

# Mathematics Council NEWSLETTER

The Alberta Teachers' Association

Volume 11

Number 5

May 1993

## From the Editor

By now, you likely will have had time to read, digest and discuss the recommendations of the Blue Ribbon Panel.

Initially, the panel was set up to look at the results of the Mathematics 30 diploma exam for the past three years and to recommend changes to improve student achievement. It soon became evident to panel members that the problem was not specific to Mathematics 30 but covered a whole spectrum of stakeholders from the students themselves to postsecondary institutions. In some instances, students, for whatever reason, are unable to make a serious commitment to the demanding course. Teachers lack necessary teaching materials and express a desire for professional upgrading. Alberta Education realizes that the course is not designed for 60 percent of the students taking it, that, in some cases, the necessary resources aren't available, and that the examination may be too long. It is felt that postsecondary institutions, in at least some cases, are requiring Mathematics 30 as a prerequisite for programs that in fact have little complex mathematics in them.

The panel members hope that each of the stakeholders will consider the recommendations seriously and take appropriate action.

The ATA and Alberta Education have already taken some positive action. Students who write the exam in June will receive an additional 30 minutes if they require it.

We who teach students mathematics should take a serious look at the recommendations directed at us as professionals. Along with our heavy teaching assignments and other commitments, are we making a sincere effort to keep abreast of changes taking place in mathematics education? Are we familiar with the role of modern technology in mathematics education? Are we encouraging school boards, Alberta Education and postsecondary institutions to provide courses, time and funds for teachers to upgrade their knowledge and skills? Are we active members of MCATA and/or NCTM, organizations that provide good resource materials and conferences?

I am likely preaching to the converted because you are already a member of MCATA and therefore have indicated a commitment. How about approaching other mathematics teachers and telling them about the benefits of a MCATA membership and encourage them to join. Our membership number has remained stagnant for years. It would be great to have it reach 1,000 by year's end. Let's do our part to help reach this goal.

The MCATA executive is always looking for input from its members as to how it can better meet their needs. MCATA would like to take an active part in responding to the recommendations of the panel and is seeking your help in determining how this can best be done. Please get involved. The challenge is before us!

Have a good summer.

—Art Jorgensen

## Outstanding Mathematics Educator Award



Do you know a special teacher who should be considered for this prestigious award? I'm sure there are many worthy candidates. The nomination form was included in the March 1993 *Mathematics Council Newsletter*. How about completing it and sending it to Marie Hauk before September 15, 1993. Better yet, don't wait; do it now!

## 1994 NCTM Annual Meeting

Indianapolis, Indiana  
April 13 to 16, 1994

Although it is only May 1993, it is not too early to start planning for the event of a lifetime. Those of us who have participated in an NCTM annual conference have had an enjoyable and rewarding experience. We had the opportunity to attend numerous excellent sessions covering all aspects of mathematics education, view the latest in teaching materials and associate with math educators from across Canada and the United States. Now is the time to plan for your professional development leave for 1993–94.

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## Thought for the Day

*Education is what people get from reading the fine print. Experience is what they get if they don't read it.*

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## Summer Course

The Department of Secondary Education at the University of Alberta is offering a two-week, 3-credit, graduate-level summer course from July 5 to 16, 1993. The focus of Ed Sec 501—Teaching Junior High School Mathematics—is classroom teaching of mathematics. The course is open to all mathematics teachers. Call instructor Dr. Sol Sigurdson at 492-0753 (fax 492-9402) for course information. To register, call 492-3752.

## From the President's Pen

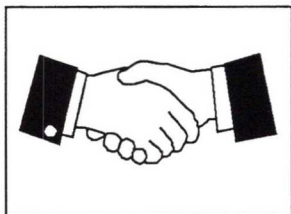
This newsletter brings me close to the end of my two-year term as president. I wish to thank all the executive members

who have been so helpful during these two years. We have restructured the executive and have planned many activities for the next five years.

Five miniconferences are scheduled for May. Watch for registration materials at your school.

Cathy Seeley from Austin, Texas, is the keynote speaker for our annual conference, "Reflection: Congruent Beliefs and Practice," in Calgary on October 29 and 30. Cathy gave the closing address, "The Human Teacher at the Helm of a Nuclear Submarine," at the NCTM annual conference in Seattle on April 3. The session was excellent. She presented us with the sea of change for teachers in a technological society. Cathy supported her presentation with an interesting set of overheads, projected from her computer using MicroSoft Power Point 3.0. Plan now to attend our conference. You cannot afford to miss such a dynamic speaker.

The Blue Ribbon Committee released its 53 recommendations at a news conference in Edmonton on March 25, with Halvar Jonson, minister of education, and Fran Savage, president of the ATA, in attendance. A copy of the recommendations has been sent to all schools. Additional copies are available from Barnett House. Please direct your



written comments on the recommendations to the Blue Ribbon Committee members. A number of recommendations are directed to all mathematics teachers.

As a council, we will continue to promote membership in MCATA and NCTM to all mathematics teachers. We also will work with all parties in the education process to promote NCTM's standards and develop more inservice programs for mathematics teachers. This newsletter will continue to be a source of information on conferences and summer institutes. Help us by passing this newsletter on to your colleagues and encourage them to become active members of the Mathematics Council.

—Bob Hart

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## Summer Workshops

The Centre for Mathematics, Science and Technology Education (CMASTE), Department of Secondary Education, University of Alberta, in conjunction with Alberta Education, is offering three workshops: (1) Junior High School Mathematics Teaching Workshop, August 16 to 19, 1993; (2) New Senior High School Mathematics Program (focus Math 30), August 16 to 19, 1993; and (3) Managing Data: Mathematics and Science Connections, August 16 to 20, 1993. For information on the first two workshops, call Dr. Sol Sigurdson at 492-0753 or fax 492-9402. Contact Dr. Al Olsen at 492-5860 for information on the third workshop. Registration information and forms are included with this newsletter.

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# Mathematics Council Annual Conference

The Palliser Hotel, Calgary  
October 29 and 30, 1993

Plan now to attend this exciting gathering of mathematics educators. Focusing on "Reflection: Congruent Beliefs and Practice," this two-day conference will allow you to listen to and talk with other professionals interested in mathematics learning and teaching.

The various organizing committees are busy putting together an outstanding program, social events, exhibits and displays. The program will feature two idea-sharing sessions similar to the Math Fare in Medicine Hat this past year. On Friday afternoon, junior and senior high teachers will have the opportunity to share their teaching ideas in at least 60 half-hour presentations. The same opportunity will be afforded elementary teachers on Saturday morning. Many other sessions and workshops will be offered throughout the two days. Four sessions will be presented by professionals from the business sector—engineering, insurance and police work. The program features Cathy Seeley of Austin, Texas, who was the closing speaker at the NCTM annual meeting in Seattle in early April and Don Fraser of the University of Toronto, who was the banquet speaker in Seattle. The closing speaker for our conference will be Gerry Fijal, a mathematics teacher-entertainer from the Calgary Catholic School Board.

A Friday evening social is being planned to enhance the social aspect of the

conference. The social committee is working hard to keep this event affordable and enjoyable so that everyone will join in the festivities.

Many publishers have expressed interest in being part of the display area. It is a chance for them to highlight their mathematics materials to a focused group of educators. As well, an area will be set aside for the display and sale of NCTM and MCATA materials. Another display area will be the browse and reflect area where teachers will submit teaching ideas and student work.

If you have student work or teaching ideas that you would like to display or present, particularly during the half-hour sessions, contact Bob Michie at 294-6309, Bob Midyette at 249-3131 or Barb Morrison at 298-1396.

The cost of the conference is \$85 plus GST for MCATA members. Plan to attend—the conference is affordable, and professionally, you can't afford to miss it!

—Bob Michie,  
Conference Chair

## Measuring Up

The Mathematical Sciences Education Board (MSEB) announces the publication *Measuring Up: Prototypes for Mathematics Assessment*. The aim of *Measuring Up* is to give some concrete examples of assessment tasks that might be appropriate for Grade 4 students who have had the benefit of a K-4 mathematics education based on NCTM's *Curriculum and*

*Evaluation Standards for School Mathematics.* These tasks are prototypes and are not ready for immediate administration to Grade 4 students. They are intended to illustrate possible directions for new assessment instruments, not to be an example of a real assessment. They should be viewed as work in progress, not as fully completed blueprints.

An introduction describes the overall intent of the book, the criteria that were used to develop the tasks, the pilot testing that was done and the intended audiences. The relationship between individual tasks and specific NCTM standards is discussed.

The major part of the book contains 13 prototypes of assessment tasks designed to take from part of a class period to two or three days. Each example includes a rationale for the mathematics education community, which describes the design considerations underlying the task, along with some variants and extensions of the task. An outline of a scoring rubric is provided for each example, and a few examples of children's work (at high, medium and low levels) are included as well.

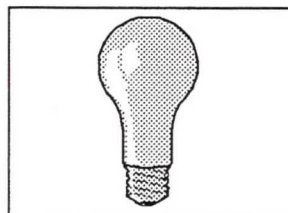
Although the book is targeted toward a hypothetical audience of Grade 4 students who have had an up-to-NCTM standards education, it can be useful in working with preservice and inservice teachers, administrators and test developers to illustrate possible directions for the future. It can also serve as a source of ideas for instruction in today's elementary mathematics classrooms.

Copies of *Measuring Up* (Copyright 1993) are available from the National

Academy Press, 2101 Constitution Avenue, Box 285, Washington, DC 20055. The cost of this 166-page, 7-by-10-inch paperbound publication in U.S. funds is \$10.95 (single copy), \$8.50 each (2-9 copies) or \$6.95 each (10 or more copies). Add \$4 for shipping and handling for the first copy, and 50¢ for each additional copy. To order by phone using a credit card, call toll-free 1(800)624-6242.

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## Challenges



Here are a couple of challenges from the 1992 International Mathematical Olympiad.

## Problems

1. Find all integers  $a$ ,  $b$  and  $c$ ,  $1 < a < b < c$ , such that  $(a-1)(b-1)(c-1)$  is a divisor of  $abc-1$ .
2. Find all functions  $f$  from the set of real numbers to the set of real numbers such that  $f(x^2+f(y))=y+(f(x))^2$  for all real numbers  $x$  and  $y$ .

## Answers

1. (2, 4, 8) and (3, 5, 15)
  2.  $f(x)=x$  for every real number  $x$
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## What's New



- In *A Different Kind of Classroom: Teaching with Dimensions of Learning*, author Robert Marzano reviews 30 years of research on the learning process and translates it into a model of classroom instruction called "Dimensions of Learning." The framework of the model is structured on the premise that the learning process involves the interaction of five types, or dimensions, of learning. To order the 190-page book, send \$15.95 (U.S.) to the Association for Supervision and Curriculum Development (ASCD), 1250 North Pitt Street, Alexandria, Va. 22314; phone (703) 549-9110, fax (703) 549-3891.
- *Options for Girls: A Door to the Future, An Anthology on Science and Math Education* focuses on turning the tide for women in mathematics and science. Published by the Foundation for Women's Resources, the 314-page book offers specific suggestions for improving science and mathematics literacy for women. To order, send \$22 (U.S.)—includes mailing fee—to Leadership Texas Alumnae Association, 210, 3500 Jefferson, Austin, Tex. 78731; phone (512) 459-1167, fax (512) 459-1408.
- *Teaching for Thinking* focuses on the importance of effective thinking in school and in life. Published by the National Association of Secondary School Principals (NASSP), the 128-page book is divided into three sections:

Curriculum Developments, Teaching and Assessment, and Concluding Perspectives. To order a copy, send \$12 (U.S.) to NASSP, 1904 Association Drive, Reston, Va. 22091-1537; phone (703) 860-0200 or 1(800)253-7746.

- *Fraction Sense*, Monograph 24, is a resource to help develop an understanding of the meaning of fractions. In their book, MaryKay Bouck, Elizabeth M. Jones and Linda Pierce emphasize teaching for understanding and furnishing students with a conceptually sound background in fractions. It contains activities that compare and order fractions, locate fractions on a number line, express fractions in simplest form and perform operations with fractions. Students use rectangular strips and later draw rectangular models to solve problems. Other topics, such as circles, are also used. Reproducible student materials, such as fraction bars, are included in the lessons.

This book would be especially helpful for teachers, as it gives teacher commentary with expected responses from students and helps to develop discourse between teacher and students, as recommended in NCTM's *Professional Standards for Teaching Mathematics* (1991). The activities can be done in small or large groups and are most appropriate for Grades 5 and 6 classrooms. Reproducible student materials are included in the guide.

To order this 145-page paperback, send \$10 (U.S.) to Michigan Council of Teachers of Mathematics, Box 16124, Lansing, Mich. 48901.

## Summer Institute on Student Assessment in the Classroom



Would you like to go back to school in September with some new assessment strategies? Then you won't want to miss the second annual Summer Institute on Student Assessment in the Classroom (SISAC). The institute will be held in Edmonton from August 16 to 20. It will be sponsored by Alberta Education and organized with assistance from The Alberta Teachers' Association, Alberta Education, Alberta universities and metro school boards.

You may choose from a variety of sessions and workshops, ranging from a half day to two days, focused on issues of concern to teachers, such as

- using performance-based assessment in the classroom,
- diagnostic evaluation in reading (the new updated program) and mathematics,
- using test results to improve instructional programs,
- improving students' writing,
- using technology to assist student learning,
- reporting students' progress to parents, and
- assessing portfolios and response journals.

Sessions and workshops will be available for teachers in Divisions I

through IV, across the curriculum. They will be presented by leading educators from across the province. Some of the Monday and Tuesday sessions will be repeated on Thursday and Friday so that delegates at the ATA Summer Conference will have an opportunity to attend.

Registration information was sent to schools in mid-March. For further information, contact Yvonne Johnson, SISAC coordinator, Student Evaluation Branch, Edmonton, 427-0010. Use the government RITE line to avoid long distance charges.

## 71st Annual NCTM Meeting

Seattle, Washington  
March 31 to April 3, 1993

### Problem

13,221 people attended the 71st annual NCTM meeting in Seattle, Washington. On Thursday morning at 9:00, if half of these people were attending sessions at the Westin and Sheraton Hotels, how many were attending the sessions at the Convention Center?

### Answer

About 10. The rest were lined up to get on the escalators!



“Tides of Change: Teachers at the Helm” was an apt theme for this convention. There is great optimism regarding the impact that the NCTM standards has had and will continue to have on curriculum development, teaching practices and assessment procedures. Implementation may seem to have tidal-wave force, but lasting change cannot occur without dedicated teachers.

Tuesday evening and Wednesday morning involved meeting and sharing with delegates at the Canadian Caucus meeting, followed by the 44th Delegate Assembly. Chairing this meeting was indeed a challenge. Transparencies flew across the overhead screen with friendly amendments, substantive amendments, and amendments to the amendments of the amendments.

The first resolution (1.M.93) was passed as amended:

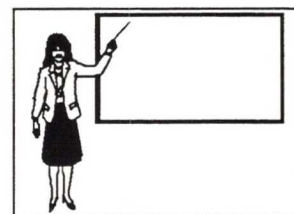
That NCTM appoint a task force to provide models that assist teachers with additional accommodations and support for the inclusion of special needs students in mathematics classes.

The second resolution (7.O.93) was also passed as amended (not the exact wording):

That NCTM act as an advocate to see that every state/province/Washington, DC, establish and maintain an office within the state/province/Washington, DC, Department of Education whose focus is leadership in mathematics education.

Then, there were the sessions—859 in all! How do you choose? The first day,

you make your preferred choice for each time slot. When you realize that no two consecutive choices are in the same building, you are undaunted and spend the day madly dashing about. The next day, you plan better! Although you may not get all of your first choices, the sessions are invigorating. At some, you take notes (models for discourse in the classroom); at others, you share with those around you (ideas for initiating active learning); and at still others, you “do” (folding a dollar bill into a bow tie).



The informal sessions (many hosted by publishers) provided opportunities for meeting new acquaintances and colleagues from distant places. These social activities are important for establishing and maintaining supportive networking systems.

Another popular feature is the exhibits area. This year, there were about 180 different displays where you could get information, pick up a catalog (and maybe a freebie) or make a purchase.

The Friday night banquet featured a Canadian speaker, Don Fraser (our 1991 MCATA keynote speaker), from the University of Toronto. His humorous presentation was well received.

The NCTM experience was wonderful. I extend my thanks to the MCATA executive for naming and supporting me as the NCTM delegate at this conference.

—Marie Hawk



## The Right Angle

### Notice to All Mathematics 30 Teachers: June and August 1993 Mathematics 30 Diploma Examinations

Many students and teachers raised concerns about the time it took for some students to write the January exam. Teachers estimated that students needed an additional 15 to 20 minutes to adequately complete the exam. The raw scores on the January 1993 exam were calculated out of 60 marks rather than 70. This adjustment led to the question, "Given that the January, June and August exams must be parallel in construction, what about the June and August exams?"

When the scoring of the January exam was completed, five teachers from across the province reviewed the June 1993 exam. They concluded that the June 1993 exam was parallel to the January 1993 exam in terms of its expectations of students. As in January, those students who meet the standards in Mathematics 30 and have a strong conceptual understanding of mathematics should be able to complete the exam in 2.5 hours. However, in all likelihood, some students will have difficulty completing the exam. Hence, after careful deliberation we made the following decision:

Students will be allowed an additional half hour to complete the June and August 1993 Mathematics 30 Diploma Examinations.

Share this information with your students. Further information will be sent directly to high schools in the next few weeks.

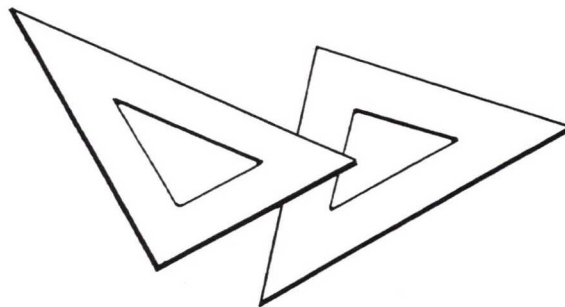
### Change to the Mathematics 30 Formula Sheet

A proposed formula sheet and  $z$ -score table for the Mathematics 30 diploma examination is attached to this newsletter. It includes more information than the current one. I would appreciate hearing your comments. Phone Florence Glanfield at 427-0010, ext. 410 or fax 422-4200.

### News from Curriculum—Secondary Mathematics

Alberta Education is establishing a Secondary Mathematics Advisory Committee on Curriculum Standards. This committee will include representatives from the ATA, APEGGA, a university and a college. The mandate of the committee will be to advise Alberta Education on secondary mathematics programs and standards. For more information, contact Hugh Sanders at 427-2984.

—*Florence Glanfield*  
*Alberta Education Representative*



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**CENTRE FOR MATHEMATICS, SCIENCE, AND TECHNOLOGY EDUCATION  
(CMASTE)  
DEPARTMENT OF SECONDARY EDUCATION  
UNIVERSITY OF ALBERTA**

**Junior High School Mathematics Teaching Workshop**

**Dates:** August 16 to 19, 1993  
**Workshop times:** 8:30 to 4:00  
**Place:** 9th Floor, Education South, University of Alberta  
**Cost:** \$200  
**Registration date:** The workshop needs 15 registrants by June 15, 1993.  
Participants will be advised on this date if the workshop is NOT running.

**Description of the Workshop**

The focus of the workshop will be on the developments in junior high school mathematics with special attention to the directions that Alberta Education is considering. More specifically there will be sessions on

1. Lesson activities with special emphasis on meaning, manipulatives and applications
2. Manipulatives and cooperative learning
3. Problem solving as a curriculum goal and as a classroom activity
4. Interactive teaching and lesson considerations such as review, mental computation, group work, seatwork, and homework
5. Teaching specific units: Algebra and Fractions
6. Technology - calculators and computers
7. Laboratory activity and materials
8. Assessment practices for junior high schools

Special Noon Hour Sessions: Alberta Education proposed curriculum changes, data management.

Note: This is a non-credit course. Special credit arrangements may be possible.

**Workshop leaders:**

Sol Sigurdson, University of Alberta - Classroom teaching, problem solving  
Ralph Mason, University of Alberta - Algebra, assessment  
Susan Ludwig, St. Clements School, Edmonton - Teaching fractions  
Katie Haden, County of Parkland Schools, - Manipulatives, cooperative learning

Teachers requiring residence at reasonable rates should contact Housing and Food Services at Lister Hall, University of Alberta, Tel. 492 - 4281, Fax. 492 - 7032

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Detach and send in. Registration Form

Name: \_\_\_\_\_

School: \_\_\_\_\_

School Address \_\_\_\_\_ Phone \_\_\_\_\_

Home Address \_\_\_\_\_ Phone \_\_\_\_\_

Send this registration form with the \$200.00 workshop fee to CMASTE, c/o Secondary Education, 341 Education South, University of Alberta, Edmonton, AB T6G 2G5.

**CENTRE FOR MATHEMATICS, SCIENCE, AND TECHNOLOGY EDUCATION  
(CMASTE)  
DEPARTMENT OF SECONDARY EDUCATION  
UNIVERSITY OF ALBERTA**

**New Senior High School Mathematics Program (focus Math 30)**

**Dates:** August 16 to 19, 1993  
**Workshop times:** 8:30 to 4:00  
**Place:** 9th Floor, Education South, University of Alberta  
**Cost:** \$200  
**Registration date:** The workshop needs 15 registrants by June 15, 1993.  
Participants will be advised on this date if the workshop is NOT running.

**Description of the Workshop**

The focus of the workshop will be on the new senior high school mathematics program with special attention to new developments in student assessment. More specifically there will be sessions on

1. Teaching methods - teaching with meaning, manipulatives, and the role of applications
2. Problem solving as a curriculum goal and as a classroom activity, including small group work
3. Interactive teaching and lesson considerations such as review, mental computation, group work, seatwork, and homework
4. Teaching specific units: Conics, trigonometry, perms. and combs., data management and statistics
5. Technology - calculators and computers
6. Writing in the mathematics curriculum
7. Assessment practices for senior high schools
8. Changes in Math 31

Special Noon Hour Sessions: Alberta Education assessment policies, Alberta Education planning for Math 31, a view from the mathematics department (U of A)

Note: This is a non-credit course. Special credit arrangements may be possible.

**Workshop leaders:**

Sol Sigurdson, University of Alberta - Classroom teaching, problem solving

Elizabeth Mowat - Statistics and writing in mathematics

Carolyn Martin - Assessment, problem solving and trigonometry

Len Bonifacio - Conics and perms and combs

Marion Oberg - Technology

Teachers requiring residence at reasonable rates should contact Housing and Food Services at Lister Hall, University of Alberta, Tel. 492 - 4281, Fax. 492 - 7032

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Detach and send in. Registration Form

Name: \_\_\_\_\_

School: \_\_\_\_\_

School Address \_\_\_\_\_ Phone \_\_\_\_\_

Home Address \_\_\_\_\_ Phone \_\_\_\_\_

Send this registration form with the \$200.00 workshop fee to CMASTE, c/o Secondary Education, 341 Education South, University of Alberta, Edmonton, AB T6G 2G5.

**CMASTE  
PRESENTS  
A SUMMER INSTITUTE  
MANAGING DATA: MATHEMATICS & SCIENCE CONNECTIONS**

- When:** August 16 - 20, 1993
- Where:** University of Alberta, Edmonton, Alberta
- What:** Through participation in workshops, laboratory activities, and seminars, you'll have the opportunity to examine and develop teaching materials for data management that can be used in connecting mathematics and science. The institute leaders consist of classroom teachers, university mathematics and statistics professors, and research scientists.
- Who:** For all junior and senior high school mathematics and science teachers.
- How:** Registration is limited so register early! Cost is only \$250/person.

Upon registration, you will receive a package of institute materials. Further information can be obtained by phoning Dr. Al Olson at 492 - 5860. If you wish accommodations at reasonable rates, contact Food and Housing Services at Lister Hall: 492 - 4281 or FAX: 492 - 7032.

**REGISTRATION DEADLINE: TUESDAY, June 15, 1993**

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**CMASTE  
MANAGING DATA: MATHEMATICS & SCIENCE CONNECTIONS  
REGISTRATION FORM**

**NAME:** \_\_\_\_\_

**ADDRESS:** \_\_\_\_\_

**PHONE:** \_\_\_\_\_

**Are you interested in taking this institute for graduate credit?** \_\_\_\_\_  
(Additional fees apply for graduate credit.)

Please enclose a personal cheque or money order with your registration form. Please make cheques payable to CMASTE/Department of Secondary Education.

Please mail registration form and fee to:  
CMASTE - Department of Secondary Education  
Faculty of Education  
Rm. 341 Education South  
University of Alberta  
Edmonton, AB T6G 2G5

## PROPOSED - MATHEMATICS 30 FORMULA SHEET 1994 EXAMINATIONS

The following information may be useful in writing this examination.

- The roots of the quadratic equation  $ax^2 + bx + c = 0$  are

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

- The distance between two points  $(x_1, y_1)$  and  $(x_2, y_2)$  is

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

### Polynomial Functions

- $P(x) = D(x)Q(x) + R$

### Trigonometry

- arc length  $a = r\theta$
- $\sin^2 A + \cos^2 A = 1$
- $1 + \tan^2 A = \sec^2 A$
- $1 + \cot^2 A = \csc^2 A$
- $\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$
- $\csc A = \frac{1}{\sin A}$
- $\sec A = \frac{1}{\cos A}$
- $\cot A = \frac{\cos A}{\sin A}$
- $\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$

### Quadratic Relations

- eccentricity  $e = \frac{|PF|}{|PD|}$ , where  $F$  = focus,  $D$  = directrix, and  $P$  = point on the conic

### Permutations and Combinations

- $n! = n(n-1)(n-2) \dots (3)(2)(1)$
- ${}_n P_r = \frac{n!}{(n-r)!}$
- ${}_n C_r = \frac{n!}{r!(n-r)!}$
- $(x+y)^n = {}_n C_0 x^n + {}_n C_1 x^{n-1} y + {}_n C_2 x^{n-2} y^2 + \dots + {}_n C_k x^{n-k} y^k + \dots + {}_n C_n y^n$

General Term

$$t_{k+1} = {}_n C_k x^{n-k} y^k$$

### Sequences and Series

Arithmetic:  $d$  = difference between 2 consecutive terms  
 $a$  = first term

- $t_n = a + (n-1)d$
- $S_n = \frac{n[2a + (n-1)d]}{2}$  or  $S_n = \frac{n}{2}(a + t_n)$

Geometric:  $r$  = ratio of 2 consecutive terms  
 $a$  = first term

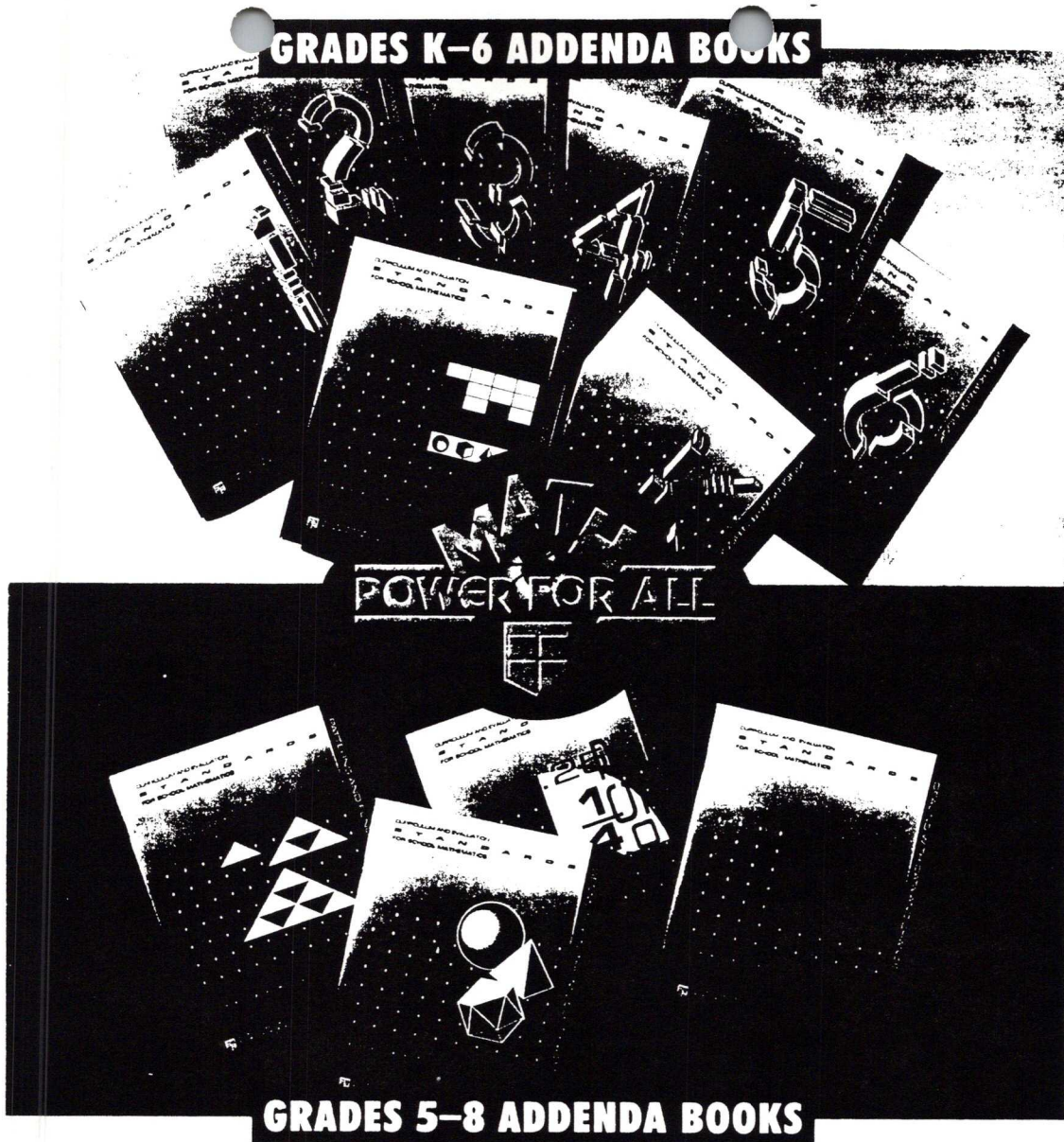
- $t_n = ar^{n-1}$
- $S_n = \frac{a(r^n - 1)}{r - 1}, r \neq 1$

### Exponential and Logarithmic Functions

- $\log_a mn = \log_a m + \log_a n$
- $\log_a \frac{m}{n} = \log_a m - \log_a n$
- $\log_a m^n = n \log_a m$



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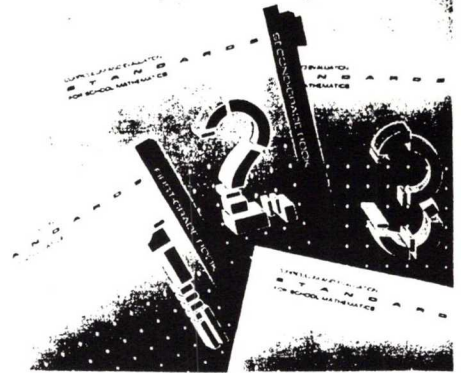
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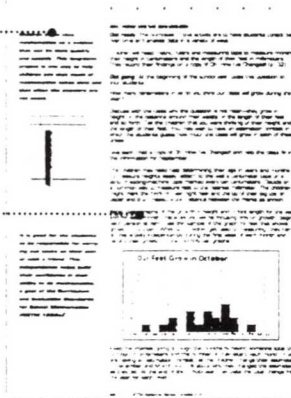
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Editors: J. M. Barnes  
T. E. Kieren

\$15.00

Centre for Mathematics, Science,  
and Technology Education,  
University of Alberta

ISBN 0-88864-922-3

Although frequently perceived to be a dead and unchanging body of established facts, mathematics is a dynamic field that might be more appropriately characterized as the pinnacle of creative thought than the embodiment of objective rationality. This view of the discipline is exemplified by chaos theory and fractal geometry—two relatively recent areas of mathematical inquiry that have sparked not only great interest as topics of research but considerable debate on the nature of mathematical knowledge. With the publishing success of such texts as Gleick's *Chaos: Making a New Science*, interest in the topic has spread from a once-small circle of mathematicians to the public at large.

The monograph, *Chaos, Fractals, and Infinity: Introductory Ideas for the Secondary Classroom* was produced by a group of mathematics educators who set out to explore the topics of chaos theory, fractal geometry, and infinity as curriculum areas. The project was developed around the question: What happens to the curriculum when new mathematical ideas come into play?

The papers presented in the monograph are provided as a springboard for thinking about chaos theory and fractal geometry. Some concepts important to the study of these areas are provided, but the main purpose of the monograph is to provide teachers with a range of background ideas and possibilities for student involvement.

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