Mathematics Council
NEWSLETTER
The Alberta Teachers' Association

Volume 10 Number 2 December 1991

From the Editor

A real concern exists in Canada regarding the low level of mathematics achievement of many of our students. As usual in situations like this, the search is on for someone to blame. However, pinpointing the blame is not simple. As educators, we must look at what can be done in the schools to improve the situation.

Many people contend that students' final achievement in mathematics is largely determined by how they succeed in the primary and elementary grades. Many students leave Grade 6 with the attitude that mathematics is difficult and uninteresting, and they see little practical use for it.

Primary and elementary teachers have difficult assignments when they are expected to teach practically all subjects to their students. It is unreasonable to expect them to be experts in all areas. However, there is general opposition to having subject specialists, for example, where one teacher teaches mathematics to several grades. Therefore, to overcome the problem, each elementary school should have a designated mathematics leader, a person who is particularly skilled in mathematics education, to serve as a resource person for the other teachers. The National Council of Teachers of Mathematics (NCTM) has long supported this concept, as is evident from the following position paper. As teachers, we should encourage the appointment of mathematics leaders within our schools.

Mathematics Leaders in Elementary/Middle Schools

A key component in the improvement of mathematics instruction for all students is greater attention to the elementary/middle school mathematics program through providing stronger mathematics leadership at individual schools.

School mathematics leaders are essential for raising the level of mathematical knowledge and pedagogical competence of the staff; for coordinating mathematics instructional effort within and between schools; and for helping to assure the implementation of a comprehensive, high-quality program. In addition, school mathematics leaders will support the roles and efforts of teachers, supervisors and administrators who are increasingly concerned with promoting excellence for their students.

For these reasons, the NCTM advocates that every elementary/middle school identify a school mathematics leader to provide ongoing leadership and assistance in planning, implementing and evaluating a comprehensive school mathematics program. These leaders should be available as a resource to all staff for curriculum design, professional development, teaching methodology, classroom management, selection of materials and student assessment.

More specifically, school mathematics leaders may perform or assist in any or all of the tasks connected with the essential instructional functions listed below.

Curriculum Design

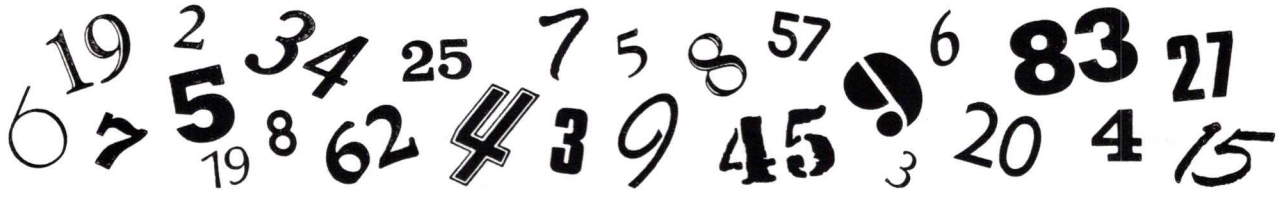
* Provide leadership in the development of mathematics instructional programs to meet diverse student needs.
* Coordinate the implementation of a sound instructional scope and sequence for mathematics.
* Facilitate the review and revision of the curriculum.
* Integrate mathematics with other content areas.

Curricular Content

* Relate the content of provincial and local curriculum guidelines to the individual school's program.
* Present and interpret mathematics content to meet teachers' needs.
* Promote the importance of mathematics.
* Keep abreast of national, provincial and local recommendations for updating and revising curricular content by participating in the activities of professional associations.

Methodology and Materials

* Acquaint teachers with successful and innovative strategies for classroom instruction through demonstration lessons and conferences.
* Consult with teachers in selecting and implementing activities that improve motivation and attitude toward mathematics.
* Review, and recommend for acquisition when appropriate, teaching materials, calculators and computer software, and assist teachers in integrating them into the program.



By order of King "Lion" Hart
All Lords, Ladies, and peasants who perform equations of sums and divisions are hailed to the King's County and yonder city, Medicine Hat.

Thou shouldst prepare thyself to eat, drink, hear wisdoms, and in whole, make merry.

Come, take safety and lodging within the walls of the King's Lodge in said city.

By King's Proclamation it shall be, in the eleventh month, on the days fifth, sixth, and seventh, in the year of Our Lord, one thousand nine hundred ninety-two.

God speed ! Do not tarry !

Math Fare

November 5, 6, 7 1992

Medicine Hat , Alberta

Assessment

* Participate in the review and selection of means of assessment.
* Assist staff in designing and using classroom tests.
* Assist staff in interpreting and using test data, and placing students in appropriate activities.

Other Functions

* Work with staff in determining needs and priorities for professional development.
* Assist teachers, on request, in self-evaluation activities.
* Plan and budget for the purchase of instructional materials.
* Maintain and promote effective communication among grades and schools, and with parents, the community and support personnel.
* Coordinate instruction between regular and special programs to meet individual student needs.
* Manage, schedule and equip a mathematics laboratory or teacher resource room.
* Provide direct instruction, as appropriate, for individual students, mathematics teams or special projects.

School mathematics leaders serve as an immediate resource to teachers by demonstrating knowledge, competence and leadership in mathematics education. Thus they should know and understand mathematics substantially beyond that which they may be expected to teach, and they should have knowledge and competence in the methods and techniques appropriate for effectively teaching mathematics to elementary/middle school students.

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> Most people are in favor of the two-party system: one on Friday night and one on Saturday night.
>
> *—The Globe and Mail*

Regional Services Committee Report

Dick Kopan

Leadership Conference 1991

This conference was held in Toronto from July 5-7. Ten of the 11 affiliated groups were represented, and much sharing went on. I hope that there will be some follow-up to our discussions.

Plans are under way to hold the 1992 Leadership Conference in Calgary. need more elementary teachers there, as well as new people who can be iden as potential leaders.

Promotion Kits

NCTM has assembled an awareness kit to promote Professional Standards for Teaching Mathematics and Curriculum and Evaluation Standards for School Mathematics. Included are 100 transparency masters, accompanying notes, four brochures, a video and an order form. Do not call NCTM for the kit. Free kits will be mailed to all affiliated group presidents and supervisors. If you wish to review this kit, contact Bob Hart, MCATA president.

Membership

NCTM membership is at an all-time high with over 85,000 members. President Iris Carl's goal is to bring the membership to 100,000 during her tenure. Help us meet this goal by joining and/or maintaining your membership in NCTM.

I would like to thank everyone who helped make my first year as Canadian representative of the Regional Services Committee enjoyable and rewarding.

Alberta High School Mathematics Competition

All high schools in Alberta are encouraged to participate in the annual Alberta High School Mathematics Competition (AHSMC). For information, contact Professor Alvin Barager, Chairperson, AHSMC Board, Department of Mathematics, University of Alberta, Edmonton T6G 2G1.

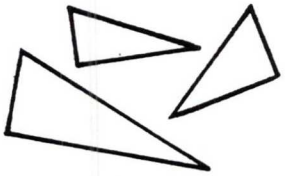
Here are two problems, and their solutions, from the 1990-91 Alberta High School Mathematics Competition, Part 1.

Problem 1
Each face of a cube is to be colored red, yellow or green, such that there are two faces of each color. The maximum number of distinctly colored cubes, independent of how they are held, is
(a) 3 (b) 4 (c) 5 (d) 6 (e) none of these

Solution
(d) There is one cube in which every pair of opposite faces is of one color. There are three cubes in which exactly one pair of opposite faces is of the same color. There are two cubes in which no pair of opposite faces is of the same color.

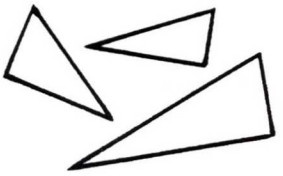
Problem 2
Of the following five numbers, the only perfect square is
(a) 548543213 (b) 548543215 (c) 548543231 (d) 548543241 (e) 548543251

Solution
(d) A square cannot end in a 3. Also, when divided by 4, a square always leaves a remainder of 0 or 1. To find this remainder, only the number formed of the last two digits needs to be considered.



The Right Angle

Florence Glanfield



The Canada-wide numeracy assessment project is proceeding on schedule. The ministers of education from across Canada met recently to reconfirm the intent and purpose of the project, and to work on solutions to address Ontario's concerns with the project. Ontario currently holds observer status of the project and is concerned with the issue of curriculum fit: Is it fair for its students to be tested on material that may or may not be covered in its provincial curriculum? The project team hopes that this issue will be resolved through an "opportunity-to-learn" analysis.

A small number of Alberta classrooms is currently involved in an informal field test of the items that will be used to produce an official field test, which will be held across Canada in spring 1992. Following the official field-test, items will be reviewed for validity, and a final instrument will be constructed. The instrument will be administered in May 1993. The final instrument will be written by a sample of 13- and 16-year-olds from across Canada. Sampling will be done on a school-by-school basis, with selections made by project staff in cooperation with ministries of education from across Canada.

If you would like additional information regarding this project, please contact Phill Campbell, Jack Edwards or Florence Glanfield at 427-2948, fax 422-4200.

Elementary Mathematics Update

A field review of the draft mathematics component of the Program of Studies for Elementary Schools took place in February and March 1991. A draft copy was sent to all superintendents, elementary school principals, teachers (ECS-Grade 6), ECS private operators, selected university staff, and other groups and individuals across the province. Revisions to the draft were made based on the written responses as well as on the responses from the regional meetings held in the various zones across Alberta.

The revised program is expected to be authorized by spring 1992, along with some basic resources. As other resources become available, the list of authorized basic resources will be extended. The schedule for implementation is being reviewed because of requests for a year of optional implementation.

Teaching and learning resources are currently being reviewed.

The proposed elementary mathematics program, along with selected resources that are being considered for basic status, will be used by some teachers in Alberta in a focused field review during 1991-92. The feedback obtained will be used to

* make final revisions to the draft,
* make decisions with regards to recommendations for basic resources, and
* obtain materials for the Teacher Resource Manual.

Developmental work on Section E: Levels of Student Performance has begun. The levels of performance identify key points in students' learning relative to the prescribed Alberta curriculum. They have the potential to serve as useful referents when teachers are assessing student growth and reporting the status of student learning.

The following are some highlights of the proposed mathematics component of the Program of Studies for Elementary Schools:

* The major philosophical ideas contained in the current mathematics component of the program have been retained. These ideas have been more clearly articulated to link them directly with the specific learner expectations.

* Increased emphasis is placed on problem solving because of its importance in connecting mathematical concepts to real-life situations. Problem solving is integrated throughout the strands.

* A major focus continues to be on students' understanding of the processes of mathematics through active learning. However, there is greater emphasis on relating mathematical concepts to the real-life experiences of the learner, and representing them by using manipulatives (concrete mode), diagrams (pictorial mode), and written and spoken symbols (symbolic mode). The connections among the concrete, pictorial and symbolic modes are highlighted. Language plays a major role in developing students' understanding of mathematics and is closely linked to the use of manipulatives and diagrams.

* There is increased emphasis on estimation (quantity, computation and measurement). This is motivated by the focus on applying mathematical concepts to develop number sense and to determine the reasonableness of solutions obtained by using the calculator, computer and various measuring devices.

* A new strand called Data Management, involving statistics, graphing and probability, has been included.

* ECS is included.

* Care was taken to ensure that the mathematics component of the program complements the new Junior High Mathematics Program of Studies.

* Grades were changed to levels to emphasize that within any grade students may be working at various levels in their understanding of mathematics.

* * * *

If you have comments about any article in the Newsletter, about math education in general or about an interesting problem, I would be glad to hear from you. I am always searching for interesting articles, comments and problems.

—Art Jorgensen

Dates to Remember

* 11th Annual Conference of the ATA Computer Council
  "Synergy '92: People, Ideas, Technology"
  Palliser Hotel, Calgary, Alberta
  March 19-21, 1992

  Keynote Speakers: Tom Snyder, Snyder Productions
  John Wilkinson, Saturn School Project

  For information, contact Bill Leonard, Cambrian Heights Elementary School, 640 Northmount Drive NW, Calgary T2K 3J5; phone 284-2246.

* 70th NCTM Annual Conference
  Nashville, Tennessee
  April 1-4, 1992

* Seventh International Congress in Mathematical Education
  Laval University, Quebec City
  August 17-23, 1992
  (Information on this conference was included with the October 1991 Newsletter.)

* MCATA Annual Conference
  Medicine Hat, Alberta
  November 5-7, 1992

President's Message

Bob Hart

As this year's MCATA president, I represented Alberta at the NCTM Leadership Conference in Toronto this past summer. The presidents and the NCTM representatives from nine provinces attended. We shared common concerns and discussed possible solutions to a number of issues facing Canadian mathematics teachers. Associations are restructuring their organizations to represent better all levels of teaching, which is a recognition of the need to involve more elementary educators. Many organizations have recognized the need to be more politically active within their provinces.

The 1992 NCTM Leadership Conference will be held in Calgary on July 8-10. Volunteers to help host this conference should contact Richard Kopan, NCTM Canadian Regional Director at 271-8882 or me at 284-3729 (both in Calgary). This will be a wonderful opportunity to experience the tremendous support we receive from NCTM.

Diane Congdon, Wendy Richards, Art Jorgensen and I spent five days this past summer at the ATA Summer Conference in Banff, where we met with representatives from the other specialist councils and the ATA to learn and to coordinate the efforts of these groups for the benefit of all Alberta teachers.

Your MCATA executive is working on plans and goals for the next five years. We need you to become involved, to assume leadership roles and to promote the Mathematics Council to all mathematics teachers in Alberta. A number of the regions of Alberta are not well represented on the Council. A major goal of the executive is to increase membership. You can help. Pass this newsletter on to colleagues. Encourage them to join MCATA. Our strength comes from increased membership. Our association exists for you.

Publications Director's Report

John Percevault

At the March 1991 MCATA executive meeting, I was named publications director for a one-year term. Guidelines for the directorship and for the editorial board were revised as follows. The publications director will chair the editorial board, which is composed of the ATA staff adviser and editors of the Newsletter, the Journal, and the monographs. The board will referee submissions and authorize the publication of monographs. This new organization of duties should increase service to the members and maintain and improve the recognition that MCATA publications have attained.

1990-91 Publications

Newsletter

Art Jorgensen continued as newsletter editor. Five newsletters were published.

delta-K

At the October 1990 MCATA executive meeting, Craig Loewen and John Percevault accepted the coeditorship of the Journal. One issue of delta-K, edited by Linda Brandau, was distributed in fall 1990. The coeditors published two issues of delta-K, the first on problem solving and the second on technology in mathematics.

Monographs

1. Meaning in Mathematics, edited by Dr. A. Olson
   The manuscript has been received and revised. A decision to publish has yet to be made.

2. Language in Mathematics, edited by Dr. D. Sawada
   This monograph will be published in 1991.

1991-92 Plans

Newsletter

Volume 10 will consist of five issues; number 1 was published in October.

delta-K

Three issues are planned and will focus on manipulating and activating mathematics, ideas K-12, and continuity and integration in mathematics instruction. Manuscripts other than those that support the main theme will also be included in these issues.

Monographs

Four monographs are planned (publishing dates still to be determined):

1. Introductory and Programmable Calculators, edited by Dennis Burton
2. Problem Solving in High School Mathematics, edited by Florence Glanfield
3. Developing Number Sense, edited by Marie Hauk
4. Motivational Strategies and Methodologies, edited by George Ditto

Call for Manuscripts

A letter requesting the submission of manuscripts will be sent to regular contributors and to selected presenters of the annual conferences. According to the Editors' Handbook, a purpose of the journals is to be a forum for the exchange of ideas and opinions on the current curriculum. A second purpose is to provide information on curriculum content. This is where MCATA members can make a significant contribution to the various publications and to the Mathematics Council.

Measurement Questions to Talk and Think About

Anne Carlyle

Here are some interesting, funny and strange questions for middle school students. Students work in small groups and discuss how they would find a reasonable answer. We are more interested in the procedure than an actual solution. Students enjoy sharing their thoughts with others.

1. How many showers can you get from a bar of soap?
2. If the earth were a pumpkin, how big would a seed be?
3. How much does a paperback book cost per page?
4. How many fingernails can a bottle of fingernail-polish paint?
5. How many words are in a dictionary?
6. How much is Kool-aid per kilogram?
7. How many alphabet letters are in a book?
8. How many beans are there in a bowl of chili?
9. How many "steps" are there in an escalator?
10. How many pieces of popcorn will fill your shoe?

This activity is taken from The ComMuniCator, vol. 15, no. 3, the official journal of the California Mathematics Council.

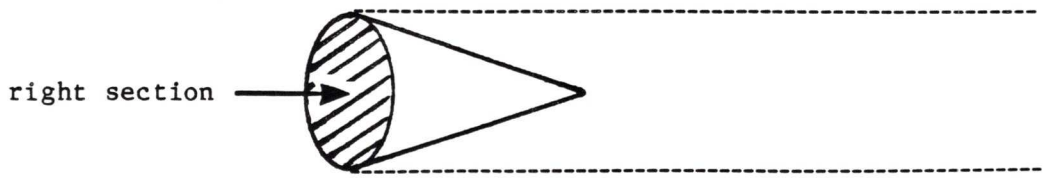
Conic Chop Suey

Eddie Chan
Alberta Distance Learning Centre

(Chop Suey is a chinese dish where you mix different vegetables and meats, and then pan fry them.)

The new Math 30 curriculum has some significant changes, especially in conics. The new approach for defining and developing conics was not commonly used before because the general formula $Ax^2+Bxy+Cy^2+Dx+Ey+F=0$ involves a lot of cases, and it would be difficult to test them all. With the new graphing calculators and computers, the task is easier, but it still involves a lot of investigations. Being involved in the development of our new course materials at the Alberta Distance Learning Centre, I find this topic interesting and challenging, yet I feel like someone sailing into uncharted waters. There is no textbook; nobody ever used this method to teach conics before. Most reference materials use the traditional ways to define and explain conics. I believe that many Math 30 teachers in Alberta feel the same way. The purpose of this article is to share my experience with other teachers and stimulate more interest in this topic. I do not intend to discuss conics in general, I only want to look at some special cases and the situation in which a degenerate conic may be created.

According to the new curriculum, conics will be defined in four ways. The first is the geometric model, which is easy to visualize. It is possible to form a circle, a point, an ellipse, a parabola, a hyperbola, a straight line or a pair of intersecting lines by cutting a cone with a plane, but it is impossible to produce a pair of parallel lines that is one of the degenerate conics. Is there a way to do it? If the right section of a cone is fixed (see diagram below) and the cone is stretched to infinity, you can see that the limiting position of a cone is a cylinder (Rainville 1961, 201). In other words, a cylinder may be considered a degenerate cone with its vertex at infinity. A plane cutting a cylinder can create a pair of parallel lines, a single straight line, an ellipse or a circle.



Conics can also be defined by using the general form $Ax^2+Bxy+Cy^2+Dx+Ey+F=0$. This algebraic model covers so many cases that one can try them out using a calculator or computer for hours. When $B=0$, things are much easier. When $B\neq0$, this general form can be a parabola, ellipse, hyperbola, straight line, parallel lines and so on. Since B^2-4AC is not included in the curriculum, sometimes it is difficult for a student to tell what it is by looking at the equation. There is one thing you can tell. If $B\neq0$, then the conic is not a circle. An equation like $50x^2+xy+50y^2-500=0$ would give you an ellipse that looks like a circle, but it is still an ellipse. If you change the value of B to 5, 10, 20, 50 and leave the other coefficients unchanged, you can compare the

ellipses. They all pass through the same four x- and y-intercepts, which are equidistant from the origin, and you can see that as B approaches 0, the ellipse approaches a circle. The general form covers all the conics plus all the degenerate conics including a point. How can you get a point? $A^2+Bxy+Cy^2=0$ is a point if $AC-B^2>0$. For example, $x^2+y^2=0$ is (0,0). The changes of D and E cause translations of axes, but these changes also affect the size of the conic. Teachers should be careful when making questions for their tests.

Locus definitions are the third way to define conics. This is similar to the traditional ways with which we are familiar. The TRM suggests many activities we can use, but teachers should be aware that sometimes it may be difficult to explain why the curve generated is a conic because you cannot use the traditional method to explain everything. Before you ask your students to do the investigations, it would be wise to have your explanation ready.

Eccentricity is the fourth way to define conics. When e=1, the conic is a parabola; when e<1, the conic is an ellipse; when e>1, the conic is a hyperbola. What about a circle? A circle is defined as the limiting position of an ellipse as e approaches 0 and therefore is considered a degenerate ellipse. Because eccentricity definitions are based on a fixed line (directrix), a fixed point (focus) and a fixed ratio (e), it would be difficult to draw the conic when e is small, and it is impossible to use circle-line graph paper to draw any curve when e=o. Because inductive reasoning is recommended by the curriculum, it gives us the luxury of drawing our conclusions without proof. The other degenerate conics can be explained using a similar approach. As e approaches 1, the ellipse becomes flatter and the limiting position of an ellipse as e approaches 1 is a line segment of length 2a (Protter and Morrey 1963, 299). The eccentricity of a hyperbola is greater than 1. When e increases, the hyperbola opens wider. As e approaches infinity, the hyperbola approaches a pair of parallel lines. When e=1, the conic is a parabola, but if you increase the distance between the focus and the directrix, the parabola also opens wider. As the distance between the focus and the directrix approaches infinity, the parabola approaches a straight line.

Have we got all the answers for all the questions about conics? Of course not! I only hope that this article will stimulate more interest and more study. My thanks to Dr. J. Muldowney of the University of Alberta for checking this article and advising me.

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