A fee of 25 cents per member per year was set.
- Members were to begin searching for material to suggest individual projects.
- Projects for the club as a whole were discussed.

The club members decided to include in their program (a) to learn how to play mathematical games, (b) to go on field trips and see mathematics in action, (c) to experiment with new concepts other than those presented in their texts, (d) to invite speakers and consultants to their meetings, and (e) to make physical mathematics models.

To date the club has learned to play chess, yatche, cribbage, rommoli and three-dimensional tick-tack-toe. Field trips have been made to a welding shop to learn about tolerance in measurement, also to the new Edmonton Post Office to find out how a math formula was used to determine the number of employees, based on a movement-time factor, and to see the use of geometric designs and simple computers to expedite the handling of letters and parcels.

A consultant has been invited to help them learn how to use a slide rule. Club members challenged a teacher, who is a good chess player, to games of chess. They built math models using paper, plastic rods, string and pegboard. Two books were bought to begin a club library.

Future plans of the club involve the completion of some individual projects; a trip to see a computer in action; a study of probability, permutations and combinations; and improvement in proficiency at some of the games.

This club does <u>not</u> provide extra time to work on material from the school curriculum. The club members plan and do the work themselves, and the teacher present does not act as a teacher but rather participates as a member of the club and helps with supervision.

Georg Cantor, the mathematician responsible for the theory of sets, the foundation of modern mathematics, had a view which every teacher should recite before each mathematics lesson:

"The essence of mathematics
lies in its freedom."

BOOK REVIEW

The book reviewed here is *Mathematics in Primary Education; Learning of Mathematics by Young Children*. It is prepared by the International Study Group for Mathematics Learning, Palo Alto, California, compiled by Dr. Z.P. Dienes, Professor of Education, University of Adelaide, Australia, on behalf of the International Study Group, and published with the permission of UNESCO, 1966.

The book should be available from

UNESCO Publications
University of Toronto Press
Toronto, Ontario.

The address of the source organization is

UNESCO Institute for Education
70 Feldbrunnenstrasse
2 Hamburg 13
Federal Republic of West Germany.

This book of 164 pages is an illuminating report on recent research into the learning of mathematics by young children. It is compiled and integrated by the psychologist-mathematician Zoltan P. Dienes out of the proceedings of three international conferences called especially to discuss new developments in elementary school mathematics.

The report is biased, in the sense that the theoretical and procedural perspectives of Dienes are ever present as the integrating frame of reference. However, as one reads the report such a bias transforms into a distinct benefit; it becomes increasingly evident that much of the insight manifested in the report is as much a product of the bias as it is of the results reported.

The latter do not constitute the contents of a typical methods book on the teaching of elementary school mathematics. Rather, they constitute some of the significant findings of research, of which all good methods books must take serious cognizance. Accordingly, no

recipes will be found. The report contains only the latest discoveries of master chefs experimenting to find the whys and hows of the processes prerequisite to the creation of better recipes.

Much of the report concerns itself with the whys and hows of creating good physical embodiments of mathematical concepts, such as number systems (integers), vectors and operations. Many ingeneous embodiments are discussed, and several principles of how these physical embodiments can be used best to teach the concept are suggested.

The book is not exhaustive, nor does it pretend to be. It does, however, give a good picture of how the frontiers of knowledge are being extended - knowledge of how young children learn mathematics.

The report is recommended highly to any elementary school teacher who believes that elementary school students learn mathematics in a way that is, in many respects, basically different from the way in which secondary students learn it. It is recommended to all high school teachers of mathematics.

- Daiyo Sawada

Editors' Note: Mr. Sawada, who earned the degree of Master of Education from the University of Alberta in 1966, is a sessional instructor in the Department of Elementary Education of the Faculty of Education at the above university. One of his interests is the development of mathematical concepts in young children.

HELP WANTED

In the January issue of the *Newsletter* we made a plea for news items to be supplied by the readers. So far we have not been inundated by submissions. Surely something of interest to teachers of mathematics is happening in your school or in your locality. It may be a teaching technique or type of material that you have found to be particularly effective; it may be a problem that has an interesting aspect or solution; it may be a point of view that you would like to share with others. Whatever it is, let's hear about it.

JUNIOR HIGH SCHOOL MATHEMATICS IN THE CLASSROOM

By S.E. Sigurdson and T.P. Atkinson

Editors' Note: On Monday, March 6, the two editors visited classrooms in Ponoka Junior High School to observe teachers and classes working with mathematics as presented by the textbook series Exploring Modern Mathematics. They wish to express their appreciation for the cooperation and helpful comments which they received from Mrs. M.G. Astley, Mrs. D.A. Elliot, Mrs. S. Clark and Mrs. E.L. Freeman. This article summarizes the ideas formed by the writers as a result of observing the classes and talking to the teachers.

The implementation of the new program has proceeded reasonably well, although it has demanded a willingness to accept it and considerable inservice work on the part of the teachers. Now that the change to a modern program has been effected, certain results seem evident.

The pupils like the majority of the material, especially the geometry. The ideas in general are more challenging than in the previous program and pupils are able to handle more difficult concepts. The level of mathematical thinking has risen.

The teachers are using the textbooks as a distinct aid to their teaching and in a variety of ways. One most interesting feature was the manner in which the exploratory exercises were used - in three distinct ways: for individual work in class; for homework (to be discussed the next day); and as a basis for discussion. A comment made by one teacher to her class indicates that the program is being entered in the right spirit: "There are no bears in these woods, so don't be afraid to explore." However, another teacher suggested that only pupils of above-average ability could use the "Let's Explore" exercises in the manner for which they are intended.

One aspect of the modern programs once again raised its ugly head, namely terminology. There seems to be an excessive amount of it. The difficulty is compounded by the two series being used in the junior high school. The vocabularies and the notation of the two do not

match at all. A common departmental examination for Grade IX will always be a problem because of this. Perhaps it is the duty of every teacher to make sure that the terminology is approached appropriately so that it can be a help, not a hindrance.

Credit is due to Mrs. Freeman for her experimental work prior to the general use of the EMM program. In the 1965-66 and the 1966-67 school years she has taught Grade IX mathematics from EMM 3. She teaches 120 pupils in five classes this year. Two groups we observed seemed to be competent with the mathematical ideas they had met. The results of the Grade IX examination written by last year's classes were encouraging.

It is indeed a pleasure to enter a junior high school mathematics class and observe students and teachers working on mathematical ideas that are significant and important for modern learning. It is somewhat surprising to see Grade VII students interested in clock arithmetic. They are interested not because of its usefulness but because of the mathematical relationships they discover. We distinctly had the feeling that mathematics is being studied for much more than its applications, namely because it is a basically fruitful and enlightening activity. As we listened to the discussion of the arithmetic of the five-minute clock, we were impressed by the idea that every educated person in our society has the basic right to learn about a mathematical system that can be made by using five elements.

IMPROVE YOUR TEACHING OF MATHEMATICS

The two major universities in Alberta are offering this summer, in the category of Continuing Professional Education, non-credit programs in mathematics education for teachers. The programs are essentially the same as those offered in previous years. The material dealt with will be pertinent to junior and senior high school mathematics courses, with specific attention to the newly authorized series of texts for Grades IX and XII. Presentations will be in the form of both lectures and workshops. Listed on the following page are the courses offered.

University of Calgary:

Three weeks, July 3 to 21, 1967
Dr. S.A. Lindstedt, Dr. A.A. Gibb
Classroom teachers

University of Alberta:

Two weeks, July 3 to 14, 1967
Dr. S.E. Sigurdson, Mr. D.B. Harrison
Classroom teachers

Interested teachers should write to the Department of Extension at the university of their choice for further information and an application form. Some school systems grant financial assistance to teachers who improve their competence through such non-credit work.

"In only two or three weeks, you, too, can become a better teacher of mathematics."

AVAILABILITY OF TEACHER'S EDITION OF GRADE IX MATHEMATICS TEXT

STM: The Special Edition of *Seeing Through Mathematics 3* and Teaching Guide to accompany it will not be available until July. Groups of teachers wishing to proceed with inservice preparation should use the Canadian edition of *Seeing Through Mathematics 2*, Part 2, and the American edition of *Seeing Through Mathematics 3*, Parts 1 and 2.

EMM: The Canadian Teacher's Edition of *Exploring Modern Mathematics 3* will be available in the near future. To provide the service rapidly, the publishers are revising only the amended sections of the American edition by "kleen-stick" inserts.

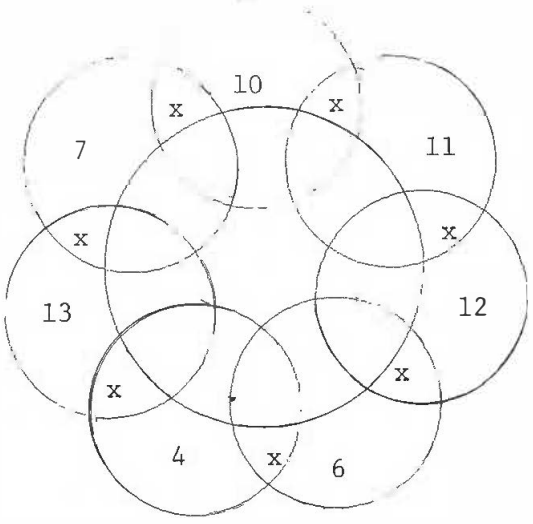
School systems which have purchased the American edition may have the copies replaced by revised copies at no charge. School systems supplied with the American edition at no charge for inservice work may obtain revised editions at the list price less normal discount from the Alberta Textbook Branch.

PUZZLES TO PONDER

1. D O N A L D
   G E R A L D
   R O B E R T

Replace the letters in the three names with digits 0, 1, 2, ..., 9 so as to name three numbers in Hindu-Arabic numerals, with the third number being the sum of the first two. To help you get started, D represents 5.

2.



The numerals 1 through 14 are to be placed in the spots marked by x's in the figure so that the sum of each set of three numbers indicated in a small circle is 21. One number in each small circle is named for you.

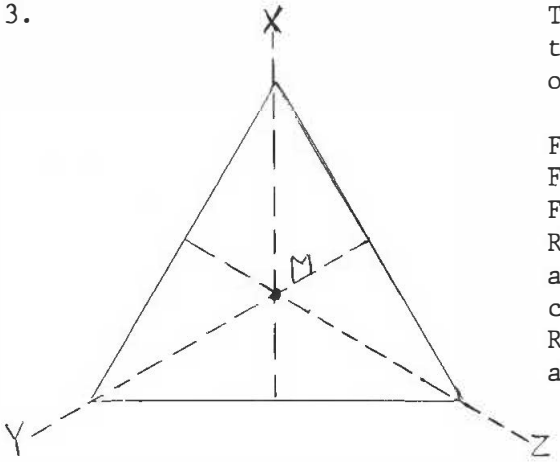
Perhaps the set at the top is 5, 10, 6. After all, 5 + 10 + 6 = 21.

ANSWERS TO PUZZLES

1. 526485 + 197485 = 723970

2. 10, 2, 11, 8, 12, 1, 6, 14
   4, 3, 13, 5, 7, 9.

3.



The symmetries of an equilateral triangle form a mathematical system of six elements as follows:

Flip about axis X is A.
Flip about axis Y is B.
Flip about axis Z is C.
Rotation counterclockwise 120° about M is D. Rotation counterclockwise 240° about M is E.
Rotation counterclockwise 360° about M is F.

If the operation on the elements A, B, C, D, E, F is "followed by" and symbolized "f", then, for example, A f B = D.

(a) Is the operation closed? commutative? associative?

(b) Is there an identity element for the operation?

(c) Are there inverses?

(d) Does the system change if the axes X, Y, Z are thought of as being a fixed frame of reference external from the triangle, instead of being part of the triangle?

(The foregoing puzzle, or problem, was prompted by a letter received from a Grade VII mathematics student in Forestburg.)