Vol. 36 #2, December 1997

Ontario Mathematics Gazette

IN THIS ISSUE

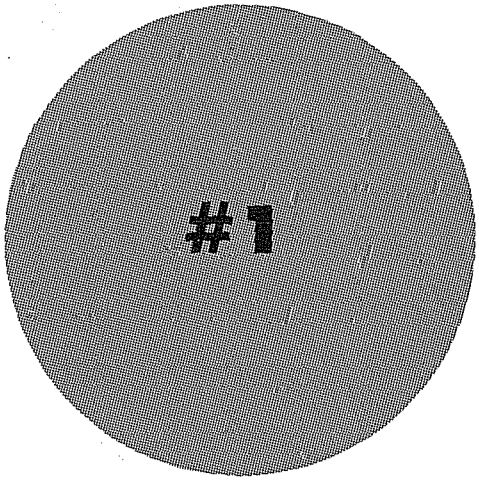
Enriching Mathematical Creativity in the Elementary Classroom

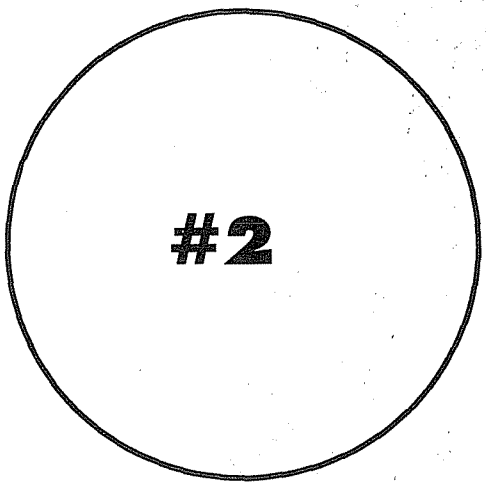
Exploring Mathematics at the Ontario Science Centre

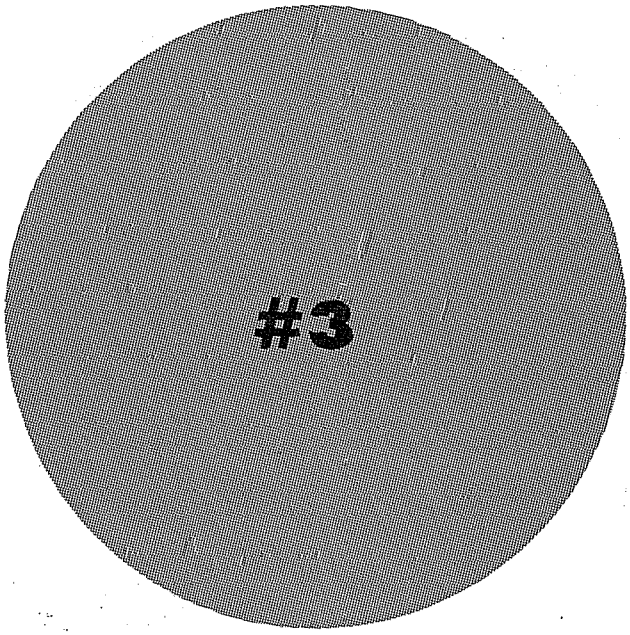
Mathematics and Me

Exploring 2^k-1

Simple Harmonic Motion Using a Ball Attached to a Slinky







Which one of the three circles is more different that the other two circles

?

ONTARIO ASSOCIATION FOR MATHEMATICS EDUCATION
ASSOCIATION ONTARIENNE POUR L'ENSEIGNEMENT DES MATHÉMATIQUES

"How do you write tests, homework & classwork?"

"by hand?"
(The old way)

Final Exam

1. State the Domain of $y = \frac{x-10}{\sqrt{x^2-16}}$.

2. Which relation is the inverse of $y=(x$

3. Use a half-angle identity to find the exa

a) $\frac{1}{2}\sqrt{2-\sqrt{2}}$ b) $-\frac{1}{2}\sqrt{2-\sqrt{2}}$ c) $\frac{1}{2}\sqrt{2}$

4. If $f(x)=2x-5$ and $g(x)=\frac{2}{x+3}$, find

a) $\frac{-(5x+11)}{x+3}$ b) $\frac{1}{x-4}$ c) $\frac{5x}{x}$

5. If $\sin\theta=-\frac{1}{2}$ and θ is in quadrant I

a) $\frac{-\sqrt{3}}{3}$ b) $\frac{\sqrt{3}}{3}$ c) $\sqrt{3}$

6. Given $f(x)=\frac{x^2}{x+3}$ and $g(x)=3x-2$,

a) $\frac{4x^2-2x}{x+3}$ b) $\frac{4x^2+7x-6}{x+3}$ c)

"struggling with your word processor?"
(The hard way)

Final Exam

1. State the Domain of $y=\frac{x-10}{\sqrt{x^2-16}}$

2. Which relation is the inverse of $y=(x-2)^3$?

a) $y=\sqrt[3]{x-2}$ b) $y=\sqrt[3]{x}-2$ c) $y=\sqrt[3]{x+2}$ d) $\sqrt[3]{x}+2$

3. Use a half-angle identity to
cos 67.5°:

a) $1/2\sqrt{2-\sqrt{2}}$ b) $-1/2\sqrt{2-\sqrt{}}$

4. If $f(x)=2x-5$ and $g(x)=\frac{2}{x+3}$

a) $\frac{-(5x+11)}{x+3}$ b) $\frac{1}{x-4}$

5. If sin θ=-1/2 and θ is in qua

a) $\frac{-\sqrt{3}}{3}$ b) $\frac{\sqrt{3}}{3}$

6. Given $f(x)=\frac{x^2}{x+3}$ and $g(x)=3x-$

a) $\frac{4x^2-2x}{x+3}$ b) $\frac{4x^2+7x-6}{x+3}$

7. a) If $\sin\alpha=1/3$; $\cos\beta=3/4$;
quadrant IV, find $\cos(\alpha-\beta)$

b) Evaluate: tan(arcsin$\frac{\sqrt{3}}{2}$ + a
quadrant angles.

"With MathType!"
(The right way)

FINAL EXAM

NEW 3.5 VERSION includes new geometry templates

1. State the Domain of $y=\frac{x-10}{\sqrt{x^2-16}}$.

2. Which relation is the inverse of $y=(x-2)^3$?

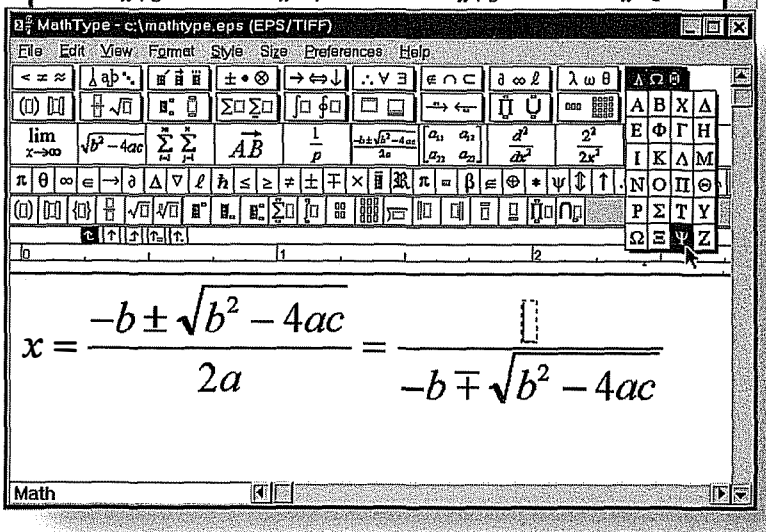
a) $y=\sqrt[3]{x-2}$ b) $y=\sqrt[3]{x}-2$ c) $y=\sqrt[3]{x+2}$ d) $\sqrt[3]{x}+2$

3. Use a half-angle identity to find the exact value of cos 67.5°:

a) $\frac{1}{2}\sqrt{2-\sqrt{2}}$ b) $\frac{-1}{2}\sqrt{2-\sqrt{2}}$ c) $\frac{-1}{2}\sqrt{2+\sqrt{2}}$ d) $\sqrt{3+2\sqrt{2}}$

4. If $f(x)=2x-5$ and $g(x)=\frac{2}{x+3}$, find $[g\circ f]\,(x)$:

a) $\frac{-(5x+11)}{x+3}$ b) $\frac{1}{x-4}$ c) $\frac{5x+13}{x+3}$ d) $\frac{1}{x-1}$



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

MathType works with any Macintosh and Windows word processor (and any other software) to create publication-quality equations in your documents. Use your mouse to point-and-click (or the keyboard) on over 280 math symbols — MathType does the rest — automatically formatting your equations according to the established rules of mathematical typesetting.

Upgrade your Equation Editor ...
MathType is the powerful, full-featured version of the Equation Editor included in Microsoft Word, Works and many other Windows and Macintosh products. If you frequently include equations in your documents, you will find MathType is much better suited to your needs. MathType is as easy to use as Equation Editor and has many extra features to help you work faster and create better-looking documents.

MathType™ ... The *best* thing for writing equations since chalk!™

Order today:
Academic pricing: $199 (CAN.)
Competitive upgrade: $119 (CAN.)

To Order ... Call 800-827-0685
Fax 562-433-6969
Email sales@mathtype.com
World Wide Web http://www.mathtype.com

Put MathType on every math & science teacher's computer with a MathType School or District License.

MathType and "The best thing for writing equations since chalk!" are trademarks of Design Science. All other company and product names are trademarks and/or registered trademarks of their respective owners.

▲ Table of Contents

Columns

- ▲ About the Gazette 1
- ▲ Editorial / John Egsgard 2
- ▲ Letter to the Editor 3
- ▲ President's Message / Judy Crompton 4
- ▲ Teaching Ideas from the Editor 16
- ▲ About Problem Solving: Is a Tie Possible? / John Grant McLoughlin 17
- ▲ Directors' Dialogue / Peter Saarimaki 21
- ▲ OAME 1997-98 Board 28

Articles

- ▲ Enriching Mathematical Creativity in the Elementary Classroom / Doug McDougall and Ann Kajander 5
- ▲ Exploring Mathematics at the Ontario Science Centre / Louis Lim 10
- ▲ Mathematics and Me / Bessy Koutsaris 13
- ▲ Exploring 2^k-1 / L. Keith Roy 14
- ▲ Simple Harmonic Motion Using a Ball Attached to a Slinky / James Rahn 18

Notices

- ▲ OAME Linking Assessment & Instruction in Mathematics:Connecting to the Ontario Provincial Standards / Transition Years 15
  / Junior Years 15
- ▲ OAME Board of Directors Nomination Form 16
- ▲ OAME Excellence in Mathematics Award Certificate 20
- ▲ OAME Awards Nomination 23
- ▲ OAME 1998 Gateways Conference Notice 25
- ▲ OAME 1997 Financial Statement 26

Advertisements

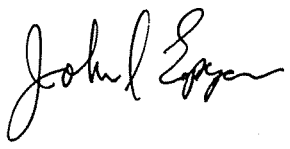
- ▲ Design Science . . . . . inside front cover
- ▲ The Bookman 6
- ▲ Société Rad enr 8
- ▲ CAMPS '98 • The University of Western Ontario . . . 12
- ▲ Neufeld and Associates 19
- ▲ GVMA 21
- ▲ Texas Instruments . . . . . inside back cover
- ▲ Gage . . . . . back cover

▲ Editorial



This issue of the *Gazette* arrives after a difficult fall for all teachers. Many of us feel discouraged and wonder if all the effort at self improvement is worthwhile for it does not seem to be appreciated. Yet a few moments reflection may lead us to see that we must continue to improve both for our own self esteem and for the good of the students in our classrooms. Governments will rise and fall. Ministers of Education will come and go. The constant factor is our love for mathematics and for our students. Many of us can remember the years when education was not a political football. Those were the days when decisions were made by educators in the Ministry not by politicians eager to follow Robarts into the premiership through the education portfolio. Those times may never return so we must find our peace in our continued dedication to our students.

This issue of the *Gazette* contains articles for both the elementary and secondary teachers. Two of the articles are written by teachers new to our profession. It is good to see these young teachers eager to share their ideas. I would hope that many of you would by-pass your frustrations with self-serving politicians by taking some time to share your teaching ideas with your peers.



A drawer contains two coins, each one either gold or silver. You do not see the coins, but an observer tells they are not both gold. Beyond this you know nothing (and must therefore assume all possibilities equally likely.) You take one coin out of the drawer at random and it turns out to be silver. What then do you judge to be the probability that the other coin is also silver?

KEITH DEVLIN IN "ALL THE MATH THAT'S FIT TO PRINT".

About the Gazette

The Gazette—ISSN 0030–3211—is indexed in the Canadian Education Index and is published four times per year. Its Canadian Publication Mail Product Sales Agreement Number is 601349.

Editor

▲ **John Egsgard**

Associate Editors

▲ **Yvonne Bergsma**

▲ **Norm Viirre**

Abacus Editor

▲ **Frances Schatz**

Design, Tech Art and Production

▲ **Penny Clemens**
Graphic Designer, Cambridge, ON

Printing & Binding

▲ **Pole Printing,** Box 69, 89 King Street
Forest, ON N0N 1J0 (519) 786-5112

Advertising Manager

▲ **Dean Murray**

Submission of Advertisements

Advertisements for the Gazette should be sent to Dean A. Murray at the above address. Courier is recommended to avoid possible delays.
Deadlines for advertisements are January 23 for March issue, April 1 for the June issue, July 1 for the September issue, and October 1 for the December issue.
Full page advertisements are to be on 8.5" by 11" paper with a minimum of 1/2" margins and single sided. Each advertisement should be camera-ready and colour advertisements should have no bleeds.

Advertising Rates

Advertising Rates are available by telephoning or writing the Advertising Manager.

Permission to Photocopy

Unless otherwise indicated in the article, permission to photocopy material from the Gazette is granted to classroom teachers for instructional use, to authors of scholarly papers and to librarians who wish to place a limited number of copies of articles on reserve. In all such instances due credit should be given to the authors and to OAME. Permission must be sought for any commercial use of the content of this journal. Other uses of OAME journal material should be reported to OAME.

Submission of Articles

Articles for the Gazette should be submitted to John Egsgard at the address on the left.

Deadlines for information to be included in the Gazette or the Abacus are: June 15 for the September issue, October 15 for the December issue, January 15 for the March issue, and April 15 for the June issue.

Notice to Authors

Your article should be typewritten or word-processed, double-spaced on one side of 21.6 cm x 27.9 cm paper with 3 cm margins. Diagrams and figures should be drawn by computer, if possible, or neatly drawn in black ink in camera-ready form. Please submit four copies to the editor and keep one as protection against loss. Submissions are blind-reviewed, so please send your full address and affiliation on a page separate from the manuscript. Computer files of text, and graphics where possible, will be requested later if your article is accepted.

OAME / AOEM Membership Form

Join the over 2000 mathematics educators, kindergarten through college and university, who enhance mathematics education in Ontario.

Your membership:

- ▲ **Includes OAME/AOEM Publications - Gazette and Abacus**
- ▲ **Supports Professional Development through the Annual Provincial Conference, the Leadership Seminar, and Regional Mini-Conferences**
- ▲ **Provides opportunity for local input with chapter affiliation**
- ▲ **Promotes mathematics through Excellence in Mathematics certificates, I Love Math buttons, and several OAME/AOEM awards**
- ▲ **Encourages networking and information shoring**
- ▲ **Stimulates Problem-Solving at all grade levels**

OAME/AOEM MEMBERSHIP APPLICATION OR CHANGE OF INFORMATION FORM

Name: (first name(s)) (surname)

Home Address: (no.) (street) (apt.)

(town/city) (province) (postal code) (telephone)

EDUCATIONAL INSTITUTION: _____

Address: (no.) (street) (town/city)

(board) (postal code) (telephone)

☐ Elementary ☐ Secondary ☐ CAAT ☐ University ☐ Other

CHAPTER AFFILIATION (Check one):

☐ CHAMP	☐ COMA	☐ GOLDEN	☐ GVMA	☐ ISOMA
☐ MAC^2	☐ NOMA	☐ NWOAME	☐ PINE RIDGE	☐ QSLMA
☐ SAME	☐ SWOAME	☐ TEY^{2}MS	☐ WOMA	☐ Y^{4}MA

OAME/AOEM Membership: ☐ New ☐ Renewal ☐ Correction

Membership Fees:
☐ one year $40 ($50 outside Canada)
☐ five years $180 ($225 outside Canada)
☐ student members $25 ($30 outside Canada)
☐ retired members $30 ($35 outside Canada)

Send form and cheque, payable to OAME, to:

OAME

▲ LETTER TO THE EDITOR

Dear Editor

With reference to the article ***The Manipulative Connection*** by Laura and Richard Sgroi in the **June, '97** issue, I would like to make some observations about the subtraction of integers and the multiplication of integers.

The authors show us how to represent "abstract concepts in tangible form" to "help students 'see' their meaning and structure".

1. Consider the example in Figure 11 (Integer Subtraction).

   Some students are able to cross the bridge from the use of manipulatives, to the concept and to the strategies (which in this case is an algorithm) by themselves but some need help.

   I have found that when I wanted to get at the apparently silly "add the opposite" algorithm that I posed a series of questions like that in the bottom diagram of Fig 11.

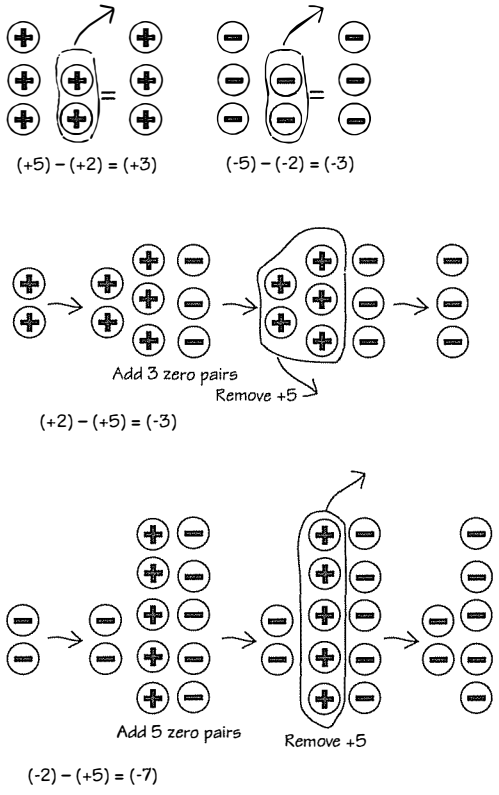


Figure 11 from OAME Gazette Vol. 35 #4, June 1997

You will notice in the bottom diagram in Fig 11 that the net effect of **subtracting** (removing) +5 was that we **added** -5 (which is the **opposite** of +5).

Note how the bottom diagram makes this explicit whereas the 2nd diagram does not. The difference is that the two numbers are opposite in sign. The relative absolute values of the numbers do not matter. (If you use the materials with:

(+2) - (-5), (+5) - (-2) or (+5) - (-2)

you will see what I mean.)

2. When we analyse the Integer Multiplication strategies shown we can see that the inverse idea can be used to develop strategies for division of integers.

If you wish to see an elaboration of the subtraction ideas see Chapter I of *Alge-Tiles*.

For an elaboration of the division of integers with manipulatives you can see Concept 7 of *Soar With Integers*.

Keep up the good work!

Sincerely
Jack LeSage
9 Mountbatten Rd, Barrie, L4M 1T4
(p) 705 728 9958, (f) 705 728 3445
mlesage@interhop.net

References

Morrison B.&H. (1995). *Soar With Integers.* Barrie: Exclusive Educational Products (EEP).

Scully J. *et al* (1991). *Alge-Tiles.* Barrie: EEP.

It is by turns amusing and depressing to track the way descriptions of numerical relations depend on the authors' intentions. To make a quantity appear large, for example, a consumer group, a political group, or business advertiser might stress a linear measure of its size. To make it appear small., it might stress its volume. Thus although a single tower of nickels stretching from sea level to the height of Mount Everest would contain more than four million coins, you can easily verify that this pile would fit comfortably into a cubical box about 6 feet to a side.

JOHN ALLEN PAULOS IN "A MATHEMATICIAN READS THE NEWSPAPER"

▲ PRESIDENT'S MESSAGE



JUDY CROMPTON

Hello again out there in mathematics land! This is my third message. It is October 18, and I am three days late in getting this message to our excellent *Gazette* editor, John Egsgard. Sorry, John.

I always enjoy reading the *Gazette.* The articles are timely, interesting and useful. The presentation is clear and effective. An added bonus for our members in elementary school is the *Abacus,* which presents classroom ready activities. I know that a tremendous amount of work goes into producing the *Gazette* and the *Abacus.* I offer a special thank you to John, to Frances Schatz who edits the *Abacus,* and to all the *Gazette* staff and reviewers. You are providing a very valuable service to OAME members.

Now, what's new?

You will be happy to know that the OAME **Early/Formative and Transition Years Curriculum Committees** have been hard at work on the Grade 1-8 guideline. Susan Stuart kicked off the work in the last Gazette with an article that examined the guideline in grades 1-6. The **Early/Formative Committee** continues to look closely at the guideline, and are planning another article that will provide suggestions about implementation.

The **Transition Years Committee** has been closely examining the grade 6-8 continuum. Led by Chair Joe Hall and Executive Liaison Barry Scully, they are in the process of taking the expectations and rearranging them so that the flow from grade 6-8 can be seen. Two strands have been completed and a number of suggestions have been made for adjusting the sequence.

And in **Specialization Years ...** the OAME SY committee, led by Chair Shirley Dalrymple, is working on the production of two items that will be shared with members. The first is a document dealing with the effective use of technology in the classroom; this will be available for purchase this year. The second is some sample "rich learning tasks", fully developed, fully described and fully field-tested by members of the SY committee in their classrooms. These will be provided to OAME chapter representatives to be shared with their members.

These are examples of the direct support to the membership that the OAME Board of Directors is committed to providing.

A little more information about Specialization Years. We are all waiting for the announcement of the Ministry's decisions regarding secondary reform. Following that announcement will begin a round of curriculum guideline writing. OAME, in conjunction with OMCA and other members of the Fields Institute Mathematics Education Forum, have struck a committee to begin preparation in anticipation of the guideline writing for mathematics. The committee is composed of a mix of secondary and post-secondary educators and is chaired by Myrna Ingalls, who is a member of the OAME Specialization Years Committee.

I mentioned the term "rich learning tasks" in a previous paragraph. This, of course, is the theme of **Leadership 97**, set to go on **November 13-15**. I am pleased to report an excellent response to the conference. I'm really looking forward to it.

I must close now, I'm off to play my last round of golf for this season. I play once a week from April through October with a group of old friends, all of whom are teachers. We hack away quite happily, doing at least as much chatting as swinging. It is a spectacular fall day ... just a little cool, but the sunshine is dazzling. We play at a course that nestles right into the base of the escarpment. The view from the tee on Number 8 is awesome ... you look directly at the escarpment, which today will be aflame with the brilliance of a Niagara autumn. I can hardly wait!

▲ Enriching Mathematical Creativity in the Elementary Classroom

DOUG MCDOUGALL AND ANN KAJANDER



Dr. Douglas McDougall is an Assistant Professor in the Department of Curriculum, Teaching and Learning at OISE/UT in Toronto. He teaches graduate level and B.Ed level courses in mathematics and technology.



Dr. Ann Kajander is an Adjunct Professor at the School of Mathematical Sciences and is a faculty liaison for the School of Education at Lakehead University, Thunder Bay. She conducts Kindermath classes from her home.

The OAME Focus on Renewal of Mathematics Education document (1993) suggests that the school mathematics curriculum include the following features:

- *Problem solving should be the central focus of the mathematics curriculum*
- *Classroom should provide a comprehensive and rich approach to problem solving in a climate that encourages and supports students' efforts*
- *The students' ability to explore, speculate, validate, and convince others is critical to the development of mathematical reasoning in our classrooms (OAME and OMCA, 1993, p. 4).*

Furthermore, the **NCTM Curriculum Standards** (1989, 1991) suggest that children need to investigate, experiment, and explore everyday objects and other physical materials (p. 48).

Outlining the Challenges

Teachers can help students become creative explorers in their classroom. However, there are a number of issues prohibiting the effective implementation of a creative program. Textbooks, student expectations and teachers' understanding of geometry are three of the issues.

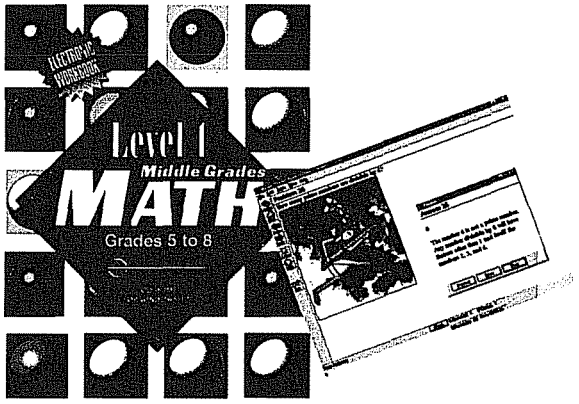
It is important for teachers to make their own decisions about what happens in their classroom and not to be bound exclusively by the textbook. Multiple solutions and varying approaches are a reality in the world of mathematics that textbooks have difficulty addressing. As a result, teachers trained in the traditional way may not have experienced many of the more interesting ideas in mathematics themselves. Students learn quickly that they will receive grades based on the "right answer" approach and assume that this type of problem is "mathematics." Fitting all of mathematics into a textbook is as impossible as fitting all of visual art into a textbook: many of the valuable things must be omitted. As Henderson (1996a) describes the situation with respect to geometry, which is one of the areas to which textbooks can do the least justice, "much interesting and useful geometry is either not taught at all, or is presented in a way that is inaccessible to most students."

There are a number of examples that illustrate Henderson's assertions. Historically, geometric topics are placed at the end of the textbook. McDougall (1997) describes a teacher's view of geometry and her approach to planning. Karen, a Grade 8 teacher, traditionally teaches the geometry unit at the end of the year. However, she finds that she is frequently unable to get to those topics because of the very busy end of year activities. When asked how she felt about not getting to geometry, she said" I don't mind because, as a student, I did not like geometry, I didn't do well, and I just tell them what to do anyway" (McDougall, 1997, p. 103). If teachers organize their yearly plans so that geometry is at the end of the year, geometry topics are not given the promised attention.

The **OAME and OMCA Focus** document (1993) and the **NCTM Standards** document (1989) conclude that the exploratory process is important to learning to develop concrete levels of understanding. If concrete levels of understanding are not in place, students are not able to build higher-order generalizations upon them (Skemp, 1987, p. 32), and must resort to memorization. Eventually, of course, memorization is insufficient and

TWO GREAT NEW CD-ROM PRODUCTS

FROM MATH LEAGUE PRESS!



MIDDLE GRADES MATH LEVEL 1

(FOR WINDOWS 3.1 OR WINDOWS 95)

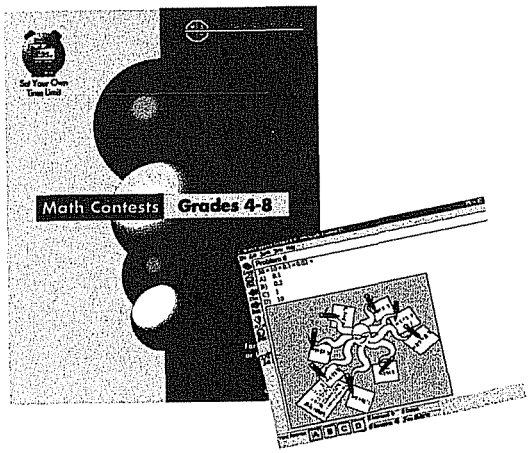
OVER 5000 PRACTICE PROBLEMS BY TOPIC TO COVER AN ENTIRE 6TH GRADE CURRICULUM AND A WIDE RANGE OF SUBJECTS, MAKES THIS AN EXCELLENT LEARNING TOOL FOR STUDENTS IN GRADES 5-8. FEATURING:
-BUILT-IN, SEARCHABLE HELP SECTION
-ANSWERS & DETAILED SOLUTIONS
-REPORT WRITER
-40 DIFFERENT MAJOR MATH SUBJECTS

AND

MATH CONTESTS GRADES 4-8

(FOR WINDOWS 3.1 OR WINDOWS 95)

CONTAINS 53 ORIGINAL MATH CONTESTS GIVEN IN THE UNITED STATES & CANADA. CONTAINING 30-40 MULTIPLE CHOICE PROBLEMS DESIGNED TO BE SOLVED IN 30 MINUTES. THESE CONTESTS HELP STUDENTS DEVELOP PROBLEM-SOLVING SKILLS AND DEVELOP A MORE OPEN APPROACH TO PROBLEM SOLVING. THIS CD-ROM CONTAINS THE SAME FEATURES AS *MIDDLE GRADES MATH.*





THE BOOKMAN

TEXTBOOK & EDUCATIONAL OUTLET INC.

(800) 461-TEXT / (416) BOO-KMAN
FAX: (416) 224-5324 / EMAIL: email@bookmantext.com
4910 YONGE STREET, NORTH YORK, ON M2N 5N5

the entire perilous structure comes crashing down, sometimes into a sense of mathophobia.

The characteristics of students provide us with part of the solution. Children are naturally creative (Ward, Finke and Smith, 1995) and we must guard against "schooling" it out of them. Helen Buckley, in her poem "A Little Boy", describes a child who enjoys drawing pictures in many colours. His teacher instructs him to draw a red flower with a green stem. She asks him to wait for her and to draw one exactly like hers. Although he feels that he can draw one that is better, he reproduces her drawing. Later, another teacher asks him to draw a flower and he asks "what colour?" Even though the subsequent teacher encourages him to choose any colour he likes, he chooses a red flower with a green stem.

It is possible that traditional classroom activities play a role in stifling children's natural desire to "play around" and think divergently as well as three-dimensionally. For example, in a small group task involving multiple clues for the construction for a 3-dimensional figure (see Figure 1), children aged seven were observed stacking one block over another much more quickly than did a group of ten year olds working on a similar task at the next table.

The seven year olds naturally began stacking the cubes early on in the task. The 10 year olds, being more accustomed to two-dimensional paper and pencils tasks, found this a less obvious approach.

Mathematically creative students may be difficult to handle in regular classroom situations. Teachers may even find the more creative thinkers disruptive in a traditional teacher-directed lesson because they may come up with questions and ideas that may not be on the teacher's lesson plan.

Mathematical creativity, like other forms of creativity, may involve both a divergent and convergent component (Kajander, 1989). The divergent component is the "playing around" phase, where new ideas are generated. The convergent element in mathematical creativity may have a distinct nature; students draw upon exciting ideas or examples to form a new higher-order idea or generalization. As Skemp (1987) describes, this can only truly happen if students have had enough time playing with and understanding the concepts. Presenting the rule first and then the example, as is often done in textbook lessons, prevents the students from actually doing useful mathematical work themselves.

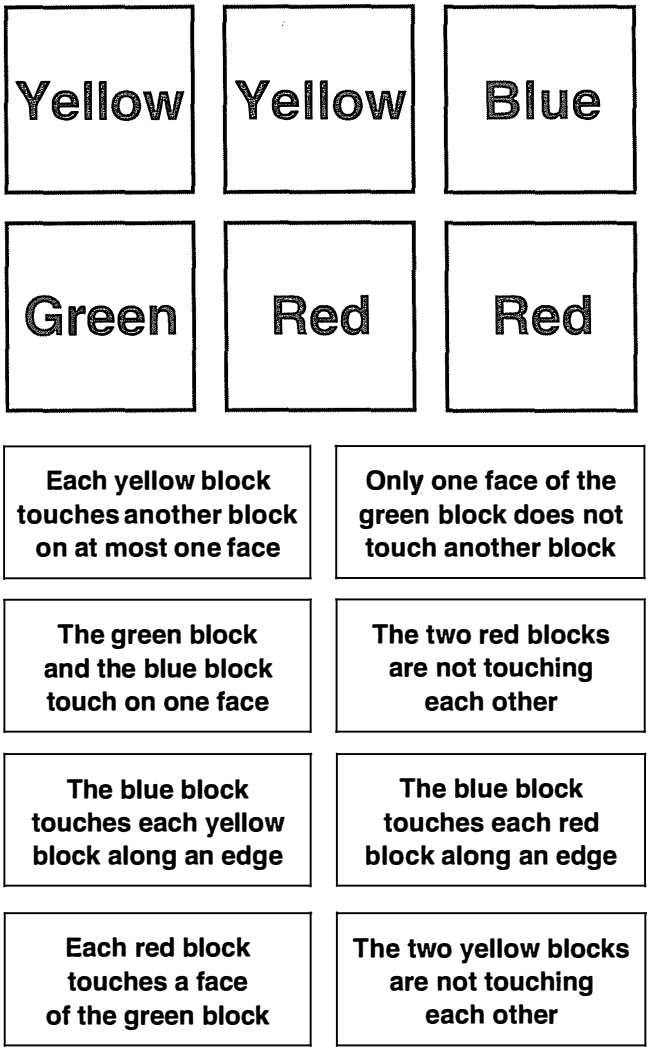


Figure 1. Multiple Clues with Cubes Activity

Suggestions for Classroom Implementation

Focusing on activity-based lessons allows for both the development of concrete understanding as well as for individual creative ideas. Collaborative groups have also been shown to be helpful in the learning process. For example, children working on the task shown in Figure 1 have been observed to get very excited arguing amongst themselves and sharing clues and ideas. They challenge each other's suggestions and are forced to verbally justify and clarify their ideas. Of particular interest was their perception of "touching." One student believed that the sides had to touch while another felt that a vertex was sufficient for "touching." The communication between the students lent support to the mathematical construction within a social perspective of constructivism.

Ideally, groups will probe deeply enough into the problem to generate and explore a sufficient number of ideas to begin to converge to something valuable, in this case, a higher order mathematical idea. For example, children in a grade 5 classroom (Zack, 1995) were given a series of tasks involving an increasing number of diagonals. In each case, students were asked to find the total number of diagonals among the diagrams. After finding the total number with three sides, then four sides, they realized that an alternate method of finding the number of diagrams was needed. As the number of sides increased, this approach became more tedious and the students began spontaneously to try to construct a general formula for the number of diagonals.

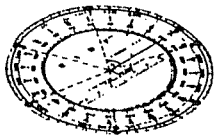
Sharing amongst the groups helped to spark a new progress (Zack, 1995). The teacher may wish to play a role in the final convergent process, that is, the drawing together of the groups' work to find a commonly accepted idea.

As the NCTM Standards and the OAME and OMCA documents state, student involvement and hand-on exploration must be the new agenda on mathematics education. This allows us to widen the scope from the narrow range for topics selected to fit textbooks based on the "right answer" type of mathematical problems. Since much of mathematics does not fit into this category, students have traditionally received a very restricted view of mathematics.

Because teachers have often not experienced topics allowing for mathematical investigation, and may only be comfortable with the "finding the right answer" learning situations, such change can be an intimidating process (McDougall, 1997). Karen found herself feeling uncomfortable during her work with Geometer's Sketchpad (McDougall, 1997). She was trying to complete the Grade 8 Geometric Constructions unit with this software and was concerned that she did not know all the right answers. Students asked many questions that she could not answer and she felt that she did not have control of the classroom nor the topic. As the students gained confidence with the geometric relationships, the teacher felt more at ease with not having the "right answer." She began to work with the students at the computer and with their various investigations. The very nature of the investigative classroom allowed Karen to work collaboratively with her

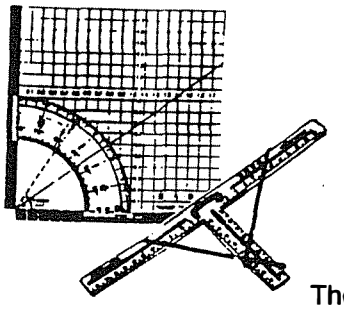
RADE

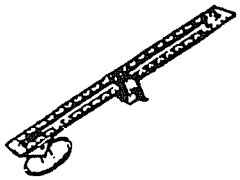
I-N-D-I-S-P-E-N-S-A-B-L-E



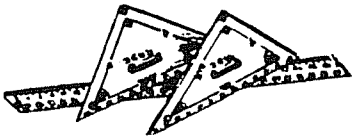
The **trig-o-meter** and **slope-o-meter**
Essential tools in all well-equipped math labs!

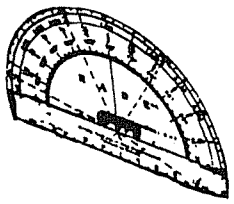
The **RADE protractor** with radians and degrees
For students and teachers! You can't work without it!





The **square set** and **meter stick**
Practical and indispensable throughout all grades!





The **board compass**
Finally circles that loop!

The **board protractor**
with radians and degrees
A revelation for the teacher!

RADE Protractor guide
Technical explanations
-Practical & reproductible exercises

RADE Instruments Guide
Technical explanations
-Practical & reproductible exercises

Head Office :
Société Rade enr.
352, de la Neuve-France
Saint-Jean-sur-Richelieu,
Quebec
J3B 1A1
Phone : (514) 349-3317
Email : dgm@total.net
Web site :
http://www.cam.org/~reidl

Also distributor for Ontario :
B & B School Supplies
75 Watline Avenue bureau 101
Mississauga, Ontario
L4Z 3E5
Phone : (905) 890-0404
Free call : 1-800-668-1108
Fax : (905) 890-7999

For a traditional blackboard and for a modern blackboard

students. The "knowing the right answer" approach formerly held by the teacher changed into a new teacher response of "I don't know, let's find out together."

Many teachers are uncomfortable with the idea of evaluating work in exploratory environments. To begin, we suggest that the teacher mix traditional and investigative activities, so that everyone can adjust gradually, and that the newer methods of evaluation are introduced slowly. Karen used paper and pencil evaluation techniques in her Grade 8 Mathematics class. She observed student constructions on the computer screen and asked investigative questions. Initially, she was uncomfortable with this technique but, after observing her students and gaining a better insight into their understanding of geometric relationships, she felt that she would add individual observation to her repertoire of assessment strategies.

Another method of evaluation is journal writing (Henderson, 1996b). The students reflect on the process of investigation in a journal which is read by the teacher. Teachers make general comments, supporting and further questioning the investigations of students. Another possibility is teacher evaluation of group presentations (Zack, 1995). Pairs or groups may also be asked to hand in written reports of their activities, similar to a lab report. In general, the investigative effort itself must be evaluated, not just the product.

Summary

Mathematics explorations and collaborative activities are important in the development of a mathematical community capable of creative thinking. Students need to participate in activities that provide the opportunity for multiple solutions, and experience alternate approaches that are creative. Children are interested and prepared to undertake such activities (Kajander, 1996).

We can help students become creative explorers in a classroom organization including cooperative and collaborative groups as well as individual and paired explorations. Games and open-ended questioning encourage enjoyment as well as acceptance for multiple solutions. Use of visual and spatial reasoning activities allows for the development of concrete geometric understanding, which must come before abstract reasoning can successfully take place.

Journal writing and working with a partner or even an older "math buddy" encourages self-reflection and a probing for deeper understanding. Large group discussion can tie the work together and allow decisions about the "best answer" to be made. Teachers may find that keeping a journal themselves or working with a mentor or colleague, will be supportive in these new learning environments.

In general, teachers are encouraged to become active participants and explorers of new mathematical ideas. They need to know that it is okay not to always be the one with the right answer. Sometimes, there just isn't one.

References

Focus on Renewal of Mathematics Education: A Document for Ontario Educators. Toronto: The Ontario Association for Mathematics Education and The Ontario Mathematics Coordinators Association. (1993).

Henderson, D. W. (1996a). *Alive Mathematical Reasoning.* Lecture given at CMESG '96, Halifax, NS.

Henderson, D. W. (1996b). *Experiencing geometry on plane and sphere.* Upper Saddle River, NJ: Prentice-Hall, Inc.

Kajander, E. Ann. (1996). *Mathematics Enrichment in an Out-of-School Setting.* Proceedings of the CMESG '96, Halifax, NS.

Kajander, E. Ann. (1989). *Possible Components of Mathematical Ability: A Study of Mathematical Creativity in a Deductive Geometry Curriculum Unit.* Unpublished Doctoral Thesis. Toronto: University of Toronto.

McDougall, D. E. (1997). *Mathematics Teachers' Needs in Dynamic Geometric Environments: A Search for Control.* Unpublished Doctoral Thesis. Toronto: University of Toronto.

National Council of Teachers of Mathematics. (1989). *Curriculum and evaluation standards for school mathematics.* Reston, VA: The Council.

National Council of Teachers of Mathematics. (1991). *Professional standards for teaching mathematics.* Reston, VA: The Council.

Skemp, R. R. (1987). *The psychology of learning mathematics.* Hillsdale, NJ: Lawrence Erlbaum Associates.

Ward, T. B., Finke, R. A. & Smith, S. M. (1995). *Creativity and the mind: Discovering the genius within.* New York: Plenum Press.

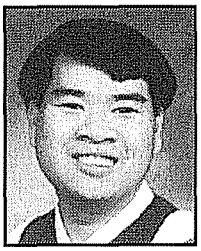
Zack, V. (1995). *Algebraic Thinking in the Upper Elementary School: The Role of Collaboration in Making Meaning of 'Generalization'.* Proceedings of the Nineteenth International Conference for the Psychology of Mathematics Education, Recife, Brazil, pp. 106-113.

MathType™ . . . The *best* thing for writing equations since chalk!™

Mathtype™ was used to create formulas in this issue of the OAME/AOEM Gazette. Courtesy of Design Science. www.mathtype.com

▲ EXPLORING MATHEMATICS AT THE ONTARIO SCIENCE CENTRE

LOUIS LIM
ISOMA REPRESENTATIVE TO OAME
QUINTE SECONDARY SCHOOL



Louis Lim is a second year Mathematics Teacher currently with the Hastings County Board of Education. Last year, he had the privilege of working with Ron Lancaster who gave him the gift of viewing the world mathematically. Louis is also a part-time Master of Education student at Queen's University interested in teaching Mathematics through technology. He was appointed the ISOMA rep to OAME this past June.

Mathematician Karl Gauss is famous for saying "Mathematics is the queen of the sciences." Several of my grade 8 students probably thought I woke up on the wrong side of the bed when I informed them that they were going on a **Mathematics** trip to the Ontario Science Centre to discover that what was said a century and a half ago is still accurate.

All the grade 8 students at St. Mildred's-Lightbourn School, an all-girls independent day school in Oakville, spent an entire day at the Ontario Science Centre. The purpose of this field trip was to review, extend and consolidate concepts covered this year in our Mathematics programme while having lots of fun in the process.

Students were organized in groups of four and were responsible for visiting four major areas: *The Science Arcade, Communication, Space, and Human Body*. A total of 17 groups were formed, and each group started their Math adventure from a different section of the 25 page work booklet I prepared. Several teachers, parents, and a teacher candidate from York University accompanied the students on the field trip.

Student feedback was very positive. Students commented that they enjoyed the opportunity to work in groups, saw how useful Mathematics is through active involvement with the exhibits, and were amazed at how much Math actually exists in the Science Centre. Circulating between exhibits, I was very pleased with the energy, enthusiasm and level of responsibility the students demonstrated. Each group was able to plan out their day; e.g. when to go for lunch, whether to complete all the questions in the workbook so they could visit other exhibits, or to explore near-by exhibits concurrently with working through the workbook.

I believe there is great potential for Math field trips at all grade levels. I got the idea after attending my department head's, Ron Lancaster, Toronto Math Trial for his grade 7 students. As a Math teacher, there is no greater reward than seeing students actively involved in their learning and enjoying it! Below, I have included some of the problems to provide the reader with a flavour of the trip. I am keeping my fingers crossed that the Ontario Science Centre will become an annual field trip for our Mathematics students.

1(a). Find the "Pythagorean Theorem" display. Explain how the model demonstrates the Pythagorean Theorem.



Emily and Nicole carefully count the number of vertices, faces, and edges of each of the five regular solids to discover "Euler's Formula".

1(b). Does the Pythagorean Theorem also hold for the 85° triangle on display? Explain.

1(c). Let's answer the problem on display: "If c x c = c^2 and c = 5 units, 5 x 5 = 25 sq. units. Then, if a^2 is equal to 16 square units, how much is b^2 ? How much is b?"

1(d). If the a square has 9 units of liquid, and the b square has 16 units of liquid, how much liquid will the c square have?

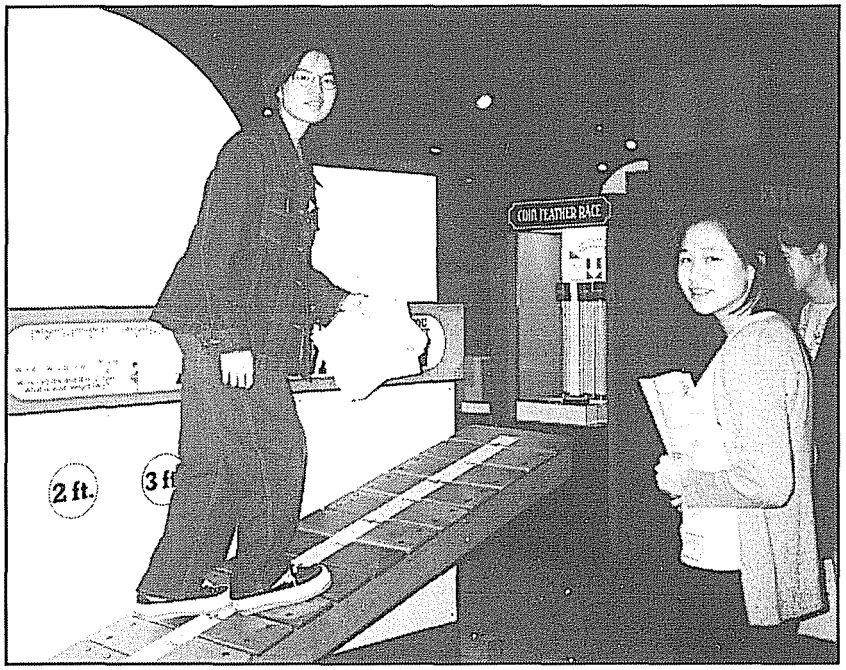
1(e). If the a square has 100 units of liquid, how much liquid could the two smaller squares have? Explain.

2(a). Archimedes is considered to be one of the greatest mathematicians of all time. He used the lever to successfully change the way humans move objects. With the lever, engineering was founded. The law of levers is used today in gears, cranes, machinery, bridges, buildings, nuts, bolts, and tools. Write the equation for the "Law of Levers". Explain what each variable represents.

2(b). Rewrite the equation, $w_1 \times A = w_2 \times B$, by solving for w_1 .

2(c). Find your weight using the "Law of Levers". Show all essential steps.

2(d). Is this your actual weight? Suggest a reason why the result may not be exactly correct.



Joanne stands on the lever to calculate her weight. She takes tiny steps and finds that the lever starts to move at 3.5 feet.

3(a). Find the "Bicycle Generator" Exhibit. Mr. Lim found the front wheel to have a radius of 20 cm. Calculate the circumference of the bicycle wheel on your stationary bike. (Remember that the distance a bicycle wheel turns around once is the circumference of the wheel.)

3(b). How many times does the wheel have to turn to travel 1 km? Show work.

3(c). Co-operative Group Experiment: Let's calculate the distance covered by riding the stationary bike as fast as you can in 15 seconds. It was found that every time the rider's left foot reaches the bottom of the pedal, the front wheel revolved 2.4 times.

Student #1: Rides the stationary bike;

Student #2: Timer for 15 seconds;

Student #3: Counts the number of times the rider's left foot reaches the bottom of the pedal (start with left foot on bottom);

Student #4: Encourages the rider to pedal faster.

4(a). Find the "Interference" display. Perform the experiment by reading out loud the **colour** of each word as fast as you can. Explain your results.

4(b). Did you find a particular colour(s) more difficult? Why?

5(a). Find the "Whodunnit" video display. Pay close attention to the video and pick the right suspect who committed a crime at the Ontario Science Centre. List the number of the suspect.

5(b). In research situations, _____ out of 100 eyewitness identifications can be wrong. Think of several reasons why this number is so high.

5(c). Express the above as a fraction in lowest terms, as a decimal, and as a percentage.

5(d). If 462 eyewitnesses were asked to select from a Police Line-Up during the past few months, how many of them will identify their suspect correctly?

6(a). Calculate the length of your femur using the tape measure provided.



Candace is riding the stationary bike as fast as she can. Katie is busy counting the number of times Candace's left foot reaches the bottom. Melanie is timing for 15 seconds, while Constance is doing a superb job encouraging Candace to pedal even faster.

6(b). Scientists have developed an algebraic model which can predict the height of a person, y, knowing the length of his/her femur, x:

$$\text{Males: } y = 1.9x + 81.3$$

$$\text{Females: } y = 2.0x + 73.0$$

Use the length of your femur to determine your height. Is this your height?

6(c). Anthropologists investigate the anatomy and physical make-up of early humans by analyzing the bones they uncover. A femur bone found at a construction site measured 45 cm. Determine the height of this early human.

7. Find the "Science Of Weaving Display". Mathematical ideas appear in woven fabric designs. Study the bedspread, and find as many mathematical concepts present as you can. Here are some suggested guidelines: line of symmetry, turn (rotational) symmetry, geometric shapes or combination of shapes, reflected patterns.

COMPUTER SCIENCE ASTRONOMY MATHEMATICS PHYSICS and STATISTICS

LIGHT, QUANTA & RELATIVITY
Victor Elias
Applied Mathematics • Pleva Teaching Award

ORDER FROM CHAOS:
The importance of randomness in mathematics and nature
Peter Poole
Applied Mathematics • USC Award of Excellence for Undergraduate Teaching

COMPUTER SCIENCE CONUNDRUMS
Department of Computer Science

MASTER CLASSES IN PROBLEM SOLVING IN MATHEMATICS AND PHYSICS
Tom Griffiths - Descartes Medal
Michael Dawes - Mathematics
Patrick Whippey - USC Teaching Award

ASTRONOMY:
What Time is it?
Why is it dark at night?
Where does all this stuff come from?
Jim Moorhead
Physics & Astronomy

IMAGING FOR 2000 AND BEYOND.
What does one of the world's largest magnets do?
Ravi Menon
Roboris Research Institute

INTERESTING ISSUES IN STATISTICS
David Stanford
Statistics & Actuarial Science • USC Teaching Award

FIELD TRIPS
Observatories • Rocket Launching

CAMPS '98
JUNE 28 - JULY 4, 1998
THE UNIVERSITY OF WESTERN ONTARIO

This Residential Comp is for excellent students interested in Computer Science, Astronomy, Mathematics, Physics and Statistics. The problem-solving sessions will be of particular interest to students who participate in the Descartes, Sir Isaac Newton, Euclid, or Canadian Association of Physicists contests. It is a superb preparation for all University programs in these fields.

Camp registration fee of $600 includes all meals, accommodation and field trips. Parents are invited to a special banquet on Friday evening. For information please contact: Let's Talk Science

▲ MATHEMATICS AND ME

BESSY KOUTSARIS



Bessy Koutsaris is a recent graduate from York University's Faculty of Education, Primary/Junior program. She would like to extend a special thanks to Jackie Harris, her former course director, for all of her support. Bessy is currently looking forward to someday teaching in her own classroom.

In elementary school, I thought math was fun,
I always used to participate and get my work done.
Whether we did addition, subtraction, multiplication, or percent,
I usually understood what my teachers meant.

Grade four was the year when I most enjoyed math,
We constantly engaged in hands-on activities, and had a laugh.
Cooperative learning was always stressed,
The students in Mrs. S' class never left school feeling depressed.

I was fortunate because my dad always worked on my math with me,
And he was never disappointed when I came home with a "B".
Support and encouragement was in the air,
Everyone around me really seemed to care.

In high school, my positive attitude gradually turned negative,
I started hating math, and all it had to give.
In every math class I began sitting in the back,
And soon realized that it was the high grades I seemed to lack.

My grade eleven math teacher, I'll never forget,
He always made us leave class in a cold sweat.
Many assignments and quizzes were given each week,
Which left us with very little time to sleep.

Unfortunately, Mr. D kept putting all the girls down,
He made me feel like I shouldn't be around.
Unmotivated and discouraged that was me,
While most of the boys worked with glee.

This is the only class which I ever failed,
And yes my parents really "wailed".
Math was like an unfamiliar language to me,
One for which, I didn't hold the key.

For me in high school, math was like a maze,
It always left me in a daze.
Which ever way I would bend,
It was terribly difficult to reach the other end.

In my final year of high school my attitude changed,
Which I truly and thankfully found strange.
When I stepped into the class of Mr. C,
His lively approach made all the difference for me.

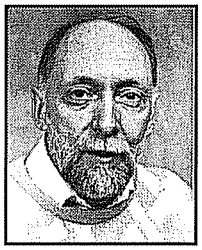
Mr. C was available every morning and after school,
He helped me realize that math was cool.
The students always worked in groups of six,
And together there were very few problems that we couldn't "fix".

I began to see math as challenging and exciting,
So I stuck through the course, and kept on fighting.
Mr. C made math seem fun and important,
And constantly talked about all the avenues that it can open.

Math is a way of thinking, an art, and a tool,
A subject that we should never take for granted in school.
Math is all around us, a part of almost everything,
So we must try to teach our students the value it can bring!

▲ EXPLORING 2^K-1

L. KEITH ROY
DEPARTMENT OF MATHEMATICS AND STATISTICS
LAKEHEAD UNIVERSITY, THUNDER BAY



Keith is Chair of Mathematics and Statistics at Lakehead University. He has been a speaker at several OAME and NWOAME conferences and is the author of ten previous articles in the Gazette.

The following discussion uses the concepts of prime numbers, exponents and the factor theorem, and consequently might be of interest to high school teachers.

Fermat Numbers

Perhaps the best known examples of expressions similar to 2^k-1 are the Fermat numbers 2^k+1 where $k=2^n$ and n is a nonnegative integer (see [1][2]). Fermat conjectured that such numbers were all prime numbers. However for n=5 the Fermat number $2^{32}+1$ equals 641 x 6 700 417. So the conjecture is incorrect.

Now consider numbers of the form 2^k-1 where k is a nonnegative integer. If k=2 or 3, then $2^2-1 = 3$ and $2^3-1 = 7$ which are prime numbers. However, if k=4, then $2^4-1 = 15$ which is not a prime number.

Factoring 2^{k-1}

The following example illustrates a technique which is sometimes useful for finding factors of 2^k-1 when k is large.

Consider $2^{60M}-1$ where M stands for one million. Is $2^{60M}-1$ divisible by 3? Is it divisible by 5? How about 31 and 155?

Checking as large a number as $2^{60M}-1$ for factors would be tedious, even using a computer, if one chose to try simple division. Instead consider the fact that $2^2-1 = 4-1 = 3$ and that 60M is divisible by 2 (the exponent). Similarly $2^2+1 = 4+1 = 5$ while $2^5-1 = 32-1 = 31$, and 60M is divisible by the exponents 2 and 5. Consequently, using the rules of exponents,

$2^{60M}-1 = 2^{2(30M)}-1 = (2^2)^{30M}-1$, and

$2^{60M}-1 = 2^{5(12M)}-1 = (2^5)^{12M}-1$.

Since 155 = 5 x 31, it will be a factor of $2^{60M}-1$ as long as both 5 and 31 are factors.

One other idea needs to be introduced in order to be able to make use of the above expressions. Consider the polynomial x^r-1 where r is a positive integer. Using the factor theorem, since the expression x^r-1 becomes zero when x=1, then x-1 must be a factor of x^r-1. Similarly, if r is an even positive integer, the expression x^r-1 becomes zero when x=-1 which means that x+1 is a factor of x^r-1.

Suppose $x = 2^2$ and r = 30M.
Then $2^{60M}-1 = (2^2)^{30M}-1$ has a factor of $x-1 = 2^2-1 = 3$.

Suppose $x = 2^5$ and r = 12M.
Then $2^{60M}-1 = (2^5)^{12M}-1$ has a factor of $x-1 = 2^5-1 = 31$.

Finally, suppose $x = 2^2$ and r = 30M, which is an even number. Then $2^{60M}-1 = (2^2)^{30M}-1$ has a factor of $x+1 = 2^2+1 = 5$.

Since both 5 and 31 are factors of $2^{60M}-1$, so is 155.

Notice that this technique cannot be used to check whether the prime number $2^7-1 = 127$ is a factor of $2^{60M}-1$ since 60M is not divisible by 7. However 127 certainly is a factor of $2^{70M}-1$.

There is a rather different way of showing that 5 is a factor of $2^{60M}-1$. Notice that $2^{60M}-1 = (2^4)^{15M}-1 = (16)^{15M}-1$. When a number ending in 6 is multiplied by another number ending in 6, the result is also a number ending in 6. So $(16)^{15M}$ ends in 6, and therefore $(16)^{15M}-1$ ends in 5. So $2^{60M}-1$ is divisible by 5.

Factoring $2^{k+1}-2 = 2(2^k-1)$

Obviously $2^{k+1}-2 = 2(2^k-1)$ has a factor of 2, and, depending on the value of k, factors might possibly be found for 2^k-1, and hence $2^{k+1}-2$, using the technique outlined above. As well, the following result is also useful in factoring $2^{k+1}-2$.

Suppose that k+1 is a prime number.

If k+1=2, then $2^{k+1}-2 = 2^2-2 = 4-2 = 2$ which is divisible by k+1=2.

If k+1=3, then $2^{k+1}-2 = 2^3-2 = 8-2 = 6$ which is divisible by k+1=3.

If k+1=5, then $2^{k+1}-2 = 2^5-2 = 32-2 = 30$ which is divisible by k+1=5.

If k+1=7, then $2^{k+1}-2 = 2^7-2 = 128-2 = 126$ which is divisible by k+1=7.

The above calculations are special cases of one of the many theorems proven by Pierre de Fermat. The theorem states: for any positive integer x and prime number r, x^r-x is divisible by r (see [1]). The expression 2^{k+1}-2 is a special case of the theorem with x = 2 and r = k+1.

According to the theorem, the prime number 2^7-1 = 127 is a factor of 2^{127}-2 = 2(2^{126}-1). So 127 must be a factor of 2^{126}-1. In general, if k+1 is a prime number greater than 2, then k+1 is a factor of 2^k-1.

Notice that the theorem does not hold if the composite number 4 is used for r = k+1 since 2^4-2 = 14 which is not divisible by 4.

References

[1] Meserve, Bruce E., Sobel, Max A. and Dossey, John A. (1989). *Introduction to Mathematics* (Sixth Edition), Englewood Cliffs, New Jersey: Prentice Hall.

[2] Musser, Gary L. and Burger, William F. (1994) *Mathematics For Elementary Teachers A Contemporary Approach* (third Edition), New York: Macmillan College Publishing.

Ontario Mathematics Coordinators Association
Ontario Association for Mathematics Education

LINKING ASSESSMENT & INSTRUCTION IN MATHEMATICS: CONNECTING TO THE ONTARIO PROVINCIAL STANDARDS TRANSITION YEARS

- **Nine field-tested Assessment Activities with related Learning Outcomes**
- **Sample Student Solutions illustrating Levels of Performance**
- **Notes to Teachers**

This 98-page document is on sale at the following rates:

1 -10 copies $10.00 each

(OAME members $8.00 for first copy, state membership number)

11 -100 copies $8.00 each

Mailing or delivery costs extra.

Ontario Association for Mathematics Education
Ontario Association of Junior Educators
Ontario Mathematics Coordinators Association

LINKING ASSESSMENT & INSTRUCTION IN MATHEMATICS: JUNIOR YEARS

- **Ten field-tested Assessment Activities with related Learning Outcomes**
- **Sample Student Solutions illustrating Levels of Performance**
- **Notes to Teachers including 10 additional activities**

This 100-page document is on sale at the following rates:

1 -9 copies $11.00 each

(OAME members $7.00 for first copy, state membership number)

10 -39 copies $9.00 each

Mailing or delivery costs extra.

Order by mail or fax: OAME, P.O. Box 96, Rosseau ON P0C 1J0, Canada Phone/fax (705) 732-1990
Do not send cash or cheque. • You will be invoiced with mailing costs added.

▲ TEACHING IDEAS FROM THE EDITOR

Ideas to Help Students Remember

1) I call the quadratic formula the "Russian-Danish Formula" because the Russians and Danes do not learn to factor and must use this formula to solve quadratic equations.

2) When memorizing transformation facts I tell the students to think of the y's as being obedient and the x's disobedient. If you graph y = f(x) + 5, the y's do as they are told and add 5. If you graph y = f(x+5) the x's do the opposite to what you ask and subtract 5. Similarly for the graph of y = 3f(x) the y's are multiplied by 3 because y's are obedient. Whereas the disobedient x's divide by 3 in the graph of y = f(3x).

3) In Calculus, I ask the students to learn the Power Rule, the Trig Rules, etc using a box rather than a variable because this helps in using the chain rule.

$$\text{For example : } \frac{d\square^n}{d\square} = n\square^{n-1} \quad \text{and} \quad \frac{d\sin\square}{d\square} = \cos\square \quad \text{and} \quad \frac{dy}{dx} = \frac{dy}{d\square}\frac{d\square}{dx}$$

$$\text{Thus, } K = \frac{d\sin^9(\cos(2x^4+7))}{dx} = \frac{d\square^9}{d\square}\frac{d\sin\Psi}{d\Psi}\frac{d\cos\Theta}{d\Theta}\frac{d(2x^4+5)}{dx}$$

$$\text{where } \square = \sin\Psi, \quad \Psi = \cos\Theta, \quad \text{and} \quad \Theta = 2x^4+5$$

$$\text{Hence } K = 9\square^8(\cos\Psi)(-\sin\Theta)(8x)$$

$$= 9\sin^8(\cos(2x^4+5))(-\sin(2x^4+5))(8x)$$

▲ NOMINATIONS FOR OAME/AOEM BOARD OF DIRECTORS 1998-99

Each year, elections are held for President-Elect, 3 Vice Presidents (1 year term) and 6 to 9 Directors (3 year term) of OAME/AOEM. Nominations for these positions are to be submitted by 4:00 p.m., January 15, 1998, to:

Barry Onslow
Past-President, OAME/AOEM
Faculty of Education

Include the nominee's qualifications with the Nominations Form. A nominee must be a member of OAME. By March, 1998, the Nomination Committee will publish a slate of candidates, including qualifications, for consideration by the membership. Voting will be by mail and is open to all OAME/AOEM members. The election will be released at the Annual General Meeting of the OAME/AOEM in Toronto in May, 1998.

Nomination Form

I nominate: _____

For the position(s) of: ☐ President-Elect ☐ Director ☐ Vice-President

Nominee's Address: _____

_____

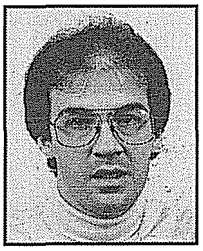
Telephone: (h) ( ) _____ (w) ( ) _____

Nominator's Address: _____

_____

Telephone: (h) ( ) _____ (w) ( ) _____

▲ About Problem Solving: Is a Tie Possible?



JOHN GRANT MCLOUGHLIN
FACULTY OF EDUCATION
MEMORIAL UNIVERSITY OF NEWFOUNDLAND

The field of recreational mathematics invites participants to investigate and explore mathematical ideas through the means of games and puzzles. The next few columns will highlight the potential contribution of recreational mathematics to mathematical learning and problem solving. The intent is to share a variety of games that are suitable for students at various grade levels; further, it is hoped that the ideas will spark some dialogue amongst readers of the column. Please share your experiences with these games along with any mathematical insights that you wish to offer. Perhaps some readers would like to provide details of one of their favourite mathematical games.

This article will focus attention on two games, namely, Number Squares and Sim. The descriptions of these games are adapted from a rich source of recreational mathematics entitled ***What's Your Game: A Resource Book for Mathematical Activities***. The games are described here so that you may play them with your classes. Playing these games gives rise to a common question: "Is a tie possible?" You are encouraged to consider this question as you play with them.

Number Squares

Number Squares is played using a 4 x 4 grid. The numbers 1, 2, 3, 4, 5, ..., 16 are written on separate cards. The cards are placed face up beside the grid so that both players can clearly see them. Players alternate turns. Each turn consists of placing a card in one of the 16 unit squares on the grid. (Each card/number can appear at most once in the grid.) A player must NOT place a card which leaves two consecutive numbers adjacent (either vertically, horizontally, or diagonally). The first player who can not place a card on the grid is declared the loser.

Sim

Six dots are drawn on a piece of paper to represent the corners of a hexagon, as shown.



Players alternate joining any two of these dots with a line segment - each player uses a different colour. A player loses if he/she completes a triangle in their own colour with its corners at points of the hexagon.

It is important to clarify what is meant by the words "completes a triangle in their own colour with its corners at points of the hexagon." Upon playing the game you will quickly see that numerous small triangles will form within the interior of the hexagonal frame. These triangles do not impact upon the rules. Rather we are only concerned with those triangles that have three of the original six dots as their vertices. A player only loses when a line segment completes such a triangle and all three sides of the triangle are the same colour.

Extensions

Games such as **Number Squares** and **Sim** invite players to consider extensions. Variations in the size of the grid or the shape of the frame may lead to games taking on considerably different looks. For instance, a 3 x 3 grid would make **Number Squares** a much simpler game to analyze. The game of **Sim** may be adapted by beginning with five dots or eight dots, for example. How would the game be affected if the hexagon was not convex? Some interesting variations of Sim have developed in my own classes when students have misinterpreted the rules. The idea is to have fun while considering the underlying principles and at a more advanced level, even investigating the mathematical concepts central to the games. While playing these games, don't forget to consider the question: "Is a tie possible?"

Reference

Cornelius, Michael & Alan Parr. (1991). *What's Your Game: A Resource Book for Mathematical Activities.* Cambridge: Cambridge University Press.

▲ Simple Harmonic Motion Using a Ball Attached to a Slinky

JAMES RAHN
SOUTHERN REGIONAL HIGH SCHOOL

This article has been used with permission from the New Jersey Mathematics Teacher, Vol, No.1. Fall, 1995.

Today with the new technology available for the classroom it is possible to collect real physical data, fit curves to the data, and explore various characteristics of the function and/or data. One interesting experiment that can be completed involves collecting data on the simple harmonic motion of a ball attached to a Slinky. THe slinky and small rubber ball will cost less than $2.00. Other than the slinky and the ball the activity will use an altrasonic motion detector, the Texas Instrument CBL, and a T1-82 Graphing Calculator. The ultrasonic motion detector measures the distance between the detector and a nearby object by sending out pulses that bounce off a nearby object and back to the detector. The data is collected by the CBL and sent to the T1-82 calculator. The T1-82 calculator displays a scatter plot for the distance vs. time of the oscillating ball. The first time the graph is displayed the class usually responds in unison, "look it's a sine curve." Then they are hooked. The next task is to try to fit a graph to a piece of the data. Equations relating to simple harmonic motion are usually of the form

$$y = \cos(B(x + C)) + D \quad \text{or} \quad y = A \sin(B(x+C)) + D.$$

Equipment and Programs Needed.

- CBL unit
- T1-82 graphing calculator
- Vernier CBL motion detector
- Small Slinky® Spring
- Small rubber ball
- Slinky .82P Program*

**Slinky.82P is a modification of the Motion.82P program supplied in the CBL System Experiment Workbook.*

Procedures

1. Attach the CL unit to the T1-82 graphing calculator. Attach the motion detector to the SONIC port of the CBL unit. Turn on the CBL unit and the calculator.
2. Run the program SLINKY .82P*. As the data is collected it will be stored in lists L2 and L4 of the calculator. Time will be stored in L2 and the distance of the ball from the motion detector will be stored in L4. The program will prompt you to PRESS ENTER TO START COLLECTING DATA. At this point you need to hold the slinky at a given height. Pull down on the ball to get an oscillating motion started. When the motion is started press ENTER. You will hear a clicking sound as the data is collected. Try holding the slinky steady during the data collecting.

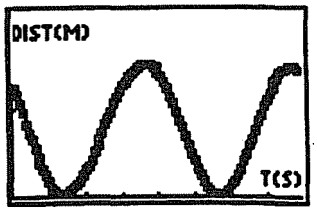


Figure 1

3. As soon as the data is collected the T1-82 calculator will display a scatterplot of the data. What type of function does the motion of the ball represent? (Figure 1) Does the function appear to be sinusoidal?
4. Let's fit a curve to the data. A good choice might be $y = A \cos(B(x + C) + D$. It is necessary now to understand the importance of the constants A, B, C and D on the positioning of the function.

   A = the amplitude or the object's maximum displacement from its resting position. A normal cosine curve has an amplitude of 1. Recall that the function $y = \cos x$ never moves beyond $y = \pm 1$.

   B = the angular frequency of the object. This number is related to the period of the cosine function through the equation $B = \frac{2\pi}{T}$, where T is the period of the function.

   C = the phase angle. This measure is related to the starting position of the ball. Normally the cosine function passes through its maximum value of $y = 1$ when $x = 0$. We will need to determine the x value which produces the maximum y value. To create this horizontal shift we will need to use the opposite of C.

D = the vertical shift

This measure relates to the maximum and minimum values achieved by the oscillating ball. The function y = cos x has all its y values between y = ±1. By studying the oscillating ball we can determine how much to shift the equation vertically to fit the data.

Fitting the data with a cosine function

1. Type the equation y = cos(B(x + C)) + D in one of the Y= slots in your T1-82 calculator. Begin by storing 0 for all variables A,B,C,D. (Type 0 STO ALPHA A, to store 0 for A).

2. To determine the amplitude of the function press STAT and select choice 1. Edit. Scroll down L3 to look for the highest and lowest Y values. (Figure 2) Make note of the position of each in the list (e.g., L3(25) = .655263 and L3(48) = .01317). Return to the home screen by pressing 2nd QUIT. Type in L3(25)-L3(48) and then press ENTER. This, of course, is twice the amplitude since it is the total displacement made by the ball. Press ÷ 2 ENTER. This number is the amplitude. To store this for A press STO ALPHA A.

L1	L2	L3
	.91999	.65197
	.95999	.65417
	.99999	.65526
	1.04	.65526
	1.08	.65417
	1.12	.63441
	1.16	.60916

L3(25)=.655263

Figure 2

3. To determine the angular frequency return to the list 3 and note the two places where the maximum height is achieved. Use the corresponding L2 values to the highest and lowest points of the graph. Return to the home screen and type in L2(77)-L2(25) and then press ENTER. This is the period, T, of the cosine curve related to the oscillating ball. To divide T into 2π type 2π ÷ ans. To store this for B, press STO ALPHA B.

4. To determine the phase shift use the corresponding L4 value to the highest value (e.g., L2(25)). Type -L2(25) ENTER. This is the amount of shift required to move the cosine curve to fit the data for the oscillating ball. To store this value for C type STO ALPHA C.

5. The final step is to move the graph vertically. Check L3(1) for the initial height. Determine the value of y1(0) by typing 2nd, Y-VARS, 1:Function, ENTER. From this value subtract L3(1) by typing -L#3(1).

6. Press graph and look at your graph. (Figure 3) How well does it fit the data?

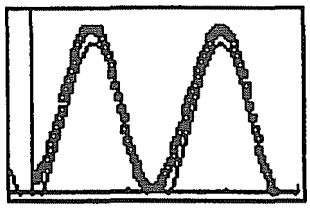


Figure 3

7. Here are some additional question you may want to think about.

   a. Check the values of A, B, C, D. Why is the value of A less than 1?

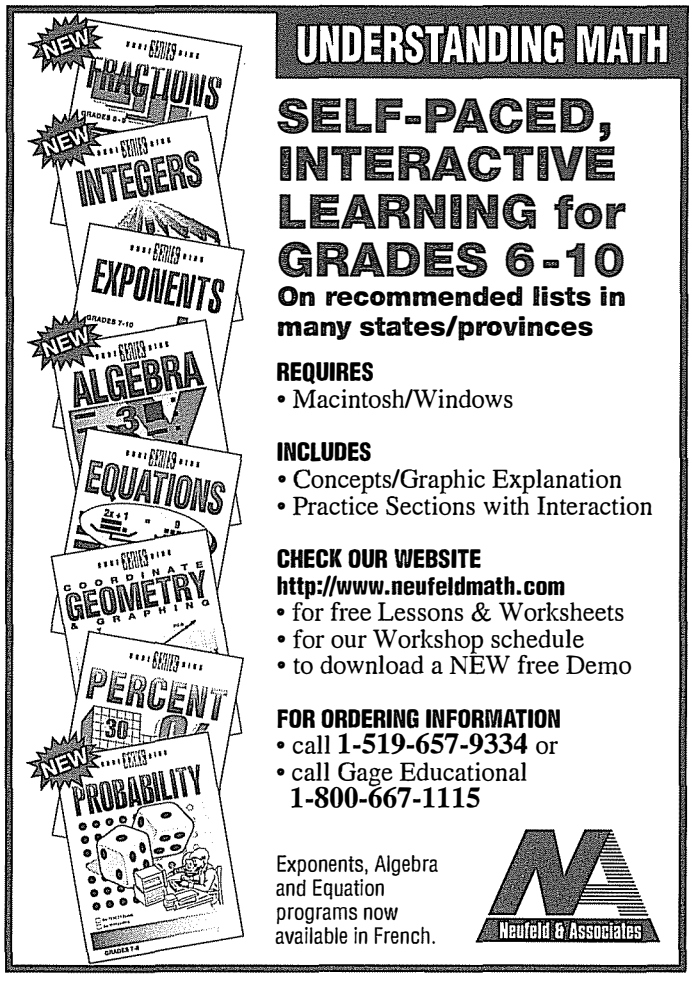
   b. What would cause the values of B to changes?

   c. What would cause the values of C to changes?

   d. Will the value of D always be positive?

   e. What do the maximum (minimum) points on the graph represent?

   f. When the slope of a tangent line to a curve is position (negative) what does this tell you about the direction that the ball is travelling?



g. What would be the slope of a tangent line drawn at the maximum (minimum) points on the graph? Why is this?

h. Turn off the scatter plot (2nd, STA, PLOT, Plots Off, ENTER) and graph just the function. Change the window on the function to just look at one complete cycle of the graph. Also change the window so that the graph fills most of the window vertically. Describe what seems to be happening to the slope of the tangent line as you move from a minimum point of the curve to a maximum point on the curve.

i. Draw a horizontal line at a point halfway in between the minimum value and maximum value of the graph. What does the slope appear to be at the point on the graph where this horizontal line crosses the graph? What does this tell you about the behaviour of the ball?

```
File Name: SLINKY.82P      Type: Program      Protected: No
Comment: Program file dated 05/04/95, 21:36

:PlotsOff
:FnOff
:AxesOn
:{1,0}→L1
:Send(L1)
:{1,11,2}→L1
:Send(L1)
:25→B
:ClrHome
:Disp "PRESS ENTER TO"
:Disp "START COLLECTING"
:Disp "DATA."
:Pause
:{3,B^-1,99,0,0,0,0,0,1}→L1
:Send(L1)
:ClrDraw
:Get(L3)
:Get(L2)
:max(L3)-L3→L3
:0→Xmin
:max(L2)→Xmax
:.5→Xscl
:max(L3)*1.4→Ymax
:min(0,min(L3)*1.4)→Ymin
:.5→Yscl
:Plot1(xyLine,L2,L3,·)
:DispGraph
:Text(4,1,"DIST(M)"):Text(53,81,"T(S)")
:Stop
```

Figure 4

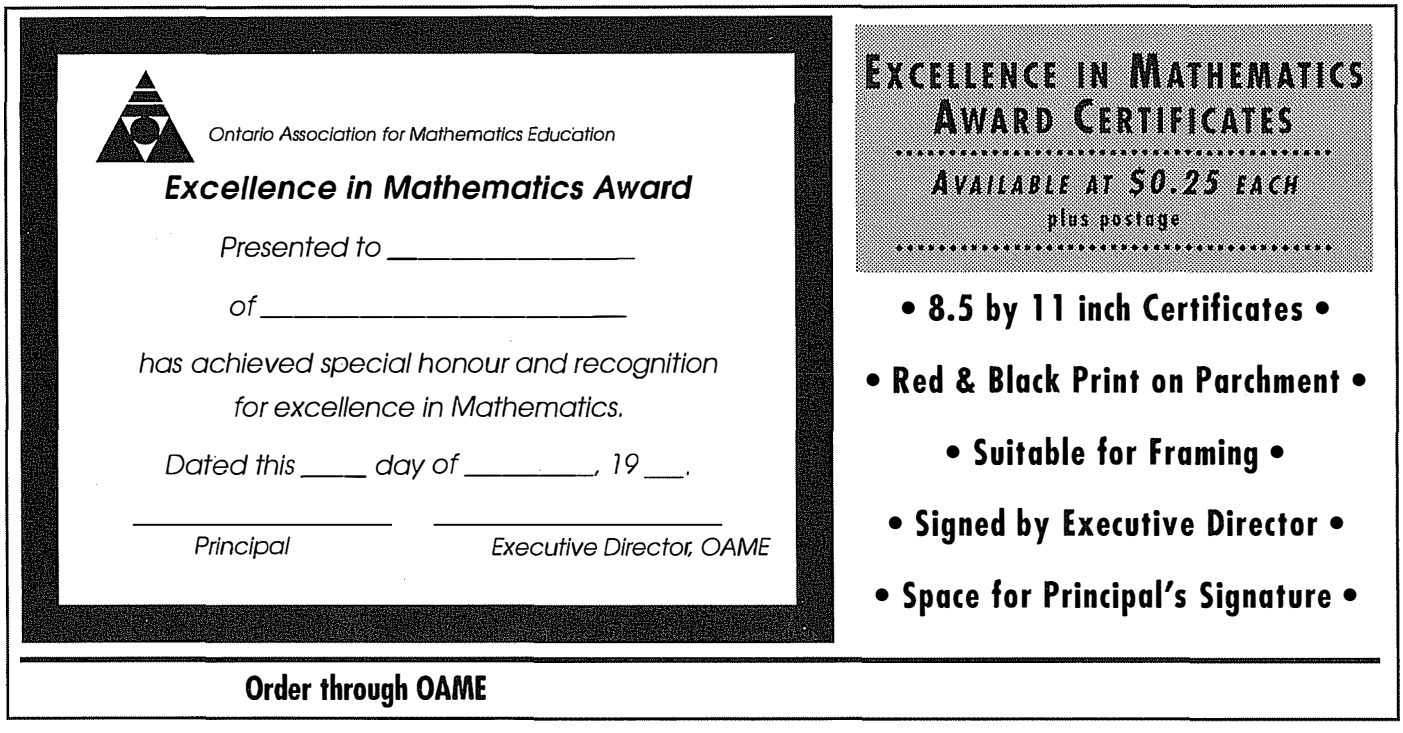
Many of these extension question are studied by most calculus students, but now other students can begin to explore these ideas before they get to calculus. Completing activities such as this help students develop a complete understanding of functions of the form $y = A\cos(B(x+C)) + D$ or $y = A\sin(B(x+C)) + D$.

References

Brueningsen, Chris and Wesley Krawiec, *Exploring Physics and Math with the CBL System*, Texas Instruments, 1995.

CBL System Experiment Workbook, Texas Instrument, 1994.

Vernier CBL Ultrasonic Motion Detector (MD-CBL) available through Vernier Scientific Supplies.



The Grand Valley Mathematics Association

Celebrating 25 years of Service to Mathematics Education

GVMA PUBLICATIONS

NEW	*A HISTORY OF THE ASSOCIATION (1997)*	$6
NEW	*GRADE 11 SAMPLE EXAM PLUS SUPPLEMENTARY QUESTIONS (1997)*	$6
NEW	*GRADE 10 SAMPLE EXAM PLUS SUPPLEMENTARY QUESTIONS (1997)*	$6
NEW	*TRANSITION YEARS SAMPLE WEEKLY ASSIGNMENTS - II (1997)*	$6
	TRANSITION YEARS SAMPLE WEEKLY ASSIGNMENTS - I (1996)	$6
	OAC FINITE MATHEMATICS SAMPLE EXAM AND QUESTION BANK (1996)	$6
	AN OUTCOMES BASED GRADE 9 MATHEMATICS PROGRAM (1995)	$6
	OAC ALGEBRA AND GEOMETRY SAMPLE FINAL EXAMS (1994)	$6
	OAC CALCULUS SAMPLE FINAL EXAMS (1993)	$6

SPECIAL ..... *RECEIVE ALL NINE PUBLICATIONS FOR ONLY* **$45**

Orders under $50 must be paid in advance. Minimum order $18. Delivery included.
Please forward your order with payment or purchase order (for no less than $50) to:

Ms. Patty Mah
Faculty of Mathematics
University of Waterloo
Waterloo, ON N2L 3G1
Fax: 519 - 746 - 6592

Cheques should be made payable to: The Grand Valley Mathematics Association

▲ DIRECTORS' DIALOGUE



BY PETER SAARIMAKI
COORDINATOR OF MATHEMATICS
TORONTO BOARD OF EDUCATION

Reporting on the OAME Board of Directors meeting held Saturday, October 4, 1997.

An Innovative First

This report is a first for OAME - as a multi-level publishing event. As you read this in your recently received *Gazette,* you may also be one of the adventurous ones who have already read this article . . . on the Internet! As an experiment, suggested by the Publications committee, this article has also been posted on the OAME web site (**http://www.mathstat.uoguelph.ca/oame**): check it out for this and other features, on a regular basis.

Agenda

The first major item on the agenda was the ratification of the appointment of a web site coordinator. Doug Evans, a recently retired secondary teacher from Smith Falls and a former OAME Director, agreed to take on this responsibility. Before the meeting was over, Doug was hard at work getting people promising to send in materials.

Been there - Done that

Many items are discussed or shared at Directors meetings that are done by the time you read this. Old news is not usually very useful. What is of interest here though, is to realize what kinds of items are part of a Directors meeting, and so some dated items are included for their informative value.

Playing the Game

Preceding the Executive Director's financial report, I shared the financial results of the 1997 OAME Annual conference (that's the one held last May in Toronto that was run by Sandy Woodcock and I and a multitude of volunteers). Last spring, shortly after the conference, the profit share for OAME looked like it might be around $3000. Once final bills were in and all proceeds tallied, we found that OAME's share was around $13 000 - a nice ten thousand dollar windfall. One Director was heard to comment that the conference attendance and fiscal planning "saved our bacon!". The final Conference Report was also presented to the Directors, including suggestions that were passed on to the chairs of the 1998 and 1999 conferences. (The September *Gazette* contained a brief review of the conference.)

Doing the Books

Setting the budget was a bit easier with the news above. Several revisions to terms of reference were passed, allowing Directors who travel long distance stay over Saturday night whenever this results in a substantial saving in airfare (you almost wonder, if it sounds this logical, why didn't we think of changing the rules before). We were whipped into such a high state of productivity by President Crompton, that we actually finished our morning agenda before the morning was over and, rather than taking an early, long break, we started on items in the afternoon agenda.

Professional Development

Reports were presented on the 1998 conference (see the ads elsewhere in this *Gazette,* and see you in North Bay. Actually, one of the greatest thrills you could give this reported, would be to see me in North Bay AND say you have actually read one of these reports - I always wonder if there is anyone out there?). Susan Stuart described a number of innovations that are making the 1998 conference one of a kind (must have been playing the Game last year!).

For 1999, Y^4MA with the Scullys at the helm, will be inviting us back to the 404 and 7. It was a corker a few years ago, and should not disappoint this time either. The Board approved the request from COMA to host the **2000 Annual Conference** in Ottawa - get ready for a capital event. **Leadership 1997** enrolment was again predicted to be a full house (were you there? Who was there from your chapter? What have they got to share with you?). If you missed out, mark **November 5, 6 and 7, 1998** in your calendar (and then make a note in June 1998 to check the workshops, apply for Board financing and send in your application.

Directors also heard about the **Ontario Mathematics Olympics**: past , present and future. Over the past years, we have appreciated the financial support of Rockwell International. After massive reorganization last year throughout North America, they have had to withdraw their support. Their last involvement was at Barrie, June 1997, and the organizers reported it was a great success.

A subcommittee of **Futures** is preparing a resource package for chapters to assist in their preparations for each year's Olympics. As well, we passed a confirmation of team constitution (2 boys, 2 girls with 2 Grade 7s and 2 Grade 8s) and recognized two categories of chapter representatives (for awards): school-based and regional. The status of the 1998 site was uncertain at the time of the meeting.

Resources

John Kersley again brought a selection of articles, quotes, cartoons, interesting web sites, and thought provoking "stuff". See your chapter rep if you're into the "off beat" or just want to have something new and different for a special class. John also showed a neat personalized OAME key-chain (In fact he already had some made up for key members of the Board). They are wooden and have the OAME logo cut out on the front, and the recipients name cut out on the back. The creator can also put your chapter logo in place of OAME's. "Wooden" you like one? Talk to others in your chapter and get your orders placed.

Special Specialization Years Presentation

Mary Lou Kestell, a past president of OAME and OMCA, gave Directors a high powered overview of the **Ministry's Secondary Reform** process. Due to the embargoed nature of the materials at the time, she couldn't actually tell us specifics, but she did review the process and plans, especially as we move on to the development of Guidelines and Course Profiles (for up-to-date information check with the Ministry of Education web site at: **http://www.edu.gov.on.ca**). This is one of the ways OAME tries to keep members conversant with changes in education.

One shareable, to help put all these reforms in perspective, is a quote from John von Neumann:

> *At the beginning of the century it was reasonable to expect that any reasonably well-informed mathematician could know all of mathematics; by 1950,*

OAME/AOEM Awards Nomination Process

Deadlines

Nominations for awards to be presented at the Annual Conference must be received by January 31 of the calendar year in which the conference takes place.

Nominations received after January 31 will be considered for awards to be presented during the next three calendar years. A nomination will be allowed to stand for three consecutive years. After that time, the nomination must be renewed. A standing nomination may be amended at any time by the original nominator. The nominator need only inform the chair of the Awards Committee in writing of the proposed changes to the nomination form.

The OAME/AOEM Nomination Form

Write a letter supporting the nomination of your candidate for the indicated award. Provide specific and detailed information about the nominee's activities as they relate to the following areas of consideration;

- demonstrations of excellence and creativity in mathematics education.
- specific contributions to mathematics education in the school, region, province or nation.
- demonstrates leadership in mathematics education in the school, region, province or nation.
- support of and contribution to the activities of OAME/AOEM.
- contribution to the development of students both within and outside of the classroom.

Please include any additional information that you feel may be relevant to the nomination, but which may not be specifically mentioned above.

The Nomination Cover Page

Complete the Nomination Cover Page and attach it to your letter of recommendation for the nominee.

Incomplete or inaccurate information may cause a nomination to be withheld form consideration.

OAME/AOEM Life Membership Award

The Life Membership Award is given to recognize a person who has contributed in a significant was to OAME/AOEM; demonstrated outstanding leadership in mathematics education; and accumulated 10 or more years of membership in OAME/AOEM.

Kenneth D. Fryer Award

In Memory of the late Kenneth D. Fryer, OAME/AOEM, in conjunction with the Grand Valley Mathematics Association, established the Kenneth D. Fryer Award. The award is to be given annually to recognize a mathematics department which fosters collegiality, team work, and excellent classroom teaching; contributes to the overall development of students; and demonstrates leadership in the mathematics education community.

Mona MacGregor Award

In recognition of the contributions made by Mona MacGregor, former OAME/AOEM Co-Secretary-Treasurer, OAME/AOEM established the Mona MacGregor Award. This is to recognize an individual who has made significant contribution to OAME/AOEM, but who is not necessarily an educator or a member of OAME/AOEM.

Morley MacGregor Award

In Memory of the late Morley MacGregor, former OAME/AOEM Secretary-Treasurer, OAME/AOEM established the Morley MacGregor Award. The award is to be given annually to recognize an elementary teacher who has demonstrated excellence in mathematics education, as well as contributing to the overall development of students beyond classroom activities.

Don Attridge Award

In recognition of the contributions made by Don Attridge, a founding member, former president and the previous Executive Director of OAME/AOEM, OAME/AOEM established the Don Attridge Award in the spring of 1995. The award is presented annually to recognize an exceptional and creative secondary school mathematics teacher who enhances the teaching of mathematics in Ontario.

AWARD NOMINATION COVER PAGE

Send to: David Zimmer

Intended Award (please check one)

❑ Life Membership ❑ Mona MacGregor ❑ Morley MacGregor ❑ Kenneth D. Fryer ❑ Don Attridge

Nominee Information:

_____

Name of Nominee (Principal and Department Head for K.D. Fryer Award)

_____

_____

School, Organization or Business Address

Telephone Number ( ) _____

Fax Number ( ) _____

Home Address_____

_____

Home Phone ( ) _____

Nominator Information:

_____

Name of Nominator

_____

_____

School, Organization or Business Address

Telephone Number ( ) _____

Fax Number ( ) _____

Home Address_____

_____

Home Phone ( ) _____

even the most brilliant scholars could know only 20% of the knowledge in the field; and by 2000, it will be possible to know only a fraction of 1% of all the mathematics

Committees

The **Awards** chair reminded us that nominations for any awards are kept on file for three years, so yearly re-submissions are not necessary. New submissions are always accepted, but only considered up to the deadline for the current year. The **Math Equity committee** is looking to expanding it's mandate, to say: **Everybody Matters/Everybody Counts**. Look for announcements regarding the Breakfast in North Bay at OAME 1998. If you or someone you know want to take a more active role in mathematics education, the Nominations committee has forms in this *Gazette.* Note the due date of January 15, 1998.

The **Promotions** people are targeting teachers-to-be by visiting Faculties of Education this year. Local chapters will be providing local contacts and on-going support. Another group will be the occasional teachers and the committee is looking for ideas on how to communicate with them. The hard working **Publications committee**, along with the new web site coordinator, are looking for new advertisers and articles for submission at either the elementary or secondary levels.

The **curriculum committee** continue to look to ways to reach and assist classroom teachers. **The Early Childhood/Formative Years** reviewed the new **Ontario Curriculum** and have prepared a gap analysis to share with all. They also examined the impact of the new **Report Card** and considered ways and means to make it useful. They are also recycling *Abacus* articles from the past and connecting them to the new curriculum.

Transition Years also did a gap analysis on the new grades 7 and 8, and considered implications for the reform of Grade 9. **Specialization Years** had nothing to do (that's a joke!). The secondary reform has not left this committee speechless: they are preparing a Technology Handbook (to be ready for the next Board meeting) and a resource package with Rich Learning Tasks (for OAME '98) that will be field tested with the help of chapter volunteers: interested? Not much to lose and a lot to gain and share.

Chapter Happenings

Chapter news is best obtained locally, because then it will be timely, rather than in retrospect. New executives are in place, usually looking for additional interested volunteers to help with mini-conference planning, newsletter collecting or Olympics preparations. Most chapters have their own newsletters, jam packed with news, teaching tips and professional development articles. Chapters are gearing up to select their Olympics teams for regional or provincial competition - this is a great way to do something directly for students.

Many chapters will have held their fall conference by now including: **ISOMA** (they're expecting over 100), **CHAMP, Y^4MA, Golden Section, QSLMA, WOMA** (check out their web site at: **http://www.math.uwo.ca/woma/**), **GVMA** (their 25th anniversary), **NOAME,** and **MAC^2** (we're not too late for this one - it's planned for February 1998)

In many cases, local chapters also sponsor one or more local teachers to attend the Leadership Conference as a way of bringing professional development home.

Miscellaneous

Ralph Connelly is heading up the investigation of chapter boundaries as amalgamations loom on the horizon - watch for details soon, as chapters find room for the membership boom. **The OTF Curriculum Forum**, the only official means for subject associations to have direct input to Ministry policies, has again been put on hold for budgetary reasons. As a result of the notice of this suspension, President Crompton was sending OTF a letter pointing out the crucial importance of the Forum at this time of reform.

Ministries and Arm-Lengths

Updates on **EQAO, Ministry Requests for Proposals, and the College of Teachers** [Each has a web site you can check - email me if you're not sure where] lead into some heady introspections contemplating OAME's mandate, mission and responsibilities. Judy, the Prez, distributed a letter being sent to Pauline Laing, Project Director for the education reforms at the Ministry. In it, she shared the concerns our committees have noted about the new curriculum. In addition, there was a lot of discussion outlining how OAME could and would get directly involved, through official Requests for Proposals, in the Ministry contracts for writing the secondary Guidelines and Course Profiles (too old newsy now).

OAME has always provided professional development opportunities for Ontario's teachers through Annual conferences (1998 in North Bay is the 25th), Leadership conferences, *Gazette* and *Abacus* journals, and local chapter mini-conferences. In looking to how



GATEWAYS

ONTARIO ASSOCIATION FOR MATHEMATICS EDUCATION
ASSOCIATION ONTARIENNE POUR L'ENSEIGNEMENT DES MATHÉMATIQUES

25TH Annual O.A.M.E. Conference
May 20 - 23, 1998
Nipissing University
North Bay

Learn about the latest in mathematics education. Work with the best math teachers from across the country and the province!

Keynote Speakers:
- Ivars Peterson
- Theoni Pappas

and others

150 elementary & secondary workshops

entertainment, banquet
25th anniversary celebration

Publishers' Display

Registration Fee: (approximate at this time)
O.A.M.E. Member,
Full Conference $140.00
One Day $75.00
Non-member $185.00

Accommodations:
Nipissing University Residence
$90.00 for 3 nights
Many local hotels & motels
Reasonable rates

LOOK FOR REGISTRATION FORMS LATER IN THE SCHOOL YEAR. FOR MORE INFORMATION, CONTACT:

Susan Stuart
Shawn Godin
Dan Charbonneau

these activities could be recognized by the College of Teachers, we were reminded of **OTF Guiding Principles** regarding accreditation. In essence, these state that the OCT should recognize only certain organizations (such as federations, faculties of education and school boards) as providing credits. This has put OAME in a delicate position, trying to get recognition for all the PD teachers get and do at OAME while respecting our OTF position at the same time.

A Question

I often try to use my section headers to develop some (very loosely connected) theme. There isn't one this time, . . . unless we notice the positive/uncertain combinations throughout. By this, I mean the juxtaposition (need to run that through your thesaurus? Just download from the web site and you'll be beside yourself!) of the positive efforts of OAME against the uncertain plans and direction of education (as ??controlled?? by the Ministry/politicians/public). [Now that is a convoluted sentence].

OAME wants to help teachers and education move ahead: our dilemma revolves around the uncertainty of who the policy makers are going to ask to determine what direction the province is going in, and ultimately what that direction will be. Stay in touch with your representatives in the local chapter for further news.

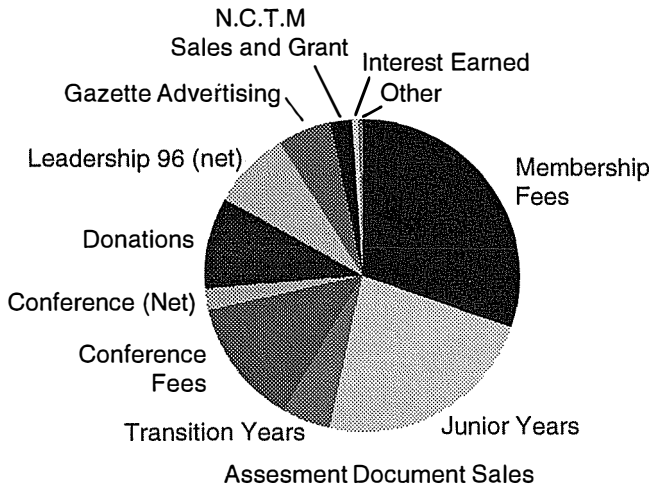
▲ FINANCIAL STATEMENT

Notice to Readers

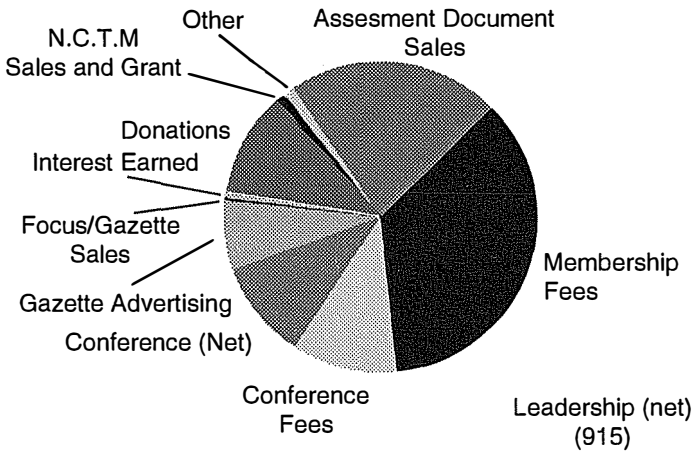
I have compiled the Balance Sheet of Ontario Association for Mathematics Education (Association Pour L'Enseignement Des Mathematiques) as at August 31, 1997 and the Statement of Operatins and Accumulated Surplus for the year then ended from information provided by the Directors. I have not autied, reviewed or otherwise attempted to verify the accuracy or completeness of such information. Readers are coutioned that these statements may be appropriate for their purposes.

Markham, Ontario, September 11, 1997 ROBERT M. Davies Chartered Accountant.

Revenue 1997 / 1996

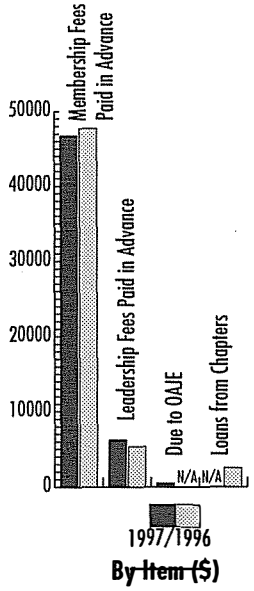


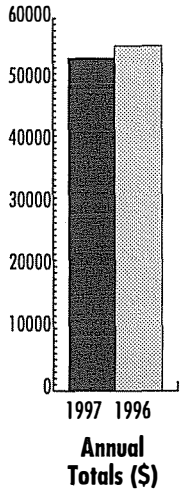
1997 ($160,119)

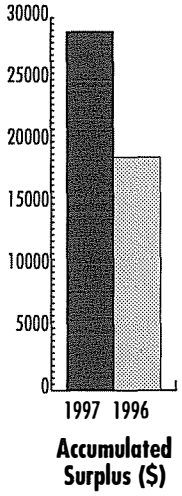


1996 ($141,541)

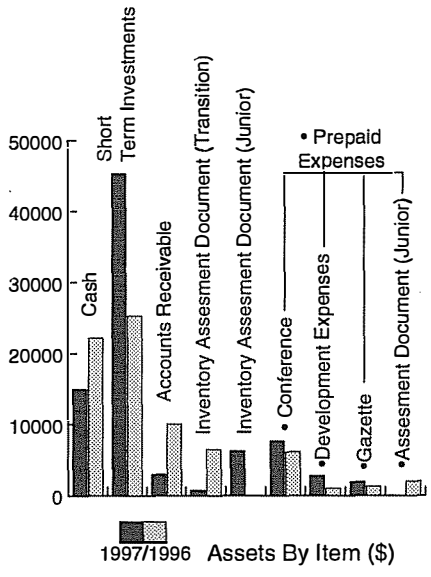
Liabilities and Surplus 1997 / 1996

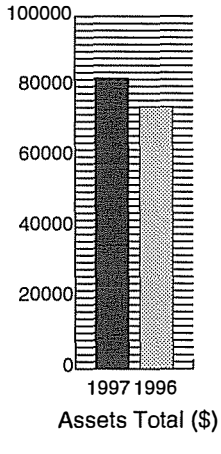




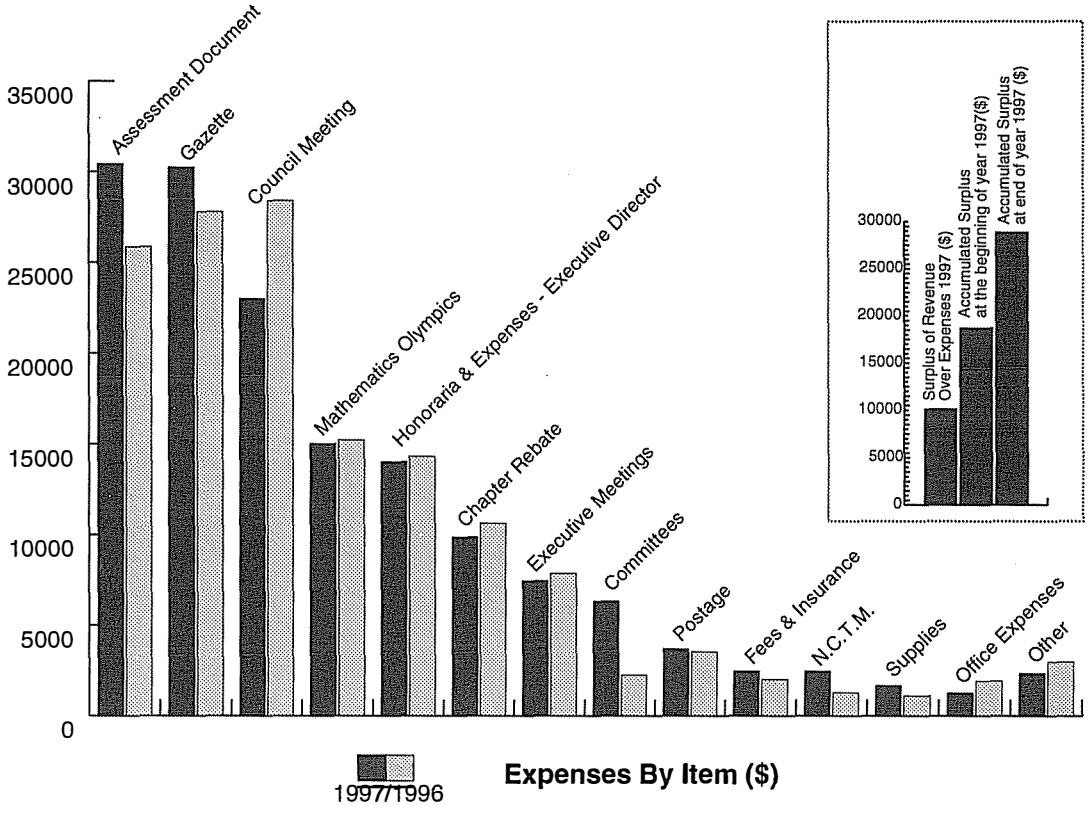


Current Assets 1997 / 1996





Expenses 1997 / 1996



OAME 1997-1998 Board

PRESIDENT
Judy Crompton

PAST PRESIDENT
Barry Onslow

PRESIDENT-ELECT
Ralph Connelly

EXECUTIVE DIRECTORS
David & Bonnie Alexander

VICE PRESIDENTS
Peter Lenczewski

Barry Scully

David Zimmer

CHAPTERS & REPRESENTATIVES
CHAMP - John Rodger

COMA - Mary Donaghy

GOLDEN - Robert Saari

GVMA - Murray McLennan

ISOMA - Louis Lim

MAC^2 - Bill Morrison

NOMA - Dan Charbonneau

NWOAME - Joe Hall

PINE RIDGE - Jacqueline Hill

QSLMA - Gordon Cooke

SAME - Anne Pedersen

SWOAME - Frank Di Pietro

TEY^{2}MS - Maureen Dunn

WOMA - Mary Howe

Y^{4}MA - Shirley Dalrymple

DIRECTORS - TERM EXPIRING 1998
Edward J. Barbeau

Shirley Fairfield

Chester Makischuk

Robert McLeish

Nancy K. Moore

Geoffrey Roulet

Emilia Veltri

DIRECTORS - TERM EXPIRING 1999
Kaye Appleby

Don Gray

Myrna Ingalls

John Kersley

Anne Muller

Bill Otto

DIRECTORS - TERM EXPIRING 2000
Marilyn Hurrell

Laurie Moher

Peter Saarimaki

Ron Sauer

Susan Stuart

Margaret Warren

NCTM REPRESENTATIVE
Frances Schatz

WEB SITE COORDINATOR
Doug Evans

Each year you are presented with a fresh supply of diamonds in the rough.

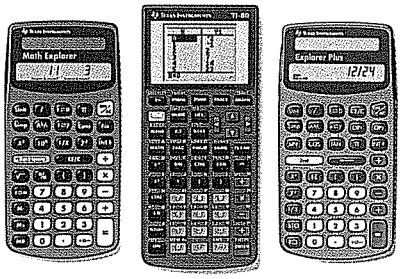
How brightly they shine is up to you.



START DOING EXTRAORDINARY THINGS

There is an art to polishing young minds. It takes patience, creativity and support. That's why we're always working with you to find new ways to help your students gain a stronger understanding of math. Whether it's developing calculators and other tools designed especially for this transitional stage of learning, or providing support programs and T³ training workshops for educators, our goal is to make your job easier and more rewarding. Because after all, the more you can do for your students, the more brilliantly they'll shine.

TEXAS INSTRUMENTS



Calculators Designed For Middle School · *The Math Explorer™ and Explorer Plus™ offer a new look with the same fraction simplification capabilities you've come to expect from TI, with the latter including scientific notation. The TI-80 combines these features with table building and data analysis.*

30 YEARS ELECTRONIC HAND-HELD CALCULATOR

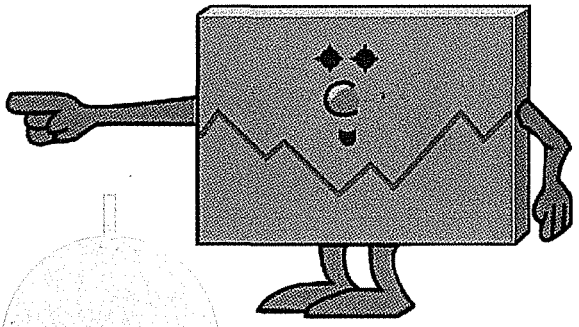
1-800-TI-CARES (U.S. & Canada) ti-cares@ti.com www.ti.com/calc

©1997 TI.

STILL CANADIAN
gage
After All These Years
Since 1844
MULTiMEDIA

5 for 1!*

Data Management Software for K-8



DATA New! EXPLORER

Grades 4-8 Students Can:

- use the Survey Tool to create and administer questionnaires
- graph category data in a line plot, bar graph, circle graph, Venn plot, grid plot, or table
- add movable lines, a median fit line, a least-squares line or other equations to scatter plots
- manipulate a graph and watch the data update
- describe their results, annotate their work, and prepare reports in the Notebook
- print their surveys, graphs, data sheets, and Notebook

DATA EXPLORER
Macintosh and Windows platforms
Save on Lab Pack of 5! Reg. ~~$179.95~~
* **Now only $119.95****
Single user also $119.95

GRAPHERS

Grades K-4

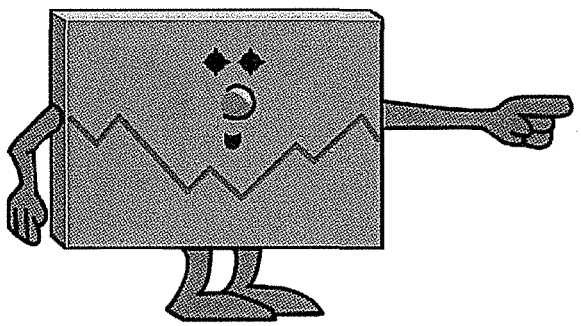
Help younger students learn about graphing. Give them a colourful and interactive world of data to:

- collect, organize, and describe
- read and interpret
- sort by attribute
- create, modify, and compare

The Warm Up section allows your students to quickly make, manipulate, and graph simple data.

Among the data sets are: colours, pets, sports, fruit, ice cream, and numbers.

The six types of graphs include: pictographs, bar graphs, circle graphs, loops, grid plots, and line graphs.



GRAPHERS
Macintosh and Windows platforms
Save on Lab Pack of 5! Reg. ~~$159.95~~
* **Now only $99.95****
Single user also $99.95

** Limited time offer valid until October 31, 1997

Gage Educational Publishing Company Toronto local phone: 416-293-8464 x430 **1-800-667-1115 x430** Fax: 416-293-9009