Submission of Articles

The *Ontario Mathematics Gazette* (*OMG*) is looking for news, articles, and good ideas that are useful to mathematics teachers and mathematics teacher education. We are seeking submissions from mathematics teachers K–12 and other mathematics education professionals that describe innovative and creative approaches to mathematics teaching.

Please keep in mind the following criteria when making submissions to the *OMG*:

- The ideas/activities must be of interest to the readership.
- The ideas/activities must be fresh and innovative.
- The mathematics content must be appropriate for the readership.
- The mathematics content must be accurate.
- The article must be well written and easily understood.
- The article and its ideas must be free of sexual, ethnic, racial, or other bias.
- The article must not have been previously published, nor should it be out for review by other publications.
- The article must be original.

Articles must be word-processed in MS Word, double-spaced with wide margins, not exceeding 10 numbered pages of text, and prepared according to the *Publication Manual of the American Psychological Association, Fifth Edition*. Figures and diagrams should be drawn by computer, if possible, or drawn in black ink in camera-ready form. Embedded images must also be submitted separately in jpeg or tif format. Proof of the photographer's permission is required, and for **photos of students** under the age of 18, the written permission of a **parent or guardian is required**.

You must submit **one hard copy** of your article, embedded with any tables, figures, and captioned photographs, to the Editor, Stewart Craven, whose address appears on page 2, along with **separate computer files for each of the text, graphics, and/or photographs**. Please e-mail the computer files to Stewart Craven at **numeratecitizen@mac.com**.

Your name should not appear anywhere in your article, including websites, so that your article can be sent out for blind review. Your name, full mailing address, and e-mail address must be included on a separate sheet. Upon review, you will be notified as to whether your article has been accepted for publication (as is, or pending minor or major revisions) or rejected.

The Editor reserves the right to edit manuscripts prior to publication. Once an article is published, it becomes the property of OAME.

PERMISSION TO REPRINT: Permission to reprint any part of this publication for instructional use or for inclusion in an affiliate or other publication must be obtained through the Editor, Stewart Craven. Full credit must be given to the author and to the *Ontario Mathematics Gazette*.

The views expressed or implied in this publication, unless otherwise noted, should not be interpreted as official positions of OAME.

▲ Table of Contents

Up Front

▲ Editor's Message/Stewart Craven 2
▲ President's Message/Anna Jupp 3

Regular Features

▲ The *Abacus* . . . . . .8-Page Insert
▲ Technology Corner: Activities Exchange /Mary Bourassa 6
▲ OAME/NCTM Report/John Kersley 9
▲ What's the Problem? Thick as a Brick/Shawn Godin . . . 11
▲ Sequential Voting Situations /David R. Duncan/Bonnie H. Litwiller 26
▲ OAME Awards 2008 /Fred Ferneyhough 27
▲ Data Rocks – Using the Canadian Community Health Survey Microdata in MDM4U /Joel Yan/Betty Temmer/Tom Steinke 29
▲ Directors' Dialogue /Ann Michele Stenning 36

Special Features

▲ EAT, SLEEP, MATH – Ontario Math Olympics 2008 /Sandra Jean Price/Jacqueline Hill 24

Articles

▲ A Public Celebration of Mathematics /George Gadanidis/Susan Gerofsky/Janette Hughes . . . 13
▲ Mathematics and Adolescence: Not So Much a Battleground, More a Merging of the Ways /Anne Watson 21
▲ Building Student-Teacher Rapport by Humanizing the Mathematics Classroom /Amanda Allan 31

Notices

▲ OAME Sticky Graph Pads 11
▲ OAME Memo Pads 20
▲ OAME Playing Cards 23
▲ OAME Elementary Sticky Chart Pads 31
▲ OAME T-shirts 36
▲ 2008-2009 OAME Board 40

Advertisements

▲ Pearson Education . . . . . Inside Front Cover
▲ McGraw-Hill Ryerson 5
▲ Wintergreen 12
▲ Psycan . . . . . Inside Back Cover
▲ Nelson . . . . . Back Cover

▲ About the *Ontario Mathematics Gazette*

The *Ontario Mathematics 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 40051074.

Editor

▲ **Stewart Craven**

Associate Editors

▲ **Anna Dutfield**

▲ **Shirley Dalrymple**

▲ **Tom Steinke**

***Abacus* Co-editors**

▲ **Mary Lou Kestell**

▲ **Kath Kubota-Zarivnij**

Design and Production

▲ **Penny Clemens,** Graphic Designer

Printing & Binding

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

Advertising Manager

▲ **Robert Sherk**

Submission of Advertisements

Advertisements for the *Ontario Mathematics Gazette* should be sent to **Robert Sherk** at the above address. Courier is recommended to avoid possible delays. Deadlines for advertisements are January 23 for the 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 0.5" 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, e-mailing, or writing to the Advertising Manager.

▲ Editor's Message

STEWART CRAVEN, EDITOR



May I first congratulate Marilyn Hurrell for the superlative work that she has done to further the reputation of the *Ontario Mathematics Gazette* as a publication that maintains high editorial standards and provides reading that educates, informs, and provides enjoyment for mathematics educators across Ontario and beyond. She has not done it alone. Also to be congratulated are Associate Editors, John Egsgard and Lynda Ferneyhough; an army of diligent reviewers; current *Abacus* Co-Editors, Mary Lou Kestell and Kathy Kubota-Zarivnij; Executive Directors, Sue and Dave Hessey; Designer, Penny Clemens; Advertising Manager, Robert Sherk; and of course, the many writers and contributors without whom there would be no magazine. It is my sincere hope that I can maintain the quality of the *Gazette* and perhaps explore some new ideas over the course of my tenure.

It is my intention to invite as many new writers as possible to contribute to the *Gazette*, while continuing to honour the work of those individuals who have published before and wish to contribute again. For example, this issue will highlight a short article entitled "Mathematics and adolescence: Not so much a battleground, more a merging of the ways" by Anne Watson of Oxford University. Some regular columnists, such as Louis Lim and Fred Ferneyhough, will be taking a well-deserved respite, but others will take up the challenge. We will also try some new ideas. For example, a column will soon be added in which diametrically opposed views are expressed. The debate will be taken up in earnest by two "avatars"—Polly Hedra and Pi Tofon. I hope that this kind of debate will not only generate conversation in the staff room, but will also prompt individual readers to write a response, either in the form of a letter to the Editor, or in the form of a full-fledged article. The following are examples of topics that often invite debate:

a) Students in K–Grade 6 should not be assigned homework.
b) The calculator is an important tool for children in the primary grades.
c) The use of concrete materials is critical for learning

mathematics at all grade levels, including secondary school.

d) All secondary school students require a curriculum that includes the comprehensive treatment of geometry.

Better yet, suggest a topic, or state a controversial idea and write 150–200 words to either support or oppose it. I will then seek out another individual to express the opposite point of view. (Positions should be supported by at least one research-based reference.) The two opposing views will appear in the *Gazette* as those of Polly or Pi; the actual authors will remain anonymous.

Early in July, I had the privilege of attending ICME11 (International Congress for Mathematical Education) in Monterrey, Mexico. It continues to amaze me that the issues and concerns that surround mathematics education appear to be universal. What doesn't surprise me is the passion with which people from all countries seek greater insight into the teaching and learning of mathematics, thus assuring that new ideas for improvement will emerge. We in Ontario have much to contribute to the body of knowledge relating to mathematics education and much to learn, as well. I hope that the *Ontario Mathematics Gazette* will continue to be a platform from which we can fully engage in the conversation. ▲

▲ Call for Manuscripts

The *Ontario Mathematics Gazette* is inviting manuscripts for all grade levels.

Instructions for submission of manuscripts are found on page 1 of any *OMG*.

Contact the Editor for further details.

▲ President's Message

ANNA JUPP, PRESIDENT



Anna has been working as an Instructional Leader of Mathematics with the Toronto District School Board for the past 10 years. She supports K-8 teachers though the development and facilitation of professional learning opportunities, resource development, and consultation. Anna has contributed to various Ministry initiatives, including the Expert Panel Reports for the Early Math Strategy and Education for All. Anna is also a mathematics AQ course instructor with OISE and has been part of an author team for primary math programs. She has served as a Board Director since 2001 and 3 years as Vice-President before becoming President. Anna was the recipient of the 2005 Union Gas Award for Outstanding Leadership in Mathematics.

Teaching and Learning Mathematics: Teachers and Students Making Connections

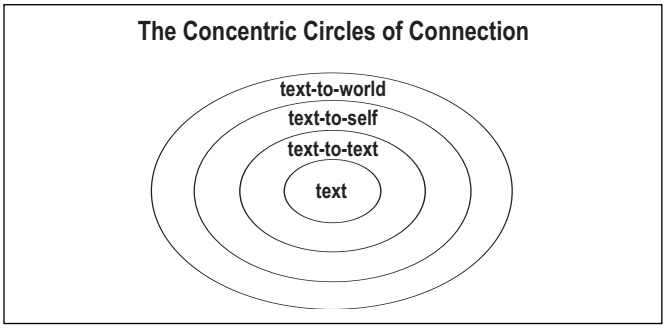
In the summer of 1960, 26-year-old Jane Goodall did the unthinkable—she arrived on the shore of Lake Tanganyika in East Africa to study the area's chimpanzee population. It was a courageous and dangerous venture, but Jane was determined to fulfill her childhood dream.

Initially, the wild animals fled from the young researcher out of fear, and Jane was forced to observe the chimpanzees through binoculars from a peak overlooking the forest. It took months before she could get close to the animals, but gradually, Jane was able to find a way to connect with the chimpanzees, forming a bond that would allow her to make some of the most important discoveries of chimpanzee behaviour made by a field researcher to date.

This type of connection, so critical to Jane's work, is also critical to us as teachers, as we strive to help students connect to the realm of mathematics. As we embark on a new school year and begin the planning and preparation required, we need to reflect on how we can make these connections meaningful and relevant.

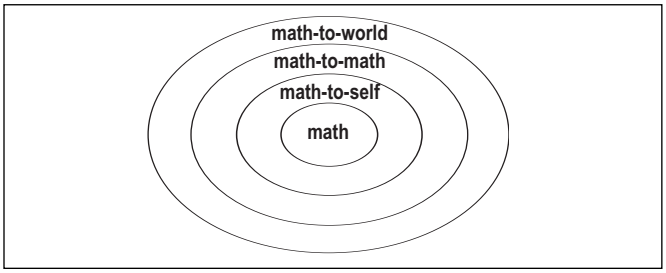
As Arthur Hyde noted, "Making connections is at the heart of doing mathematics." Yet the question remains: How do we help students connect to the mathematics

they are learning at school? As a starting point, we can turn to *Comprehension Connections: Bridges to Strategic Reading* by Tanny McGregor (2007), which describes a way of organizing the different connections students can make with the text they are considering.



When students make text-to-world connections, they think of the big ideas, themes, and/or the world around them. As they make text-to-text connections, students relate to texts or media; ultimately, as they make text-to-self connections, students relate to their own lives.

What do these connections look like when it comes to mathematics? Can students make connections to make mathematics come alive in a way that is relevant to them? For this to happen, we need to find ways of connecting math to the real world, to what students already know, and to their personal experiences.



Math-to-world connections help students identify the real-world applications of the math they are studying in the classroom. Students consider the "big ideas" in the mathematics and see how math relates to other subject areas, such as science or media literacy. Math–to-math connections help students think about how the strands/courses are related, how problems or situations are similar, and how concepts and procedures are related. Math-to-self connections help students make personal connections and apply prior knowledge and experience to new problems or situations.

As teachers, our role is to help establish these connections in a way that makes sense to the diverse student population we serve.

Consider Jane Goodall's theory of making connections:

> *Do you have a dog? Suppose he wants to go outside. How does he ask? Does he bark or whine at the door while looking at you? That's easy to understand. But dogs can ask in other ways. Perhaps he or she comes up to you (or another member of your family) and lays his head on your knee. Or he looks at you, gives a tiny whine, and wags his tail. Or he starts to pant, getting louder and louder. Or he becomes restless and walks about a lot... Dr. Doolittle's parrot, Polynesia, tells us that in order to learn animal language, we must have "powers of observation." We must be able to notice small things about birds and animals—the way they walk and move their heads and flip their wings, the way they sniff the air and twitch their whiskers and wiggle their tails.*

Similarly, as teachers of mathematics, we must carefully observe and question our students and use this connection to make instructional decisions.

Using developmentally appropriate, conceptually rich problems that are focused around the big ideas in mathematics will give students opportunities to use their prior knowledge and apply concepts and skills across strands or units of study.

Using contexts that are relevant to the different ages and stages of development will allow students to make math-to-world and math–to-self connections.

Using different forms of technology (e.g., computers, calculators, interactive whiteboards) will not only provide for differentiated instruction, but will also connect students and the mathematics at school with our technological society.

One elementary teacher expresses the benefits of helping students make such connections:

> *Making math meaningful, helping students make connections can make a significant impact in their ability to apply knowledge in a multitude of ways. The excitement and curiosity [created] from meaningful mathematics can fuel the mind of a student beyond anything they thought possible.* (Andrew Schmitt)

Jane Goodall's drive and determination to make such a connection fuelled her findings and set her along a path of unparalleled discovery. If we, as teachers, can make meaningful connections like this with our students, and aim to help them connect with the mathematics they are learning, our students are bound to reap the benefits well into the future. ▲

Announcing...

Our Upcoming Publications

Available Spring 2009!

McGraw-Hill Ryerson

FUNCTIONS 11

Functions
University
Grade 11, MCR 3U

McGraw-Hill Ryerson

FOUNDATIONS FOR COLLEGE MATHEMATICS 12

College Mathematics
College
Grade 12, MAP 4C

For further information, call: 1-888-793-7706 and ask for your local McGraw-Hill Ryerson Sales Representative

www.mcgrawhill.ca/school

McGraw-Hill Ryerson

For All Your Mathematics Resource Needs

The McGraw-Hill Companies

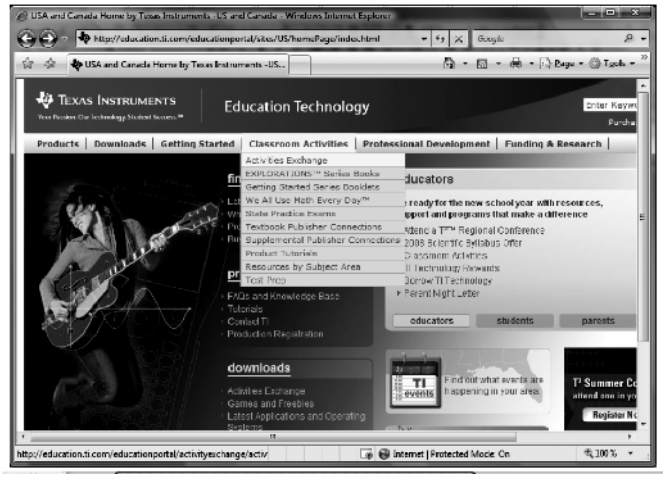
▲ Technology Corner: Activities Exchange

MARY BOURASSA

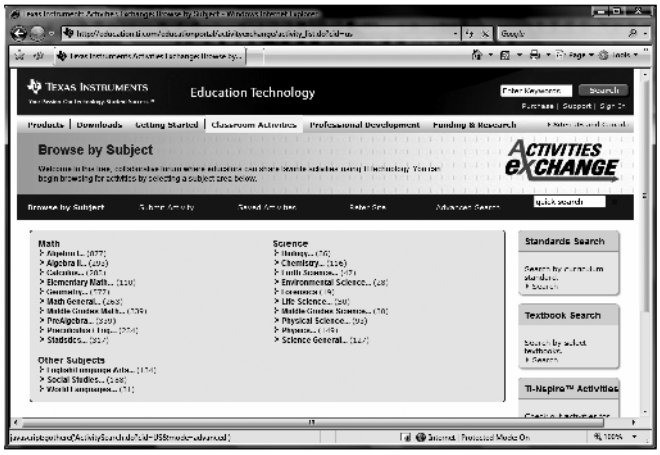


Mary Bourassa teaches mathematics at Lisgar Collegiate Institute in Ottawa. She is a strong advocate for the appropriate use of technology in the classroom. She was also past-president of COMA, gives workshops around the world and is a National Instructor for Texas Instruments.

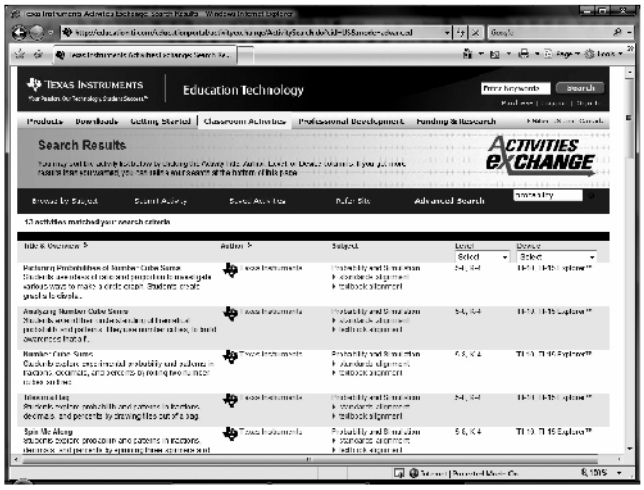
As the new school year gets rolling, I thought it would be useful to show you a great resource for activities and investigations using technology. The Internet is a wonderful resource for all types of classroom materials, but if you are looking for something quick and ready to go, check out Texas Instrument's Activities Exchange site. Go to **http://education.ti.com** and click on "Activities Exchange" from the "Classroom Activities" tab.



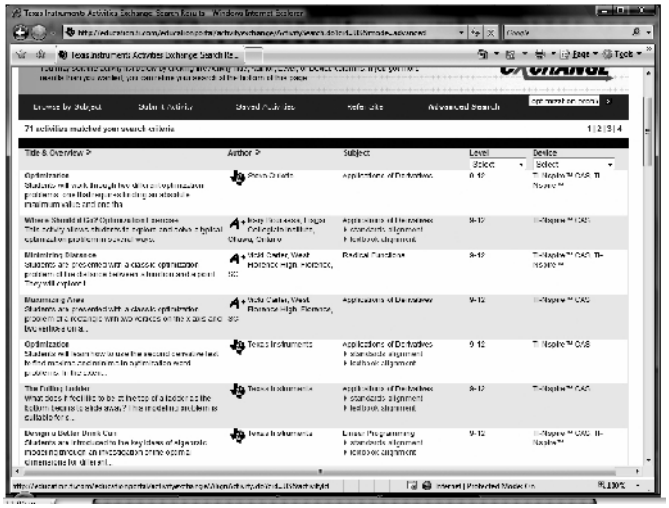
This brings you to the main page, which allows you to browse activities by subject. If you are looking for something specific, I suggest you go straight to the Advanced Search option.



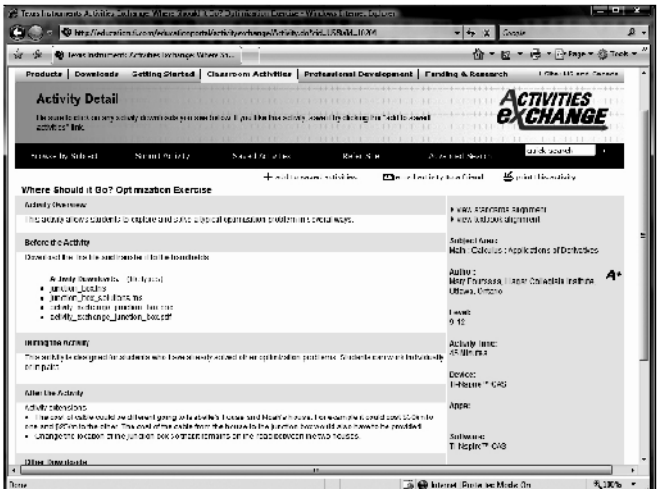
This allows you to choose subject-specific activities by grade (K–College) and by technology, using keywords. For example, typing "Probability" as the keyword and choosing K–4 as the grade level returns 13 activities.



At the 9–12 grade level, you could specify the TI-84 family of graphing calculators for a particular topic, or do the same with the CBR/CBR2. Starting a new search for optimization problems using TI-Nspire CAS yields 71 matches.



If you click on any of the titles, the activity detail will appear.



You will notice that there are several files to download. The .tns files are the TI-Nspire files that can be downloaded and then transferred to the students' handheld instruments. There is also a "Teacher" or "Solution" file, as well as a word-processed document that takes you through the activity. The format for this file is very specific, so you know what you will get when you choose any of these activities. There is an overview of the activity, followed by a list of the concepts addressed. This is followed by step-by-step directions, assessment information, possible extensions, and all of the screen shots from the student .tns file.

Here is the file for the Junction Box activity.

Junction Box by Mary Bourassa

Activity Overview

This activity allows students to explore and solve a typical optimization problem in several ways.

Concepts

- Determining the equation of an optimization problem
- Determining the minimum of a function numerically, graphically, and algebraically

Teacher Preparation

- Download the student .tns file.

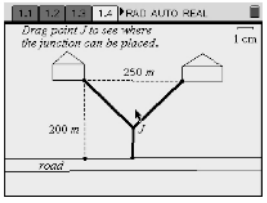
Classroom Management Tips

This activity is designed for students who have already solved other optimization problems. Students can work individually or in pairs.

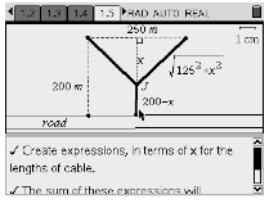
TI-Nspire Applications

- Graphs & geometry
- Lists & spreadsheet
- Notes
- Calculator

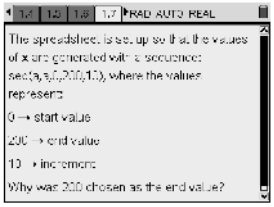
Step-by-Step Directions



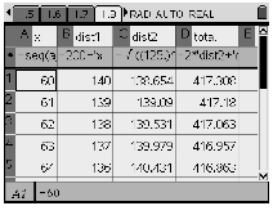
On page 1.4, students can drag point J to get a better sense of the possible locations for the junction box.



On page 1.5, students need to come up with expressions for the two distances (road to junction box and junction box to house) that the cable will run. This page has been scaffolded, with x already added to the diagram so that the expression for the distance from the junction box to each house is simpler. The labels can be added with a text box (MENU > ACTIONS > TEXT).



On page 1.7, students are shown the syntax of the sequence command, as they will need to edit this command later on. 200 was chosen as the end value, as that represents x = 200, or the junction being placed on the road.



On page 1.8 is the spreadsheet. The formulas are:

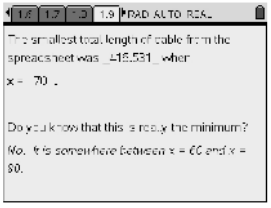
dist1 = 200 – x

dist2 = $\sqrt{125^2 + x^2}$

Note: If you want approximate results, add a decimal point after 125 (as shown).

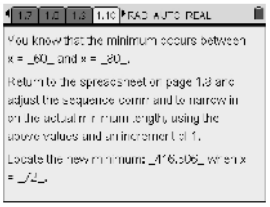
total = dist1 + 2*dist2

Students should scroll down the total column, looking for the minimum value, and should then take note of the corresponding value of x.

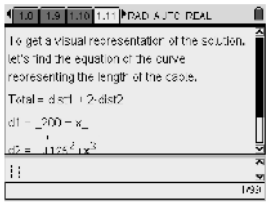


On page 1.9, students are asked for the optimal value based on the spreadsheet.

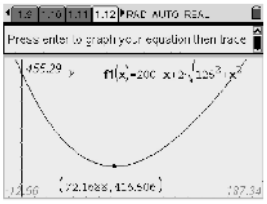
This value does not necessarily represent the true minimum, but does tell us that the minimum lies between x = 60 and x = 80.



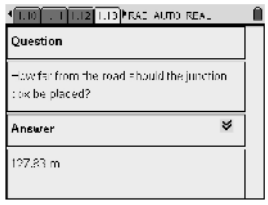
On page 1.10, students are asked to recalculate the distances by editing the sequence command.



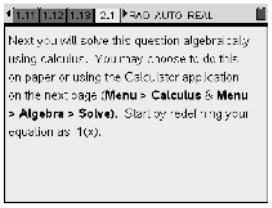
On page 1.11, students will now come up with the equation representing the distance the cable will run, using the formulas from the spreadsheet, as needed.



Once students have the equation, they can graph it on page 1.12. The window has already been set up for the correct graph. Using "Trace," students can locate the minimum.

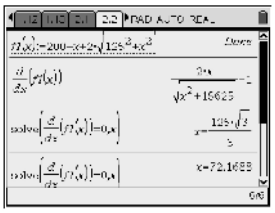


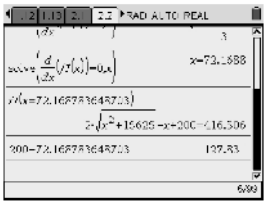
On page 1.13, students will answer the original question. Note: x is not what the question asked them to find.



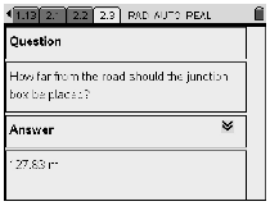
Page 2.1 provides instructions for solving the question algebraically. This is set up as a new problem so that the previous values of x do not interfere with the variable x in the equation to be solved. On page 2.2, students can use the CAS functions to:

1. take the derivative of their function
2. solve the equation resulting from setting the derivative equal to zero
3. find the optimum value of the function
4. calculate the required distance from the road





On page 2.3, students are again asked for their answer to the problem.



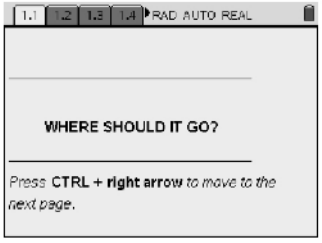
Assessment and Evaluation

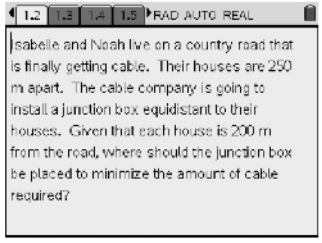
This activity is intended as an investigation. Teachers may wish to assess whether students have completed the activity, and should debrief at the end.

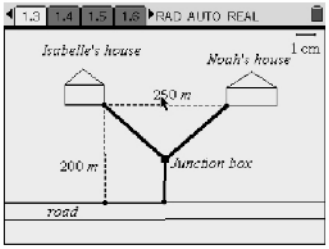
Activity Extensions

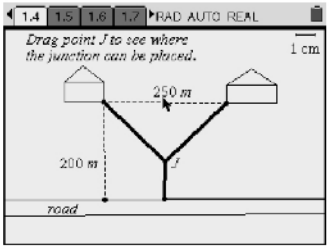
- The cost of cable going to Isabelle's house could be different from the cost of cable going to Noah's house. For example, it could cost $30/m for one and $25/m for the other. The cost of the cable from the road to the junction box would also have to be provided.
- Change the location of the junction box so that it remains on the road between the two houses.

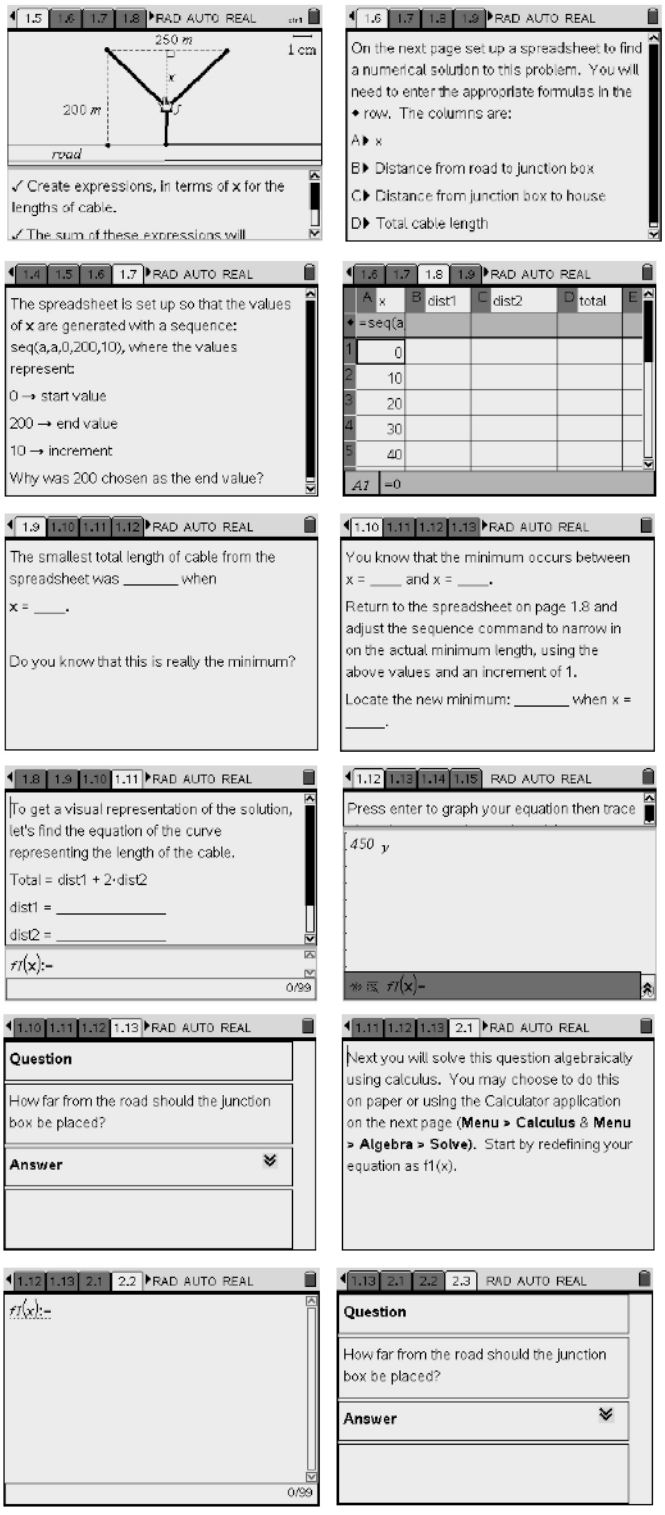
Student TI-Nspire Document: junction box.tns







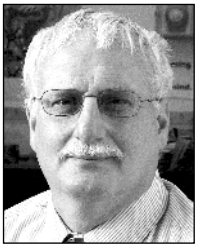




Activities Exchange is a great resource for all kinds of technology-focused activities, and I encourage you to see what you can find to help make your classroom more fun and engaging.

And don't forget that you can edit any of these activities to suit your needs and those of your students. ▲

▲ OAME/NCTM Report September 2008



JOHN KERSLEY

NCTM welcomes a new president, Henry S. Kepner, Jr. In his inaugural address, Mr. Kepner displays a keen interest in the teaching and learning of mathematics. Shortly, he will unveil a new publication devoted to curricular considerations in support of mathematical reasoning and sense making at the secondary school level. A new project in the planning stages will deal with problems students can solve through understanding, by making use of representations and connections, and by effectively communicating their mathematical reasoning. Mr. Kepner strongly supports the use of research clips and briefs providing teachers with useful, practical, researched-based information. His full President's Address can be found at **www.nctm.org**. (Type "President's Address" in the search option.)

NCTM Position Statements

"NCTM position statements define a particular problem, issue, or need, and describe its relevance to mathematics education." One such example is "The Role of Technology in the Teaching and Learning of Mathematics." In NCTM's view, calculators, interactive geometry software, applets, spreadsheets, interactive presentation devices, etc., are all vital components of a high-quality mathematics education and contribute positively to mathematical reasoning, mathematical reflection, and problem solving. NCTM maintains that such technology should complement, not replace, conceptual understanding, computational fluency, and problem-solving skills. NCTM further expresses the need for access to technology, the need for access to professional development opportunities to help teachers keep up to date, and the need for balanced mathematics programs that allow teachers to decide how their students can use technology most effectively. This implies, of course, that mathematics teachers must be open to learning about new technologies and implementing them in their classrooms. A complete list of

NCTM's position statements can be found at **www.nctm.org/postionstatements.aspx**.

A Sampling of New Publications from NCTM

70th Yearbook: Algebra and Algebraic Thinking in School Mathematics

This edition examines the status of algebra in schools and looks at changes to the algebra curriculum over the past few years. The book also discusses successful ways of helping students develop algebraic reasoning skills, while improving their overall understanding of algebra. (Stock number 13321NB9.)

Navigating through Algebra (Series)

This is the latest publication of the very successful and popular "navigation" series. This series consists of four publications: Pre-Kindergarten to Grade 2, Grades 3–5, Grades 6–8, and Grades 9–12. These books stress how fundamental ideas of algebra can be successfully introduced and developed. The books include activities and problems, as well as additional readings for teachers.

Navigating through Discrete Mathematics in Grades 6–12

This is another book in the "navigation" series. This book deals with the presentation and development of counting, vertex-edge graphs, and iterative and recursive processes. Activities and hands-on investigations involve counting, combinations, finding paths, etc. (Stock number 12996NB8.)

Getting into the Mathematics Conversation

This is a resource for Pre-Kindergarten to Grade 8 teachers. Its intent is to generate discussion about improving teaching skills and student learning. Topics include diversity, challenging students, and students' understanding of mathematics. (Stock number 13292NB8.)

A complete list of NCTM's publications can be found at **www.nctm.org**. Click on "Journals and Books" and/or "Lessons and Resources." Don't forget that there is a site especially for Canadians, called: "Resources for Canadian Mathematics Teachers" that can be found at **www.nctm.org/**. Click on "Lessons and Resources." It's listed in the left-hand column.

For Elementary Grades

Look at Me: Lessons engage students in the exploration of logical and numerical relationships while collecting and displaying data.

Can It Be? This lesson focuses on connections between mathematics and children's literature.

For Middle Grades

Sticks and Stones: This lesson allows students to investigate probability through the collection of data, an examination of the likelihood of various moves, and the use of basic ideas of expected value to determine the average number of moves needed to win a game.

Harry Potter and the Magic of Mathematics: This article illustrates how teachers can use the Harry Potter series to teach linear modelling and probability.

Navigating through Data Analysis in Grades 6–8: This publication illustrates the general notion of statistics as a process, while prompting discussions of increasingly complex mathematical issues. It provides ways to extend and deepen students' knowledge of data analysis, including comparison of data sets with equal and unequal numbers of elements, and analysis of data involving two variables.

For High School

Real-Life Traffic Data: A Vehicle for Statistical Exploration: This article examines the mathematics that can result from having students gather and examine real-time data. It also presents ideas for research projects that use real-time data.

Explorations with Chance: This lesson helps students test the fairness of certain games by examining the probability of outcomes. Students are given opportunities to predict results, play games, and calculate probabilities.

Navigating through Probability in Grades 9–12: This publication provides two different approaches to probability, using real-world contexts: interpretation of probability as relative frequency over the long run, and analyzing outcomes abstractly.

NCTM-Suggested Websites

- **www.mathsupportforparents.com** is the Family Education Network's list of resources for parents. It includes activities, articles, and other helpful ideas.
- **ocw.mit.edu** is an MIT site, listing all 1800 of its courses, including course materials, syllabi, lecture notes, exams, and assignments.
- **www.convert-me.com/en** is a handy site for all types of conversions: mass, length, area, capacity, cooking, fuel economy, etc.
- **www.superkids.com/aweb/tools/math** is a good site for creating math worksheets for topics such as

addition, exponents, telling time, and so on.

- **teachers.net/lessons** is a free databank of lessons for all subjects from pre-Kindergarten to Grade 12.
- **www.math.com/students/tools.html** is a free online calculator for basic computations, trigonometry, graphing, quadratic equations, mortgage payments, and loan comparisons.

NCTM Professional Development Opportunities

- Events are available at **www.nctm.org/profdev**.
- E-workshop information and schedules are available at **www.nctm.org/eworkshops.aspx**.

NCTM Conferences are available at www.nctm.org/meetings.

NCTM Regional Conferences for 2008 include:

- Oklahoma City, Oklahoma: October 2–3, 2008
- Cleveland, Ohio: October 16–17, 2008
- Reno, Nevada: November 6–7, 2008

Affiliate Conferences

A list of affiliate conferences can be found at **www.nctm.org/affiliates/conferences.htm**.

The NCTM Annual Meeting and Exposition will be held in Washington, DC from April 22–25, 2009 and will address the topic "Equity: All Means All." ▲

OAME STICKY GRAPH PADS



GREAT FOR STUDENT USE!
3 colours, 2.5" x 3"
50 sheets per pad
$9.00
for 10 pads

Price includes taxes. Shipping and handling extra.

Order by mail, fax or on-line:

OAME
or Order ON-LINE www.oame.on.ca
Do not send cash or cheque. You will be invoiced with shipping and handling costs added.

▲ What's the Problem? Thick as a Brick

SHAWN GODIN



Shawn is the head of Mathematics, Business and Technology at Cairine Wilson S.S. in Orleans, ON.

Welcome back to a new school year, problem solvers. As I prepare this first column of the school year, I am nursing a sunburn that I got while staining my deck over the summer holidays. Deadlines can sometimes be surreal! Last issue, I left you with the following problem:

> *The surface areas of the six faces of a rectangular prism are 1254 cm^2, 1254 cm^2, 770 cm^2, 770 cm^2, 1995 cm^2, 1995 cm^2. Determine the volume of the prism.*

This problem appeared as M191 from the April 2005 issue of *Crux Mathematicorum with Mathematical Mayhem*, and the solution appeared in the May 2006 issue. You can check out more problems at the *Crux Mathematicorum with Mathematical Mayhem* website, available at **http://journals.cms.math.ca/CRUX/**.

The above problem lends itself to trial and error. With trial and error, it's always a good idea to develop some sort of system or plan to ensure that you will not miss any of the possibilities.

To attack this problem by trial and error, start with the first face and write 1254 cm^2 = 1 cm x 1254 cm. Since this face shares one side with each of the other face sizes, we must have (if this is to work) 770 cm^2 = **1 cm** x 770 cm, **or** 1995 cm^2 = **1 cm** x 1995 cm. Unfortunately, neither of these yields a solution. We could continue this way, using 1254 cm^2 = 2 cm x 627 cm as the next possibility and so on, until we find the solution. Rather than searching randomly, the key is to work through the factors of 1254 by starting at 1 and trying each number in succession so that nothing is missed.

A slightly more sophisticated version of this method comes from realizing that, since we are dealing with a prism, each face shares a side with four other faces. For example, the face with an area of 770 cm^2 shares a side with two faces of area 1254 cm^2 and two faces with area

1995 cm^2. As a result, we see that the three areas will share a factor with the other two. Thus, if our edges have integer lengths, we should be able to find the solution if we find all the pairs of numbers whose products are the areas.

1254 cm^2	770 cm^2	1995 cm^2
1 cm x 1254 cm	1 cm x 770 cm	1 cm x 1995 cm
2 cm x 627 cm	2 cm x 385 cm	3 cm x 665 cm
3 cm x 418 cm	5 cm x 154 cm	5 cm x 399 cm
6 cm x 209 cm	7 cm x 110 cm	7 cm x 285 cm
11 cm x 114 cm	10 cm x 77 cm	15 cm x 133 cm
19 cm x 66 cm	11 cm x 70 cm	19 cm x 105 cm
22 cm x 57 cm	14 cm x 55 cm	21 cm x 95 cm
33 cm x 38 cm	22 cm x 35 cm	35 cm x 57 cm

A unique solution to this problem can be determined by using this table. Can you find the solution?

Generally, the solution to a problem becomes more succinct as the method of solving the problem gets more sophisticated and takes into account more properties of the problem.

Now, let's step back and look at the problem from a more general point of view. If we let the dimensions of the prism be *a* cm, *b* cm, and *c* cm, then the areas of the faces will be *ab* cm^2, *ac* cm^2, and *bc* cm^2, and the volume will be *abc* cm^3. Notice that

$$ab\ cm^2 \times ac\ cm^2 \times bc\ cm^2 = a^2b^2c^2\ cm^6 = (abc\ cm^3)^2$$

Thus, the volume of the prism will be $\sqrt{1254\,cm^2 \times 770\,cm^2 \times 1995\,cm^2} = 43\,890\,cm^2$, which means that we didn't even need to find the dimensions of the prism in order to solve the problem!

Now for Your Homework

The right triangle having sides 3, $\sqrt{7}$, and 4 has the strange property that the two integer lengths sum to the value under the square root sign for the length of the third side. Find another such triangle.

Until next time, happy problem solving! ▲

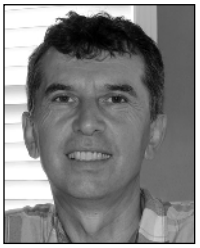


▲ A Public Celebration of Mathematics

GEORGE GADANIDIS, ASSOCIATE PROFESSOR,
FACULTY OF EDUCATION,
THE UNIVERSITY OF WESTERN ONTARIO

SUSAN GEROFSKY, ASSISTANT PROFESSOR,
FACULTY OF EDUCATION,
UNIVERSITY OF BRITISH COLUMBIA

JANETTE HUGHES, ASSISTANT PROFESSOR,
FACULTY OF EDUCATION, UNIVERSITY
OF ONTARIO INSTITUTE OF TECHNOLOGY



George Gadanidis is Associate Professor at the Faculty of Education at The University of Western Ontario. He's interested in ways of engaging students' mathematical imaginations.



Susan Gerofsky researches mathematics education with regard to gesture, genre and performance. She is an assistant professor of mathematics education at the University of British Columbia in Vancouver.



Dr. Janette Hughes is an assistant professor at the Faculty of Education, University of Ontario Institute of Technology. She teaches primary/junior language arts and intermediate/senior English methodology courses. Her research is in the area of multimodality, multiple literacies, and the performative potential of new media.

Mathematics has an image problem. As one prospective elementary school teacher commented, "Math is like an iguana. As long as it blends in [with] its environment, I don't mind it. But if I have to hold it, I'm not so fond of it." Another prospective teacher put it more bluntly: "I hate math!" Most people in our society avoid mathematics, and rarely is mathematics shared or discussed outside of mathematics classrooms or communities of mathematicians. Can you imagine people discussing mathematics with their family or friends?

The Beauty of Mathematics

In contrast to its public image, however, mathematics has a distinguished history of association with the sciences, the humanities, and the arts. According to Higginson (2004, 2006), mathematics is a fully human and wonderfully beautiful experience. Gilbert Labelle (2000), Université du Québec à Montréal, agrees:

> *I like mathematics because it is beautiful, full of surprises, gives me complete freedom of thought and, at the same time, it can be applied efficiently to solve problems in science and society.... [Art and mathematics] are similar in that they both use human imagination and skill to combine things to create new things. (p.10)*

Nathalie Sinclair (2000) of Simon Fraser University notes:

> *I like mathematics because it so often shows how one small change, like transforming an equation, introducing a new dimension, or seeing a different representation can give you a whole new feeling of how something works and how it connects to other things that we do or think about. I like the feeling of understanding something, seeing new connections, and of being able to admire the creativity of other mathematicians.... I love how excited the students can get about mathematics, how many of the topics can transform the way they think about or see things. (p.4)*

A Public Celebration of Mathematics

How do we change the public image of mathematics, and how might mathematics reinvent itself in our society as the beautiful, artistic, and fully human experience that it really is?

One powerful way for society to experience and celebrate the beauty of mathematics is to see it through the wonder-filled eyes and inquisitive minds of young mathematicians. This is where *performance* might come in to mathematics.

Math and Performance?

When we talk about mathematics and performance, people are at first taken aback. How could mathematics have anything to do with performance?

First, we should clarify which definition of the word "performance" we are referring to in this context. People often talk about "a high-performance vehicle" or "performing well on a math exam." This meaning of the word "performance" refers to meeting and exceeding tough criteria in a competitive, high-stress situation (like an exam or a car race). This is *not* the sense of mathematical performance that we are discussing here!

Instead, we are referring to the kind of performance we see in the performing arts (e.g., performing a play, performing music, reading a poem aloud, or making a film).

This raises new questions, since it is rather unusual for people to think about mathematics and artistic performance as having anything in common. For centuries, our culture has drawn a line that strictly divides the sciences and the arts; similarly, it has separated reason from emotion, mind from body, the abstract from the physical, and even thinking from performing. Mathematics has built a reputation as an ultra-rational, abstract, thinking-based scientific enterprise, and this is reflected in the way that mathematics learners have traditionally been expected to act—thinking and writing individually and silently while sitting nearly immobile at a desk.

We want to challenge this stereotype of mathematics and the range of activities appropriate for mathematics learners. Mathematics can be a science, but it can also be an art. It is rational, but also emotional; it is physical, yet abstract. Mathematics can involve quiet individual thought, but it can also involve collaborative expression, movement, theatre, and music. Students can express mathematical wonder, surprise, and humour, and they can ask—and *do* ask—important philosophical questions through the ideas they encounter in their math lessons. Mathematical concepts, feelings, and facts can be explored and communicated in performances that connect with the arts. By "performing" their mathematical questions, students can learn more about what they think, wonder, and need to learn.

Even within the idea of mathematical artistic performances, there are some difficulties around the meaning of the word "performance." For example, many of us were brought up during a time when performance was considered a kind of "high art," and the only people who were considered to be performers were artistic prodigies and geniuses—great concert pianists and orchestra conductors, or famous actors, ballerinas, and opera singers. In the past, the line between "high art" performers and audiences was strictly drawn, and those of us who were not artistic superstars had to be content with taking on the role of amateur performer or audience member when it came to music, theatre, or the ballet.

Things have changed over the past few decades, though, largely through the rise of pop and folk music (where anyone could join or start a band) and through the availability of smaller, cheaper cameras and other cultural and technological developments. Now, with social networking on the Internet, anyone can make and present artistic performances, including films, photos, music, visual art, literary works, video games, and blogs. Suddenly, it has become very common for students to produce and share all kinds of artistic performances, both in and out of school.

In today's cultural climate, it becomes easier to imagine that we can bring together mathematics learning and a more inclusive, democratic view of performance. In our new understanding of the term, performance is available to everybody. Performance no longer has to be perfected; instead, it can be the best possible in its context, using features of improvisation and collaboration—more like jazz than classical music. Mathematical performances can be done by students, teachers, teacher candidates, parents, and professors. Using live performance or the Internet to share our performances, we are suddenly offered more expressive and engaging ways to communicate our mathematical wonder and surprise, and to pose our big mathematical questions.

Examples of Math Performances

Below, we briefly describe and discuss four math performances submitted to the Math Performance Festival (available at **www.mathfest.ca**), which is sponsored by the Fields Institute, the Faculty of Education at The University of Western Ontario, and the Canadian Mathematical Society.

Little Quad's Quest

Little Quad's Quest (available at **www.edu.uwo.ca/mathscene/lq/lq1.html**) is a five-part shadow-theatre performance created by a class of fifth-grade students. Little Quad, the protagonist, is in search of his identity. Unlike Little Quad, all of Little Quad's quadrilateral friends (Square, Rectangle, Rhombus, and Trapezoid) have their own special names. Will Little Quad find his special name?



How do we find instructional time to help students create such performances when creating a performance like *Little Quad's Quest* takes much longer than simply "covering" the concept of quadrilaterals in a more typical fashion? First, we need to appreciate that the process of creating such a performance integrates mathematics concepts with language arts, visual arts, and drama, and

that the extra time spent is therefore valuable and meaningful instructional time. Perhaps more importantly, we need to appreciate that such settings offer students opportunities to think creatively and imaginatively about mathematical concepts, while providing personal and emotional connections to mathematical ideas. See **www.edu.uwo.ca/mpc/prep.html** for videos of teachers discussing their instructional planning in this context.

Measuring the Millimetres to You

Measuring the Millimetres to You, available at **www.edu.uwo.ca/mathscene/pst/pst5.html**, is a song written and performed by preservice teachers at The University of Western Ontario. In this romantic ballad, two friends are saddened because of the great distance (100 000 mm) that separates them. Then, they realize that 100 000 mm is the same as 10 000 cm. Also, when they divide by 10 and then by 10 again, they see that they are really not that far apart—only 100 m. This song provides insight into the metric system in ways that are humorous, emotional, and difficult to forget.



Now I'm a Trapezoid

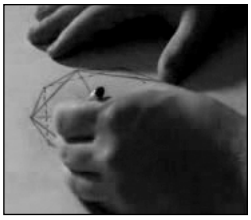
Now I'm a Trapezoid, available at **www.edu.uwo.ca/mathscene/geometry/geo1.html**, is a song about a triangle that has lost its head. Saddened by this loss, the triangle laments that it is now a trapezoid. This is one of three songs in a "Geometry Idol" contest setting. (The second song is *Triangles Rock*, and the third song is *Hexagon*.)



A triangle loses its "head" and becomes a trapezoid. Does this view of shapes and their relationships make a difference—for students, for teachers, for you? How might the student who sings the song see triangles and trapezoids differently? How might he or she feel differently about these shapes and about mathematics in general? What if the triangle were to lose all three of its vertices? What might it become? What if the triangle had been created by cutting vertices from another shape—what might that shape have been?

Building a Geometric Sculpture

Building a Geometric Sculpture, available at **www.edu.uwo.ca/mathscene/gerofsky/sculpture.html**, shows the viewer how to draw and then build a beautiful sculpture in the shape of a 3-D truncated icosahedron (otherwise known as a soccer-ball shape) out of 150 second-hand CDs and 180 nylon cable ties. Sculptor and mathematician George Hart collaborated with faculty and teacher candidates from the University of British Columbia (UBC) to design this sculpture-building workshop and to pilot it with over 400 students from Grades 4 to 12. A full ready-to-use lesson plan for the workshop is available for download at **georgehart.com/UBC/ubc.html**. (Scroll to the bottom of the page for the link.)





In fast motion, this little film shows the viewer how to get from pencils, blank paper, and a pile of recycled CDs to a spectacular, shiny sculpture, while illustrating how amazing polyhedra can be. Viewers can also learn to build a "disco ball" in the shape of a soccer ball from simple, inexpensive materials and to make other shapes (like a paramecium or a Fabergé egg) by altering one or two features of the sculpture. The film also answers questions such as:

- How can you draw a complicated 3-D shape on a 2-D sheet of paper?
- How can you impress your friends by throwing cool words like "polyhedra," "icosahedron," and "truncated" into the conversation?
- How can you tell how many edges, faces, and points there are on a truncated polyhedron, just by drawing it?
- How do you draw a convincing picture of a 3-D soccer ball?

Helping Students Perform Mathematics

Below, we share some of the ideas we have used to help students engage with mathematics performance.

How to Write and Perform a Math Poem

1. Writing a Math Poem

To lead a class workshop in writing math poems:

- Pick a math topic that evokes a sense of mystery or that offers a paradox or an unanswerable question (e.g., infinity, division by zero, dimensions greater or less than three, asymptotes).
- Identify two or more keywords or ideas related to your topic that have deep mathematical and non-

mathematical meanings. (For example, we have used the words "divide" and "zero" for a poem about division by zero; or, for a collaborative poem about dimensionality, we have asked people to write about what it would be like to be a point, a line, a square, or a cube.)

- Have the group do a timed "free write" on each of the keywords. In a timed free write, writers are asked to write down whatever comes into their minds on the topic, without stopping or lifting pen from paper, for an agreed-upon length of time (say, four minutes). If the writers run out of things to say, they can write, "I can't think of what else to say" and then go on. The timed free writes will be treated as raw material for the math poems. This method allows writers to discover and externalize what they are thinking about and helps them overcome any "writer's block" that keeps them from getting started.

Kevin Ault: Undefined

Our world is not modular

We cannot divide it into rules – lists and consequences

Our lives are not a cup of flour to be sifted and simplified

We are infinite yet shapeless

We are placeholders for the heavens

A void that loops through both the devil and the gods

Not undefined – just indescribable – never restful or at ease

An infinite inversion

Passing into both the future and the past

Confined because we are being pulled in two directions

Limitless

But unimportant

Zero

- Have writers read through their two free writes, highlighting or circling the parts they like best and want to use in their poems. To help clarify their thoughts, writers can share these ideas with a partner.
- Teach a mini-lesson on the mathematics of the topic of the poem. For example, offer two or three different reasons why division by zero is considered undefined.
- Ask writers to use their free writes and notes from the lesson as raw material for writing a poem that brings together mathematical and non-mathematical meanings of the topic. The idea is to make sense of mathematical meanings together with the feelings and poetic associations that inevitably enter into our mathematical understandings, especially when the mathematical terms are borrowed from everyday language.

Poems can be written individually or collaboratively. It sometimes helps to set up a form that writers can work with. For example, for a collaborative poem about experiencing dimensions, we set up the following simple form to facilitate the writing:

"Said the point to the line…"

"The line replied…"

"A square passing by…."

Using the sample form above, each writer would contribute one of the three sections, based on the writer's free writing and the mini math lesson.

2. Performing a Math Poem

Here are some ideas for performing the poems. Students could:

- illustrate the poem with their own artwork, like the Grade 5 poem shown on the next page
- create a dramatic reading of the poem
- use storytelling software like *Photo Story, Movie Maker, iMovie,* or *iPhoto* to create a multimedia performance of the poem
- create a song based on the poem, and record its performance

3. Sharing a Math Poem

Invite students to share performances of their poems in our Math Performance Festival, at **www.mathfest.ca**.

Numeration

Numeration is a murderer,
7 ate 9,
When he got into court,
He said, 'I had to dine!'



Subtraction is like ice cream,
They both disappear,
I know someone who likes them,
And he is a peer.



Subtraction is like geometry,
They both use line segments,
Line segments are used a lot,
They're on the monuments.



Subtraction is a casino,
You never come out with more,
When you do get some cash,
You'll use it at the store.



Addition is a birthday party,
You always get more,
You get a bit of money,
And presents galore.



Division is like friends,
You have to share with both
Both are essential
For your childhood growth.



Multiplication is a herd of animals,
It's always getting bigger,
But when one set hits another,
I think they'll merge together.



Operations are really cool,
It's one of the things I like,
Math and fishing are also great,
We measured my caught pike.
Vincent Kong



How to Interview a Math Concept

Provide students with the following instructions:

1. Preparing for the Interview

- Pick a math concept (like the number pi, the fraction 1/3, the triangle, or the hexagon).
- Make a knowledge web for your topic:
  - Use a large, blank sheet of paper.
  - Write the name of the concept in the centre.
  - All around the name of the concept, write all the things you know and can find out about the concept. (Use your textbook; use Google; ask your peers.)
  - Write down other things that your concept connects to. (For example, the hexagon is found in beehives and in floor tiles; where else can you find it?)
- Make a list of questions and possible answers, using the ideas from your knowledge web. Good interviews offer some controversy and some surprise. For example, here's a possible Q&A for the hexagon:
  - *Interviewer:* Hexagon, is it true that you are a honey thief?
  - *Hexagon:* Of course not. Where did you get such a crazy idea?
  - *Interviewer:* Tell us the truth, Hexagon. Why have you been spending so much time in beehives?

2. Writing the Interview

Now you're ready to write the interview.

- Sequence your questions in an order that tells a good story.
- Refine your questions and answers.
  - Be concise in your questions and answers.
  - Use expressive language.
  - Show humour and emotion.
- Test your interview with a friend.
  - Read it aloud, with one person playing the role of interviewer and the other playing the role of the Hexagon.
  - Reverse roles and try it again.
  - What works well?
  - What needs improvement?
- Write a brief introduction. Tell us where the interview is taking place. For example, where does the Hexagon live? Mathville? Flatland? Shapeville?
- Provide one piece of information about the interviewer. (For example, for whom does he or she work?)

3. Performing the Interview

Below are some ideas for performing your interview:

- Create a dramatic reading of your interview and record it as part of a radio show.
- Write your interview as a comic strip, with appropriate pictures and expressions for different

parts of the interview.

- Use storytelling software like *Photo Story, Movie Maker, iMovie,* or *iPhoto* to create a multimedia performance of your interview.
- Write a poem or song based on the interview.
- Create a classified ad for your concept.
- Create a poster for your concept.

To view a performance of the Triangle interview, see **www.edu.uwo.ca/mathscene/HS/triangle.html**.

Triangle, I have heard a rumour that carpenters love you. How do you feel about this?
Being loved is a wonderful thing.



But why you, Triangle? What makes you so special?
Well, I am the strongest polygon. I help carpenters make furniture, houses and other structures rigid.

I am not sure that I understand.
You see, I am the only polygon that holds its shape under pressure. Take a square for example. If you push at one of its vertices it will collapse. Push at one of my vertices and I will keep my shape.

How is this possible, Triangle?
Have you ridden a bus standing up recently?

Yes, yesterday during rush hour. In fact, the bus was so crowded that I couldn't even reach a railing to hold on to.
What did you do so that you wouldn't fall down when the bus started or stopped?

I stood with my legs apart, of course.
Aha! By spreading your legs you formed a human triangle. This helped increase your stability.

I think I see what you mean, Triangle. Is there anything else besides your strength that carpenters like?
Carpenters also like to use the 3-4-5 triangle rule to check for square corners.

How does this work, Triangle?
If you want to check whether a corner of a room is square, measure 3 m from the corner along one wall and 4 m along the other wall. If the distance between the ends of the two measurements is 5 m then the corner is 90°.

Does this have something to do with the Pythagorean Theorem?
Indeed it does!

4. Sharing the Interview

Share a performance of your interview in our Math Performance Festival, at **www.mathfest.ca**.

How to Perform a Math Problem

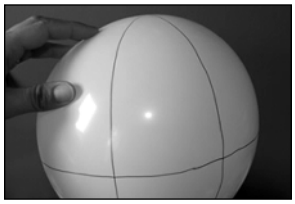
Provide students with the following instructions:

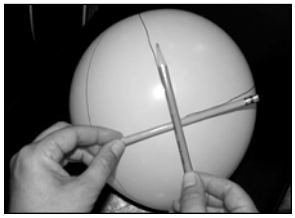
1. Selecting and Solving a Good Problem

A good math problem can be approached in a variety of ways. A good math problem also leads to new math problems. Of course, a good problem doesn't do these things on its own. It's your creative thinking that does it! Keep an open mind. Use your imagination. Don't be afraid to make mistakes. Have fun! Here is an example that you might try:

PROBLEM. If we were to draw a "triangle" on a sphere, what would be the sum of its angles?

Here's one possible way to think about this problem:





- Inflate a balloon.
- Pretend the balloon represents a globe of the Earth.
- Use a pen and draw the equator and two lines of longitude.
- Use two pencils to show the angle formed where a line of longitude crosses the equator.
- What is the size of the angle?
- Approximate the size of the angle formed where the two lines of longitude cross.
- What is the sum of the angles in this "triangle"?
- What would the sum of the angles be if we moved the lines of longitude closer together or further apart?
- What is the greatest possible sum?

2. Performing Your Math Problem

Below are some elements of good mathematical performances:

- **They connect mathematical ideas.**
  The problem above connects the geometry of a flat surface to that of a sphere.
- **They offer some surprise.**
  In the problem above, it's surprising that the sum of the angles isn't simply 180˚!

- **They express feelings and emotions.** Mathematics, like all human activities and experiences, involves both thinking and feeling. For example, we can imagine a performance of the above problem that includes the following:

  I was drawing two lines of longitude on a balloon, and I noticed that they formed what looked like a triangle when they crossed the equator. So I wondered: What is the sum of the angles in this triangle? I was really surprised to find that the sum was bigger than 180˚! But here's the really neat part that makes my mind fly: If I move the lines of longitude closer or further apart, then I notice that the sum changes. So now I'm wondering: How big and how small can the sum of the angles be? What do you think?

3. Sharing Your Math Problem

Share a performance of your problem in our Math Performance Festival, at **www.mathfest.ca** by telling a story about your problem, by sharing a poem about it, or by creating a set of drawings that expresses your ideas.

How to Organize a Math Performance Festival at Your School

Start Small

There are many ways to organize a successful Math Performance Festival. Here is one suggestion:

- Select a single focus for your festival. We suggest that you start with Math Poetry. (See the section entitled "How to Write and Perform a Math Poem.")
  - A single focus simplifies organization and communication.
  - A single focus simplifies teacher planning and encourages teacher collaboration.
  - A single focus helps give students and teachers a clear purpose.
- Select which grade or grades will participate (e.g., Grades 4–6).
- Set a time period during which students can write and illustrate their poems and create dramatic readings or songs based on their poems.
- Encourage students to author collaborative poems and create group performances.
- Invite local artists to participate in, and assist with, the Festival.
  - Contact local artists.
  - Find out about the Artists in the Schools program in your area.
  - Involve the arts teacher(s) at your school.

Think BIG

Math performance is a celebration of students' mathematical imaginations.

- Plan a celebration.
- Post students' illustrated poems in classrooms and school hallways.
- Take pictures of students working on their poems and illustrations.
- Create a slide show from the pictures.
- Organize an assembly.
  - Invite parents/guardians.
  - Invite the local news media.
  - Invite local celebrities.
  - Present a slide show of student work (with soundtrack).
  - Have some students from each class perform their poems.
- Copy and bind all of the poems to create a math poetry anthology. Print a copy for each student.
- With parental permission, post the performances on your school's website.

Share Student Performances

Invite students to share their performances in our Math Performance Festival, at **www.mathfest.ca**.

Mathematics as Performance

Exploring mathematical ideas through performance can offer a way to challenge some of the most limiting stereotypes around mathematics learning—stereotypes held not only by students, but by many teachers and parents, too. One such stereotypical view treats mathematics as the only school subject with absolute, certain, and unchanging knowledge. Mathematics is seen as a source of authoritative and infallible "right answers." While our views of history, science, and literature might change with a changing culture or new discoveries, mathematics is held to be eternal.

When we begin to think about mathematical performances, the sense of mathematics as a source of infallible truths is mitigated by our awareness of the paradoxes, unexplored territory, and deep philosophical questions that are raised. As mathematical performers, we can explore the edges of our understanding of mathematics and ask big questions. We can ask imaginative "what if" questions, and we can make sense of mathematical ideas in the context of their relationship to our lives. Mathematics can be messy and imperfect in

some ways, just as it appears to be clean and crystalline in others. Mathematical performances connect mathematics with human history, philosophy, and art, and put us in touch with the places where new mathematical ideas come to be.

Another stereotypical view of mathematics sees math as an endless cycle of questions and answers. Because so much school mathematics has traditionally consisted of solving worksheet or textbook questions, many people have grown up thinking that this is all that math could be. This view of math assumes that every mathematical question can be solved quickly and correctly by applying the correct technique. Once a question is answered (and the answer is checked against the one in the back of the book), it is discarded and another quickly answerable question takes its place. According to this stereotypical view, a person's knowledge of math ought to be easily measured by giving the person a timed test with lots of questions and then counting the number of correct answers.

As mathematical performers, we begin to disrupt this cycle of endless solving (and dissolving) of questions and problems. The questions we ask in our performances are deep and stubborn and not so easily resolved. The surprises, delights, and beauties of the mathematics we perform make us want to linger. Rather than discard problems once an answer is arrived at, we take some time to dwell in our favourite mathematical spaces and share them with our friends and family. Over time, and with contemplation, we can develop new ways of understanding and connecting concepts that may have nothing much to do with finding a single correct answer. For example, we can explore a mathematical problem by holding all of its features the same, except one, and then playing with changing that one feature—that is, playing with invariant and variant elements. We can think about simpler and more complex versions of problems that intrigue us. In playing with change and constancy and giving attention to emergent patterns, we can enjoy thinking mathematically.

Finally, a traditional stereotypical view of mathematics holds that the mathematics teacher is the expert, the holder of knowledge, while the students are empty of that knowledge. If mathematics as a discipline is treated as authoritative, then the teacher, as the representative of mathematics in the classroom, is viewed as the one authority in that room. However, when mathematical performance becomes an important element of our classrooms, we begin to realize the importance of imagination, problem posing, and boundary stretching in developing mathematical understanding. We can also see how important it is to give time and space to the questions of novices, since beginners often ask the same kinds of probing questions as those asked by the most sophisticated experts. In bringing mathematical performance into our classrooms, we honour curiosity and insight—both our own and that of our students.

References

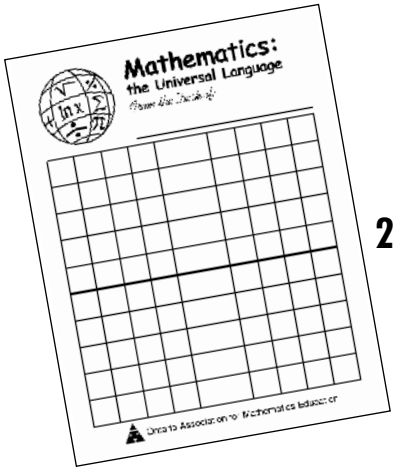
Higginson, W. (2004). Whatever made you think that mathematics might be anything other than unnatural? In G. Gadanidis, C. Hoogland, & K. Sedig (Eds.), *Mathematics as story: Mathematics through the lenses of art and technology* (pp. 64–66). Proceedings of a Fields Institute Symposium, Faculty of Education, The University of Western Ontario.

Higginson, W. (2006). Mathematics, aesthetics and being human. In N. Sinclair, D. Pimm, & W. Higginson (Eds.), *Mathematics and the aesthetic: Modern approaches to an ancient affinity* (pp. 126–142). NY: Springer-Verlag.

Labelle, G. (2000). Interview with Gilbert Labelle. MathMania 5(4), 4. Retrieved July 8, 2008 from **mathadventures.com/Labelle.pdf**.

Sinclair, N. (2000). The joy of math. *MathMania 5*(3), 4. Retrieved July 8, 2008 from **mathadventures.com/Sinclair.pdf**. ▲

OAME MEMO PADS



Mathematics: The Universal Language

50 sheets;
2 colour memo pad
4.25" x 5.5"
package of 10

$8.50

plus shipping and handling.

Order by mail, fax or on-line:

OAME
or Order ON-LINE www.oame.on.ca
Do not send cash or cheque. You will be invoiced with shipping and handling costs added.

▲ Mathematics and Adolescence: Not so Much a Battleground, More a Merging of the Ways

ANNE WATSON, UNIVERSITY OF OXFORD



Anne Watson was a secondary mathematics teacher for 13 years before becoming a teacher educator and now Reader in Mathematics Education at the University of Oxford. Despite working at such a high-achieving establishment, her driving interest is in how teaching and learning mathematics can contribute to social justice and the empowerment of all.

The job of the adolescent is to navigate change from childhood to adulthood. Those of us who have brought up and/or taught adolescents may sometimes feel that this is best done far away from both children and adults in specially protected areas of wilderness, but instead, society has decided that it should be done in school with a subject-focused curriculum. This is not as "daft" as it might first appear, and many cultures have traditionally recognized that puberty is a good time to be initiated into the formal cultural knowledge. However, the problem with modern society is that there is so much formal cultural knowledge to be acquired, whether it is really useful knowledge like how to interpret political data, or less useful knowledge, like when to call a tessellation pattern a "glide reflection."

All too often, formal mathematical schooling and adolescents' self-perceived needs clash. Yet the same kind of adolescent autonomous thinking that so often leads to disaffection and rejection—not only of mathematics, but of school and life generally—can be embedded in and enhanced by the teaching and learning of mathematics. Not only is this possible, but I will argue that it is also desirable because so many of the intellectual changes that take place in adolescence align with a deep engagement in mathematical processes.

Teaching in ways that nurture and depend on students' powers of exploration, application, and natural enquiry is known to achieve some success because these ways of working on mathematics *in* school are similar to the ways in which quantitative problems are approached and solved *out* of school. But mathematical reasoning is not "out of school" reasoning. Unless learning is carefully structured, as it is, for example, in Realistic Mathematics Education (Treffers, 1987), students do not encounter the essentially abstract, structural understandings that characterize the subject in its entirety. School is supposed to introduce adolescents to new ways of thinking, not merely allow them to use childhood ways of thinking inappropriately until they get fed up. In Vygotsky's terms, adolescents need to be supported when engaging in formal concepts, which can only be deliberately taught (Kozulin, 1986, p. xxxiii).

Adolescent Concerns

There is widespread agreement that most adolescents are concerned with:

- the development of identity
- belonging
- being heard
- being in charge
- being supported
- feeling powerful
- understanding the world
- being able to argue in ways that make adults listen (Coleman and Hendry, 1990)[1]

Adolescents engage with these concerns through interaction with their peers. Vygotsky regarded this interaction as the "leading activity" of adolescence (Elkonin, 1971), that is, the activity that leads the course of development (although not necessarily the only influential activity). Nevertheless, as Vygotsky saw it, peer interaction is the context in which adolescents work out their relationships with others, adults, the world, and themselves. Adolescents do this by employing their new-found ability to engage in formal-logical thinking so that they become capable of self-analysis, and analysis of other situations, as internalizations of social consciousness developed with peers. Piaget attributes this new-found facility to the biological development of the cortex, yet different societies appear to engender different kinds of world views, different forms of mature argument, and different kinds of abstraction. Vygotsky recognizes the role of physiological maturity, but

[1] Naming these as adolescent concerns assumes that Western psychological understandings of adolescence can be taken to be universal, which may not be the case due to the interaction of physiological and cultural factors; however, I will adopt this understanding for the purposes of this paper.

emphasizes that the use of the maturing brain is influenced by how the notion of self is worked out in the social world (Vygotsky, 1998). Thus, the biological ability to understand things in more complex, abstract ways is not the most important influence on learning. Rather, it is how adolescents use adult behaviour and interaction as mediators of their main activity with peers that influences the development of identity and self-knowledge.

The question for the teacher, then, is "How can I provide a mathematical environment in which students can develop, both as people and as mathematicians?" Often, the answer has been the creation of classrooms and tasks such as those I have hinted at above (e.g., those with a focus on peer discussion, group work, and exploration); however, I am increasingly concerned that this focus can deny access to the heart of mathematical structural reasoning, and that it can also deny ways of allowing students to develop intellectually in mathematics.

Shifts in Mathematical Action

The authority of mathematics does not reside in teachers or textbook writers, but in the ways in which minds work with mathematics itself (Vergnaud, 1997). For this reason, mathematics, like some of the creative arts, can be an arena in which the adolescent mind can have some control, can validate its own thinking, and can appeal to a constructed, personal authority. I have tried to identify key intellectual tools of the secondary curriculum as illustrations of what needs to be appropriated in order to have students engage with new kinds of mathematical understanding. Unsurprisingly, these often turn out to be the aspects that cause the most difficulty, and I would argue that the curriculum likely does not pay enough attention to these shifts as inherently difficult. Not only do these shifts represent "epistemological obstacles," to use Brousseau's terms, but they are also precisely those changes to new forms of action that constitute the formal knowledge of mathematics—that which can only be learned at school. It is inequitable to expect students to bring their everyday forms of reasoning to bear meaningfully on mathematical problems, when everyday forms do not enable these shifts to be made. For example, adolescents need to:

- shift from looking for relationships (e.g., pattern seeking) to seeing properties as defined by relationships
- shift from perceptual, kinesthetic responses to mathematical objects to conceptual responses
- shift from intuitive to deductive reasoning
- shift from focusing on procedures to reflecting on the methods and results of procedures
- shift from discrete to continuous ways of seeing, defining, reasoning, and reporting objects
- shift from additive to multiplicative and exponential understandings of number
- shift from assumptions of linearity to analyzing other forms of relationship
- shift from enumeration to non-linear measure and appreciating likelihood
- shift from knowing specific aspects of mathematics to understanding relationships and derivations between/among concepts

A shift toward seeing abstract patterns and structures within a complex world is seen by many psychologists—not only those influenced by Piaget, but also the Vygotskian school—as typical of adolescent development (Coleman & Hendry, 1990, p. 47). Such shifts are not made automatically, except by a very few students. Teachers must therefore pay explicit attention to these shifts with respect to the tasks and language used in teaching. Working with, and supporting, adolescents' intellectual growth in making these shifts is central to both mathematics and adolescence because these shifts enable:

- the development of the student's identity as someone who can do a "hard" school subject
- a sense of belonging in the mathematics classroom and elsewhere where mathematics is used
- a sense of being heard by teachers and adults
- a sense of being in charge of mathematical "truth"
- a sense of being supported in one's own thinking
- a sense of feeling powerful by using powerful methods
- an understanding of the world mathematically
- the ability to argue in ways that make adults listen

In addition, mathematics offers constant opportunities for adolescents to develop formal arguments and reasoning.

This paper is not an argument for traditional teaching; it is an argument that teachers should be aware of the intellectual tasks of adolescence, and that they should support such growth by using language and offering tasks that allow such shifts to be made. The following are examples of tasks that support such shifts while valuing students' own reasoning and meanings:

1. Use a familiar structure to explore new ideas.

Students are familiar with a grid multiplication method of the following form:

X	20	7
50	1000	350
9	180	63

X	z	+3
2z	$2z^2$	6z
-1	-z	-3

Introduce students to numbers of the form a $\pm\sqrt{b}$ and ask them to find pairs of integers (a, b) and (c, d) so that $(a \pm\sqrt{b})(c \pm\sqrt{d})$ gives a whole-number answer.

2. Urge students to find increasingly difficult examples.

Ask students to give you an example of something they know fairly well, and then keep asking for more examples until the students are pushing up against the limits of what they know. For example: *Give me a number between zero and a half; now another; and another… Now give me a number that is between zero and the smallest number you have given me; now another; … and another….*

3. Use exercises in grown-up ways.

Do as many of these questions as you need to in order to learn three new things. Now make up examples to demonstrate these three new things.

At the end of this exercise, you must use an example to show the person next to you what you learned.

Before you start, predict the hardest and easiest questions and justify your choices; when you finish, see whether your prediction was correct. Now make up harder questions and easier questions.

When you were doing Question N, did you have to think more about: a) the method, b) negative signs, c) correct arithmetical facts, or d) something else? Without getting tied up with negative signs and arithmetic, can you make up examples that show that you understand the method? [2]

Bibliography

Bills, L., Bills, C., Mason, J., & Watson, A. (2004). *Thinkers*. Derby, UK: Association of Teachers of Mathematics, **www.atm.org.uk**.

Coleman, J., & Hendry, L. (1990). *The nature of adolescence* (3rd ed.). London: Routledge.

Davis, H., & Anderson, M. (1999). Individual differences and development: One dimension or two? In M. Anderson (Ed.), *The development of intelligence* (pp. 161–191). Hove, UK: Psychology Press.

[2] More ideas are published in Watson & Mason (2006) and Bills et al (2004).

Elkonin, D. (1971). *Toward the problem of stages in the mental development of children*. Retrieved May 2008 from: **www.marxists.org/archive/elkonin/works/1971/stages.htm**.

Halford, G. (1999). The development of intelligence includes the capacity to process relations of greater complexity. In M. Anderson (Ed.), *The development of intelligence* (pp. 193–213). Hove, UK: Psychology Press.

Karpov, Y. (2003). Development through the life span: A neo-Vygotskian perspective. In A. Kozulin, V.S. Ageyev, S.M. Miller, & B. Gindis (Eds.), *Vygotsky's theory of education in cultural context* (pp. 64–80). New York: Cambridge University Press.

Kozulin, A. (1986). Vygotsky in context. In A. Kozulin (Ed.), *Thought and language* (pp. xi–lxi). Cambridge, MA: MIT Press.

Treffers, A. (1987). *Three dimensions: A model of goal and theory description in mathematics education –The Wiskobas Project.* Dordrecht: Kluwer.

Vergnaud, G. (1997). The nature of mathematical concepts. In T. Nunes & P. Bryant, *Learning and teaching mathematics: An international perspective.* London: Psychology Press.

Vygotsky, L. (1978). *Mind and society: The development of higher psychological processes.* Cambridge, MA: Harvard University Press.

Vygotsky, L. (1986). In A. Kozulin (Ed.), *Thought and language.* Cambridge, MA: MIT Press.

Watson, A., & Mason, J. (2006). *Mathematics as a constructive activity.* Mahwah, NJ: Erlbaum. ▲

CUSTOM DESIGNED PLAYING CARDS

- large 7" x 4.5" deck of 52 cards
- plus 4 extra cards with card tricks and math games on them for K-12 use in classrooms.
- 58 cards will be enclosed in a "tuck" box.



$12 per deck

www.oame.on.ca

plus shipping and handling.

Order by mail, fax or on-line:

OAME

or Order ON-LINE www.oame.on.ca

Do not send cash or cheque. You will be invoiced with shipping and handling costs added.

▲ EAT, SLEEP, MATH – ONTARIO MATH OLYMPICS 2008

BY SANDRA JEAN PRICE AND JACQUELINE HILL, PINE RIDGE MATHEMATICS ASSOCIATION

"If 1, 2, 5, 7, 8 becomes 2, 5, 26, 50, 65, and 6, 3, 8, 7, 2 becomes 37, 10, 65, 50, 5, then what would 5, 9, 4, 3, 6 become?" Have you figured out the answer? Students from across Ontario converged at Trent University in Peterborough on Friday, May 30 and Saturday, May 31 to answer many such questions.

Out of approximately 14 000 Grade 7 and Grade 8 math students in the province, the top 120 students—the "best of the best"—competed at Trent University for the honour of being the top team in the province in the 2008 Ontario Mathematics Olympics (OMO). Each team was sponsored by a local chapter of the Ontario Association for Mathematics Education (OAME), the provincial association that initiated the event 13 years ago to promote gender equity, the use of technology, teamwork, and genuine problem solving in math. This year, the event was hosted by the Pine Ridge Mathematics Association (PRMA).

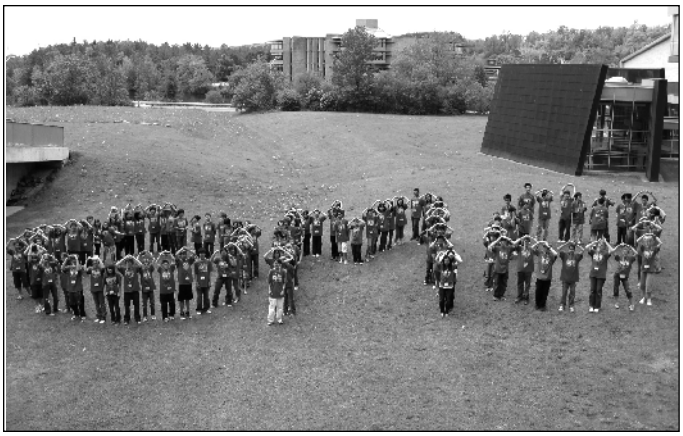
Upon arrival on Friday night, each team presented a poster and a chant that linked the team to its chapter and that explained the chapter's geographical boundaries. The chants and team posters were assessed, and each team was awarded points toward its competition total. The teams then participated in a "math trail." Despite the rain, the students were incredibly successful in completing the trail questions and challenges. This was followed by an "enormous feast" in the cafeteria. After dinner, students participated in a variety of activities that promoted team building and camaraderie among participants. Before "lights out," students had an opportunity to explore four different stations involving mathematical puzzles and games.

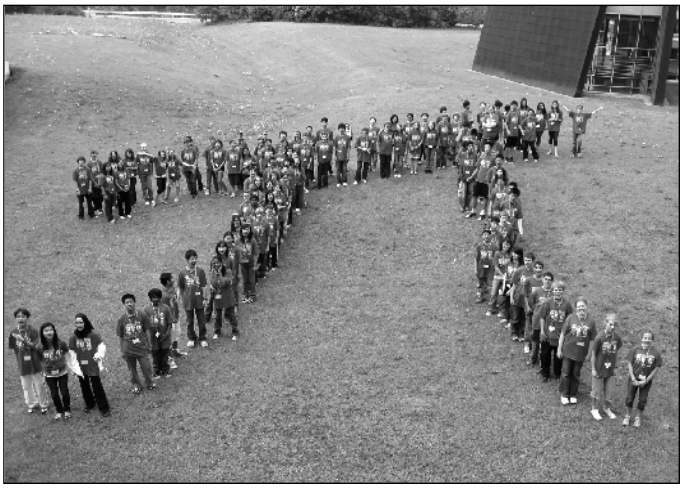
On Saturday, the students' skills were tested in four separate events: the individual event, the technology event (using Geometer's Sketchpad™), the relay, and the team event. While the students exercised their minds, their chaperones and coaches spent a fun-filled day at the Peterborough Lift Locks and the Canoe Museum. After touring the sites, they enjoyed a leisurely lunch at Montana's Cookhouse.

A celebration video, which captured highlights of the two-day event, and the awards ceremony concluded OMO 2008. The awards were sponsored by Nelson Education, Pearson Canada, McGraw-Hill Ryerson, and Texas Instruments.

In third place were the students from TEAMS 1 (Toronto Educators Association for MathematicS) —Claudinne Naidas, Sean Wen, Tommy Fan, and Emma Scholbeck. Second place was awarded to the WOMA (Western Ontario Mathematics Association) team comprising Laryssa Santavy, Luke Heuniken, Garrett Randall, and Heather Duncan Stonehouse. The COMA 2 (Carleton-Ottawa Mathematics Association) team of Hannah Barrie, David Xia, Jesse Wang, and Julie Zhu took home the trophy for first place. The name of their chapter will be engraved on the Ontario Mathematics Olympics trophy, which will be proudly displayed at the team's school until next year's event.

Special awards were also given out to individual students. The "Ray of Sunshine" award was given to Steven Wiedemann from MAC^2 for being consistently positive in his comments and actions. The "Inspiration Award" was given to Nicole Dumanski from NWOAME





for completing the Friday evening activities on her own and for displaying excellent leadership and team-building skills once her team arrived. The "Technology Awards" were given to Clarisse Schneider and Andrew Semple from CHAMP and Nilaan Gunabalachandra and Yuchen Goo from SAME. The "Spirit Award" was given to Emily Angermann from PRMA, while the "Teamwork Award" was presented to Katrina Ferrari, Paul Jung, Andrew Semple, and Clarisse Schneider from CHAMP. Winners of the "Best Chant" award, as determined by the participants, were Emily Angermann, Kevan McDougall, Vanessa Crowley, and Adam Vanderhorst from PRMA.

The Pine Ridge Mathematics Association would like to thank our sponsors for the 2008 Ontario Math Olympics: Union Gas, the University of Ontario Institute of Technology, the Imperial Oil Foundation, Desjardins Securities, Lazer Graphics, Spectrum Educational Supplies, Scholar's Choice, Pepsi QTG, Trent University, Rogue Media, Texas Instruments, Bound2Learn, MathAdventures.com, the Bank of Montreal, Staples, Nelson Education, McGraw-Hill Ryerson, Pearson Canada, Package Plus, and Jeffery Homes.

We would also like to thank all of the tireless volunteers who helped organize this tremendous event in celebration of mathematics education. ▲

CARTOON CONTEST

Create a cartoon based on a mathematical object or concept (1, 2, 3, or 4 frames)

Winning entries will be published in the Gazette

All artwork and captions must be original.

OPEN TO: Group #1 - any elementary school student
Group #2 - any secondary school student

GROUPS JUDGED SEPARATELY: Winning entries will be published in the *Ontario Mathematics Gazette* starting with the June 2009 issue (and in the subsequent 4 issues).

DEADLINE FOR SUBMISSIONS: March 31, 2009

SUBMIT ENTRIES as jpegs to: Stewart Craven at **numeratecitizen@mac.com**
Or by mail to: Stewart Craven, 118 Gledhill Avenue, Toronto, ON, M4C 5K8

ENTRIES MUST INCLUDE: Student Name, Grade, Present Teacher, Student Contact Information, School and School Address/Phone Number

▲ Sequential Voting Situations



DAVID R. DUNCAN
AND BONNIE H. LITWILLER
PROFESSORS OF MATHEMATICS
UNIVERSITY OF NORTHERN IOWA

Teachers are always seeking situations involving discrete mathematical processes. We shall develop one such situation involving voting.

Suppose that a government council is going to vote on a controversial issue. Of the nine council members, five favour the proposal and four are opposed. The final vote, therefore, will be five to four. This fact is not known by the observers at the council meeting. They learn the members' positions only when they are announced in a roll-call vote.

If the roll is called in a random order, the following $126\left(\frac{9!}{5!4!}\right)$ equally likely sequential outcomes are possible:

YYYYYNNNN	YYYYNYNNN	YYYYNNYNN	YYYYNNNYN	YYYYNNNNY
YYYNYYNNN	YYYNYNYNN	YYYNYNNYN	YYYNYNNNY	YYYNNYYNN
YYYNNYNYN	YYYNNYNNY	YYYNNNYYN	YYYNNNYNY	YYYNNNNYY
YYNYYYNNN	YYNYYNYNN	YYNYYNNYN	YYNYYNNNY	YYNYNYYNN
YYNYNYNYN	YYNYNYNNY	YYNYNNYYN	YYNYNNYNY	YYNYNNNYY
YYNNYYYNN	YYNNYYNYN	YYNNYYNNY	YYNNYNYYN	YYNNYNYNY
YYNNYNNYY	YYNNNYYYN	YYNNNYYNY	YYNNNYNYY	YYNNNNYYY
YNYYYYNNN	YNYYYNYNN	YNYYYNNYN	YNYYYNNNY	YNYYNNYYN
YNYYNYNYN	YNYYNYNNY	YNYYNNYYN	YNYYNNYNY	YNYYNNNYY
YNYNYYYNN	YNYNYYNYN	YNYNYYNNY	YNYNYNYYN	YNYNYNYNY
YNYNYNNYY	YNYNNYYYN	YNYNNYYNY	YNYNNYNYY	YNYNNNYYY
YNNYYYYNN	YNNYYYNYN	YNNYYYNNY	YNNYYNYYN	YNNYYNYNY
YNNYYNNYY	YNNYNYYYN	YNNYNYYNY	YNNYNYNYY	YNNYNNYYY
YNNNYYYYN	YNNNYYYNY	YNNNYYNYY	YNNNYNYYY	YNNNNYYYY
NYYYYYNNN	NYYYYNYNN	NYYYYNNYN	NYYYYNNNY	NYYYNYYNN
NYYYNYNYN	NYYYNYNNY	NYYYNNYYN	NYYYNNYNY	NYYYNNNYY
NYYNYYYNN	NYYNYYNYN	NYYNYYNNY	NYYNYNYYN	NYYNYNYNY
NYYNYNNYY	NYYNNYYYN	NYYNNYYNY	NYYNNYNYY	NYYNNNYYY
NYNYYYYNN	NYNYYYNYN	NYNYYYNNY	NYNYYNYYN	NYNYYNYNY
NYNYYNNYY	NYNYNYYYN	NYNYNYYNY	NYNYNYNYY	NYNYNNYYY
NYNNYYYYN	NYNNYYYNY	NYNNYYNYY	NYNNYNYYY	NYNNNYYYY
NNYYYYYNN	NNYYYYNYN	NNYYYYNNY	NNYYYNYYN	NNYYYNYNY
NNYYYNNYY	NNYYNYYYN	NNYYNYYNY	NNYYNYNYY	NNYYNNYYY
NNYNYYYYN	NNYNYYYNY	NNYNYYNYY	NNYNYNYYY	NNYNNYYYY
NNNYYYYYN	NNNYYYYNY	NNNYYYNYY	NNNYYNYYY	NNNYNYYYY
NNNNYYYYY				

Questions for Discussion:

1) In how many of the 126 cases does Y remain ahead for the entire voting process? Only 14 cases satisfy this condition. They are:

YYYYYNNNN	YYYYNYNNN	YYYYNNYNN	YYYYNNNYN
YYYNYYNNN	YYYNYNYNN	YYYNYNNYN	YYYNNYYNN
YYYNNYNYN	YYNYYYNNN	YYNYYNYNN	YYNYYNNYN
YYNYNYNYN	YYNYNYNNY		

The probability of this is only $\frac{14}{126}=\frac{1}{9}$.

2) In how many of the 126 cases does Y retain either a lead or a tie throughout the vote? In addition to the 14 results from Question 1, these 28 sequences are included:

YYYYNNNNY	YYYNYNNNY	YYYNNYNNY	YYYNNNYYN	YYYNNNYNY
YYNYYNNNY	YYNYNYNNY	YYNYNNYYN	YYNYNNYNY	YYNNYYYNN
YYNNYYNYN	YYNNYYNNY	YYNNYNYYN	YYNNYNYNY	YNYYYYNNN
YNYYYNYNN	YNYYYNNYN	YNYYYNNNY	YNYYNNYYN	YNYYNYNYN
YNYYNYNNY	YNYYNNYYN	YNYYNNYNY	YNYNYYYNN	YNYNYYNYN
YNYNYYYNN	YNYNYYNYN	YNYNYYNNY		

The probability of this outcome is only $\frac{14+28}{126}=\frac{1}{3}$.

3) In how many of the 126 cases does N hold the lead at least once? This would occur in all the cases other than those listed in Questions 1 and 2. This is 126–(14+28)= 84. The probability is $\frac{84}{126}=\frac{2}{3}$.

In those $\frac{2}{3}$ of the cases, the losing side was in the lead at least once in the voting. Observers might have supposed incorrectly that N's chances were better than they actually were.

(4) In how many cases is the final result of the vote unknown until the last vote is cast? This will occur when N and Y are split evenly after 8 votes are announced, with the ninth vote being Y. This occurs 70 times, or $\frac{5}{9}$ of the time.

Challenges for the Class:

1) In how many of these sequences did N hold a 2-vote, 3-vote, or 4-vote lead at some point?
2) Replicate this activity for councils of other sizes.
3) How might this be adapted to an athletic event in which a series of matches or games is played? ▲

▲ OAME Awards 2008

BY FRED FERNEYHOUGH

The **Life Member Award** recognizes an educator who has contributed in a significant way to OAME, demonstrated outstanding leadership in mathematics education, and accumulated ten or more years of membership in OAME. This year's winner is **John Rodger**, a career teacher in the Peel District School Board. John served as a board member of OAME from 1991–2003, was a committee chair of the 1991 OAME conference, and chaired several committees for the OAME board. Locally, John was a founding member of PAME (the forerunner of CHAMP) and served on the executive for 22 years, including several years as president of CHAMP. John's breadth and depth as an educator is apparent, and it is clear from the long list of people supporting his nomination that he clearly deserves this prestigious award. When John retired at the end of January, the mathematics community in Peel immediately felt the void; however, it will benefit for years to come, as John has touched so many lives and has encouraged so many individuals in the pursuit of excellence with respect to the teaching of mathematics.



The **Award for Exceptional and Creative Teaching in Elementary Mathematics** recognizes an elementary mathematics teacher who demonstrates excellence in mathematics education and who contributes to the overall development of his or her students. This year, the award was presented to **Sandra Jean Price**, whose creativity and excellence in teaching is demonstrated by her differentiated instruction, the use of manipulatives and technology in the classroom, and the enjoyment and success of her students. Sandra's classroom is an exciting and positive environment for learning in which students enthusiastically solve problems and communicate mathematically. As a math coach for intermediate teachers in the Durham District School Board, Sandra has also helped other teachers effectively and creatively deliver the math curriculum to *their* students. Sandra contributes beyond the classroom by developing and organizing math camps and math contests, and she is Chair of the Ontario Math Olympics this year and next. As one of her colleagues states, "Sandra's strengths are many, and they always start where her students are. She plans her instruction to ensure that all of her students move along their individual continuums for learning. She balances activities that excite and enrich the lives of the students she teaches."



The **OAME Award for Exceptional and Creative Teaching in Secondary Mathematics** recognizes a secondary mathematics teacher who demonstrates excellence and creativity in mathematics education and who contributes to the overall development of his or her students. This year's recipient, **Shawn Perry**, is a creative and enthusiastic mathematics teacher with a strong grasp of mathematics content and teaching methodology. The environment in Shawn's classroom sets the stage for students to engage in discourse-rich mathematics as they explore and share their understanding of mathematical ideas. As well, Shawn incorporates a variety of technologies into his teaching. The York Region District School Board has designated Shawn's class as a Demonstration Classroom for Mathematics so that other teachers and students can benefit from his expertise.



Shawn's leadership is further demonstrated by his role as coach of the school volleyball team and his role as student council advisor. Shawn also acts as liaison between students in Grades 8 and 9 and their parents and teachers, and he is one of the school's literacy representatives.

In the words of one of his nominators, "Shawn is committed to keeping up with current education trends, philosophies, and approaches, and is devoted to providing his students with the best instruction and learning opportunities that are available anywhere."

The **Award for Leadership in Mathematics Education** recognizes an educator who has demonstrated leadership by contributing in a significant

way to the development of mathematics teachers and the improvement of mathematics education in Ontario. The award this year goes to **Anne Yeager**, who has been active in the mathematics community for almost 35 years. Her career accomplishments exemplify leadership. How many teachers do you know who are qualified in all four divisions, as well as in special education and guidance? Anne has served in her school, Orangeville District SS, as Department Head of both mathematics and special education and has mentored her colleagues in best practices, pedagogical methods, and assessment over four different curricula. Anne has also presented numerous workshops for teachers. One of the supporting documents for Anne says it all: "Anne's sessions were planned and implemented carefully, using adult learning strategies that clearly impacted... the participants. The activities and processes were explicitly linked to the classroom community, and the practices were known to support both adult and student learning. The technologies and learning tools used during the sessions were the most up-to-date available and [were] incorporated into the agenda in such a way as to enhance teacher learning and model classroom applications."



Anne has also worked on teacher resources, including the original TIPS documents for Grades 7–9 and TIPS4RM, and her expertise even caught the attention of publishers. Both MHR and Nelson have published texts that include her work.

Anne was seconded to the Ministry of Education from 2004 to 2006, where she led the writing of revisions to the Grade 9 and Grade 10 mathematics courses and the developing and writing of training materials for the revised curriculum. Anne, now retired, has been an OAME board member and is currently a VP. She continues to offer sessions at OAME conferences. On slow days, she leads online PD sessions for math teachers or provides in-service for guidance counsellors regarding the revised Grade 12 mathematics curriculum. Anne has done it all—teacher, mentor, department head, writer, reviewer, and workshop leader.

The **Kenneth D. Fryer Award** is given to a department that fosters collegiality, teamwork, and excellent classroom teaching. The department must contribute to the overall development of students and demonstrate leadership in the mathematics education community. This award was established in memory of the late Kenneth D. Fryer and is co-sponsored by the Grand Valley Mathematics Association. This year's recipient is the **Middlefield CI Mathematics Department in Markham**. Principal Tony Lewis states: "This mathematics department consists of very dedicated and committed educators. All are open to different teaching styles and methods and to taking risks and trying new approaches." One of the successes of this department was the creation of a new and highly successful LDCC program, which has evolved into an ongoing action-research project. Initiated as a school-wide project, the mathematics department embraced it, and mathematics was the first core subject implemented. After a successful Grade 9 experience, the program was extended to Grade 10, and all members of the department were involved. During the planning stages, members of the Math Department served on a Transitions Committee, a link between the school and its five feeder schools. As a result of its success, the department has become a leader in its school community and its board. Within the school community, the department has engaged parents and shared experiences with other departments. Within its board, the department has provided the foundation for other schools to follow. Beyond this successful project, the members of the Middlefield CI Mathematics Department demonstrate their commitment to the development of their students by volunteering many hours to assist students during lunch, prep, and after school. Theirs is a story of success and incredible commitment to the young people they serve. ▲



▲ Data Rocks ~ Using the Canadian Community Health Survey Microdata in MDM4U

Joel Yan, Education Outreach, Statistics Canada

Betty Temmer, Grand Erie District School Board, Retired

Tom Steinke, Ottawa Catholic District School Board



Joel Yan has been part of the Education Outreach Team at Statistics Canada in Ottawa for 15 years. As a mathematician, he is passionate about developing StatCan resources for math and helping teachers use these resources with their classes. He recently succeeded in getting the CCHS microdata licensed by the Ontario Ministry of Education.



Betty Temmer has recently retired after many years as a math teacher and department head with the Grand Erie District School Board. Betty's love of mathematics and her long-time interest in using technology as an effective teaching tool will keep her involved in mathematics education through initiatives such as the use of CCHS microdata.



Tom Steinke is a secondary school math teacher at Mother Teresa High School in the Ottawa Catholic School District. When not skiing or cycling, Tom can be found hunting for rich data that teachers and students can use with TinkerPlots™ and Fathom™!

Great news for MDM4U teachers! Statistics Canada's best health microdata has now been provincially licensed for use in Ontario schools and will be available, along with teacher support materials, in September of 2008. This dataset contains over 1500 health and demographic attributes, and detailed data is provided for a representative sample of over 130 000 Canadians. The *Beyond 20/20* software that's included provides rapid extraction from this huge dataset and automatic aggregation of the data to selected geographic levels. Detailed documentation, including the complete questionnaire and user guide, is provided with the data and software on the CD-ROM. Additional teacher support documentation is available online at **www.teacherweb.com/ON/Statistics/Math/photo7.stm**, including:

- step-by-step user guides
- teaching strategies developed by teachers across the province
- exemplary student culminating projects based on this data

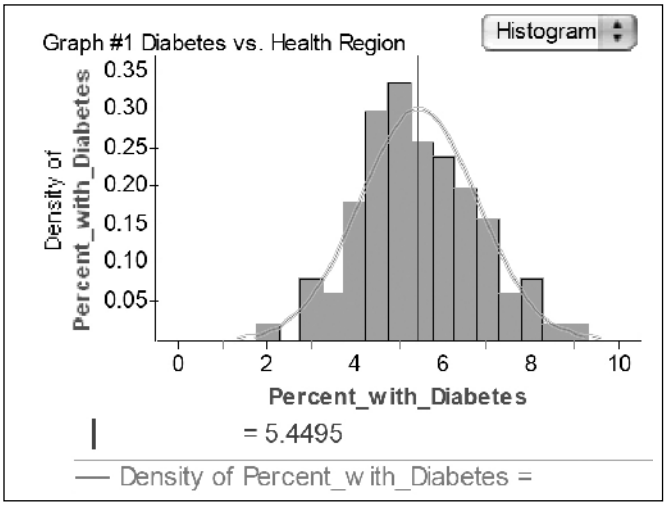
A user guide to the Canadian Community Health Survey (CCHS) is available in French (translated by J. Bourdages) at **www.teacherweb.com/ON/Statistique/Math/CCHSHealthMicrodata_guidefr.doc**. Additional teacher materials in French are also available at **www.teacherweb.com/ON/Statistique/Math**.

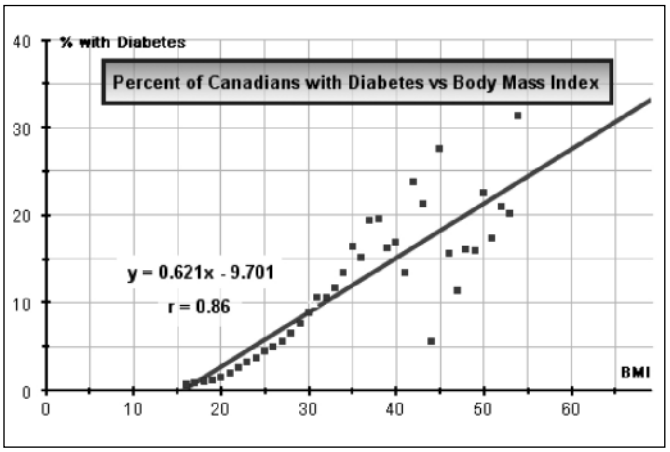
Betty Temmer, who has used this microdata for several years, details her experiences below:

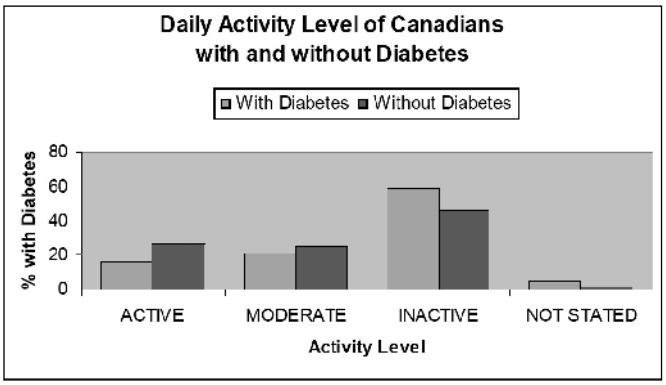
For students to be successful with the culminating investigation in the MDM4U course, they need a complex set of research, analytical, and organizational skills. Even after I felt sure that students had mastered these necessary skills, I found that many did not know where to start or how to proceed with the investigation. Finding suitable data on their chosen topic was the main stumbling block that students encountered. If you've had similar experiences, read on!

I have tried a variety of approaches, but using the CCHS data from Statistics Canada has been, by far, the most successful. Students are intrinsically interested in health-related topics. The CCHS dataset provides extensive information on the health of Canadians aged 12 and older, and related socio-economic data. The survey is designed to provide reliable cross-sectional estimates at provincial, territorial, and health region levels. For their independent investigations, I have the students choose topics based on the hundreds of variables included in the survey. Once the data is extracted from CCHS, it can be pasted into a dynamic statistics program such as

Fathom™, Excel™, or Autograph™ to be graphed and analyzed. The overall quality of the investigations that students now produce is far superior to what was submitted in the past. The following are samples of the types of graphs that students are able to produce with the CCHS data.







For most students, the main source of data for their investigation is CCHS. However, I encourage them to explore other sources, such as the Health Database in Statistics Canada or the World Health Organization (WHO) website.

In order to manipulate and extract data from the CCHS files, the Beyond 20/20 *browser is required. Since this program was not written specifically for educational purposes, teachers will need to invest a few hours of their time to become familiar with its use. The results are well worth it!*

CCHS and *Beyond 20/20* Support Resource

All publicly funded Boards of Education in Ontario will receive copies of the CD containing the 2005 Canadian Community Health Survey (CCHS) Public Use Microdata File (PUMF) from Cycle 3.1 of the survey, as well as a browser (*Beyond 20/20*) to manipulate and extract the data.

With funding from OSAPAC, Tom Steinke has produced a series of narrated video clips to help teachers and students use this wonderful data with the *Beyond 20/20* browser software. The clips are short (40 seconds to 4.5 minutes) and are designed to be viewed sequentially. To view the live video clips, check out the links this fall available through the OSAPAC website at **www.osapac.org**.

The video clips are organized as follows:

- What is it?
  - A brief introduction to the contents of the CD
- What needs to be installed?
  - Instructions on how to install the *Beyond 20/20* browser
- How to use it!
  - Instructions on how to:
    - launch the *Beyond 20/20* browser
    - find data
    - export data into *TinkerPlots*™, *Fathom*™, and *QuattroPro*™

These video clips provide a good introduction to the data, but do not do justice to the full data content and capacity of this rich resource. Data search and graphing capabilities within *Beyond 20/20* are much more extensive than shown in the animated tutorials listed above. More support resources can be found online and on the CD.

How to Get Started

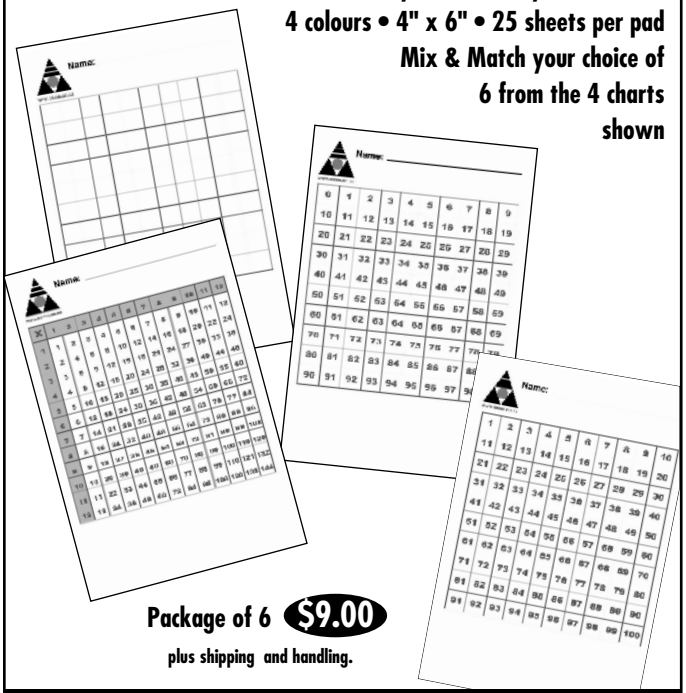
- Go through the online tutorials developed by Tom Steinke and available through the OSAPAC website at **www.osapac.org/**.
- Attend one of our training sessions. See **teacherweb.com/statistics/math/** or

www.vlearning.ca for the schedule.

- Encourage your consultant to attend the September 5 training session at the OMCA meeting. Then ask the consultant to help you get started with the CCHS.
- Contact Betty Temmer at **bettytemmer@kwic.com** if you have questions, or ask her to come to your board to do workshops.
- Get answers to your data questions related to the CCHS by contacting Sandra McIntyre at **sandra.mcintyre@statcan.ca**, or Joel Yan at **joel.yan@statcan.ca**, or our general help line at **infostats@statcan.ca**.
- For free workshops on any Statistics Canada resource (e.g., *Census at School*, *E-STAT*, or the *Function Modelling* lessons and datasets), contact Sandra McIntyre at **sandra.mcintyre@statcan.ca** in Toronto, or Joel Yan at **joel.yan@statcan.ca** in Ottawa. ▲

OAME ELEMENTARY STICKY CHART PADS

Great for Elementary or Secondary Student Use
4 colours • 4" x 6" • 25 sheets per pad
Mix & Match your choice of 6 from the 4 charts shown



Package of 6 $9.00
plus shipping and handling.

Order by mail, fax or on-line:
OAME
or Order ON-LINE www.oame.on.ca
Do not send cash or cheque. You will be invoiced with shipping and handling costs added.

▲ Building Student-Teacher Rapport by Humanizing the Mathematics Classroom

AMANDA ALLAN



Amanda Allan has taught college mathematics, edited math textbooks, designed assessment materials, and run a math-focused tutoring business (in which building personal relationships with students was always key to success). After working full-time for many years, Amanda is returning to school in September 2008 to begin her Ph.D. in mathematics education.

In her article "Mathematics from another world: Traditional communities and the alienation of learners" (2000), Jo Boaler wrote:

> *Students also described enjoyable lessons as those in which teachers treated them as people, rather than simply learners of mathematics. The students described teachers who made efforts to relate to students and talk about non-work issues occasionally; these were always non-mathematics teachers. (p. 388)*

Boaler cites McLaughlin's (1994, p. 9) study of reform schools, where students remarked that " 'the way teachers treat you as a student—or as a person actually' counted more than any other factor in the school setting in determining their attachment to the school" (cited in Boaler, p. 389). She goes on to describe the students' concerns that they were rarely given the opportunity to be "children" or even to be "human" in their math classes. The students describe cherishing times when they were able to relax and chat with the teacher in an unstructured way: "This was not because they wanted to avoid work, or spend large proportions of time off task, but because they wanted to transform the classroom into a life-like environment" (p. 389).

This passage started me thinking about how to incorporate meaningful dialogue into a mathematics classroom—the sort of dialogue that students would interpret as real human interaction, rather than just an obvious attempt to fulfill a requirement in a curriculum document. This is not so much an investigation of "how to talk about mathematics" as it is of "how to talk about things your students don't think of as mathematics—and

why you should!" Note: Although students may not think of these conversations as relating to mathematics, they can still be relevant to the material we teach; with this in mind, I have tried to find concrete examples that blend smoothly into the Ontario curriculum.

I considered the following questions:

- What makes math classes seem more sterile than other classes?
- How can I show my students that I see them as human beings, not just math students?
- What sort of interactions will make my students feel valued as whole people?
- What benefits would be derived from such an approach?

The second and third questions form the main body of my research. The fourth question will be addressed later. The answer to the first question is, I think, fairly clear. In other subjects, students discuss social issues, current events, racism, poverty—things that students experience daily and that are of real importance to their lives. In mathematics, when we talk about "real-life" situations, we often mean something like using trigonometric functions to model the movement of a Ferris wheel. It's not hard to see how a disconnect with students can occur!

Current Research in Communication

Recent work in education research and curriculum development emphasizes the importance of communication in mathematics education. However, the majority of this work focuses on encouraging students to feel comfortable talking about the mathematics they do in class, and explaining their reasoning. While this may be important for developing relational understanding (Skemp, 1987), it does not contribute to making students feel as though they are anything more than math students; therefore, it is not the solution for making mathematics classes feel more human.

Gordon Calvert (2001) discusses the current emphasis on discourse in math classes, and suggests that this may promote gender differences by encouraging a confrontational or argumentative style of discourse that comes more naturally to male students. "[T]he inequity of power and status has made argumentation and debate within academic arenas a target for criticism… this traditional form of rhetoric is considered patriarchal and is said to disadvantage women and nonwhite European males" (p. 20). Based on this assertion, the discourse-based learning environment could be seen as being more accessible to those students who already have high social or academic status (Boaler & Staples, 2008; Civil & Planas, 2004).

As further evidence of the value of varied, casual, human discourse, Thomson (2001) found that informal student-teacher interaction was directly linked to success in math and science classes at the college level. This study also raised the topic of gender differences, noting that female students were less likely to have this kind of rapport with their math and science teachers—a factor that may contribute to women's comparatively low enrollment and performance in post-secondary mathematics.

Human Interaction

In an effort to find ways to involve the whole person without ignoring the math student, I focused on creating lessons that contain some overlap with other subject areas. This overlap serves as a way to initiate different types of conversations within the mathematics classroom. This increased range of discussion will serve two purposes: First, it will improve rapport between teachers and students. As has been shown, informal student-teacher interaction is instrumental in building student motivation (and thus success) in mathematics and science classes (Thomson, 2001). Second, having a wide range of mathematically relevant discussion topics will involve students who dislike math, but enjoy the other subjects touched upon. In this way, students with a particular interest in art, travel, literature, history, or the cultural development of a specific part of the world can be drawn in. Both of these outcomes should have a positive effect on student engagement.

Mathematics students frequently suffer from misconceptions about mathematics (or mathematics education), and as a result, have difficulty using mathematics as a tool for sense making. Schoenfeld (1994) discusses the effect this has on students, citing a list of the student beliefs that result. These include:

- There is only one correct way to solve any mathematics problem—usually the rule the teacher has most recently demonstrated to the class.
- Ordinary students cannot expect to understand mathematics; they expect only to memorize it and apply what they have learned mechanically and without understanding.
- Mathematics is a solitary activity, done by individuals in isolation.
- The mathematics learned in school has little or nothing to do with the real world.

Teaching mathematics within a historical and social context presents mathematics as a human activity, rather than a system of rigid truths imposed externally. This can allow students to move beyond these misconceptions to a more relational, more relevant understanding. The rest of this article will be devoted to ways in which this idea can be put into practice.

Sample Activities

The Pythagorean Theorem

The Pythagorean Theorem provides an excellent opportunity to bring historical and cultural context into the mathematics classroom. (This approach can also be applied to other significant theorems or discoveries.) McDaniel (2003) states that:

> *Letting the statement of an important theorem and its proof diffuse into the flow of the course is like bringing the original Rosetta Stone into a history class, waving it around, and then moving on. Obviously, such an artifact deserves more care and attention. The teacher would slowly place such an object down and say 'Be careful, it's very old.' Everyone would speak softly and with respect. Any teacher can imagine enjoying such a moment in school; too few teachers recognize that mathematics offers the material for such an occasion. (p. 282)*

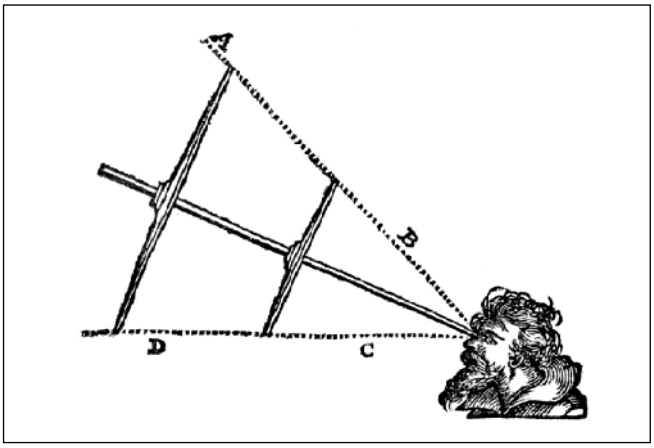
McDaniel goes on to describe his particular method of teaching the Pythagorean Theorem: Days, weeks, or even months beforehand, he begins telling students that something very important is coming. He arranges a special place to present the theorem, and often arranges crossover activities with other classes (music, dance, theatre, geography). On occasion, he has taken the class on a field trip to a museum, and used one of the museum's meeting rooms to present his lecture. From the comments written on course evaluations (often months later), McDaniel knows that he is reaching students by creating a different type of learning experience.

Trigonometry through History

John Keay's book *The great arc: The dramatic tale of how India was mapped and Everest was named* chronicles the history of the Great Trigonometrical Survey of India, which began in 1802 and lasted throughout most of the nineteenth century. The Survey was a stroke of both technological genius and colonial folly. The aim of the Survey was twofold: To map out trade routes, and to measure with previously unimaginable accuracy the size of the Earth and the heights of its highest mountains. This topic opens up potential discussions of history, colonialism, geography, and more, and will draw in students who are interested in travel, exploration, mountain climbing, or other related pursuits. In addition, working from this book could inspire discussion and/or student projects on Indian mathematics, map-making, Eratosthenes' measure of the Earth, or trigonometric investigations using surveying equipment.

Trigonometry through Measurement

Ransom (1993; 1995) discusses the process and the benefits of teaching trigonometry using old surveying equipment like astrolabes, cross-staffs, and dials. When I asked non-mathematician friends what they had found off-putting about their mathematics courses, several mentioned the lack of connection associated with trigonometric functions. There was no sense of the meaning of sin(37º) aside from "This is the number that my calculator gives me when I enter sin(37º)." The values of trigonometric functions were simply something the calculator "knew" and something that had to be accepted without understanding or context (T. McPherson, personal communication, May 2007). By having students construct the beginnings of a very rudimentary sine table using surveying equipment, the values become more real, and more human. Knowing how trigonometric tables were painstakingly calculated will give students more connection to the values of the trigonometric functions. After deriving a few of the values for themselves, students can begin to see the calculator as a tool that provides a handy shortcut, rather than as the source of some otherwise inaccessible (and incomprehensible) knowledge.



The design and use of the cross-staff.

A Mathematician Reads the Newspaper

This book by John Allen Paulos contains short newspaper-style articles on the mathematics behind baseball statistics, Vietnam War MIAs, hiring bias, gun control, DNA evidence, and more. Paulos emphasizes "qualitative understanding, pertinence to daily life, and unconventional viewpoints." Students can be encouraged to find an article on a topic of personal interest to them, and present the information to the rest of the class. In Ontario, this book fits very nicely into the Data Management curriculum—especially the Statistics strand, which addresses data collection, representation, and bias.

Math Quote of the Day

Quotations offer instant appeal, and are a way of encouraging students to discuss something they may not think of as mathematics. A "quote of the day" (or of the week, if less time is available) can consist of a brief discussion at the beginning or the end of class (or perhaps, whenever your math class happens to be Friday, last period).

Fleron (1998) writes that "Quotations can also be used to amplify historical, humanistic, aesthetic, intellectual, artistic, philosophical, and epistemological aspects of a given field." The National Council of Teachers of Mathematics (NCTM) has introduced a standard, "New Goal for Students: Learning to Value Mathematics." Quotations demonstrate the human, connected side of mathematics, which is essential for students to see if they are to learn to value mathematics.

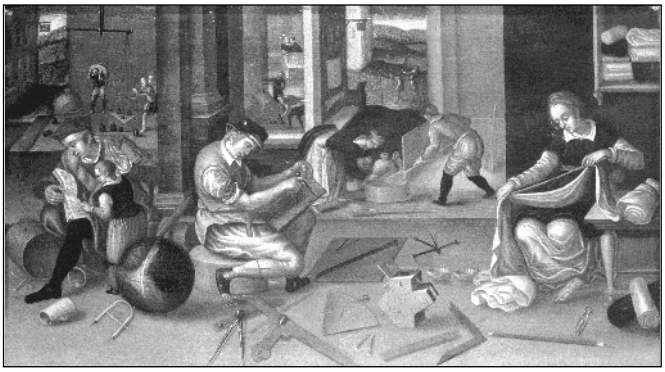
Quotations offer an excellent opportunity for students to discuss historical issues and learn about the individuals quoted. Students can be asked to find additional quotations, or to research the social or historical context in which a specific comment was made. A few sample quotes that might inspire interesting discussion are given below.

- "The essence of mathematics is in its freedom." ~ Georg Cantor
- "The study of mathematics is apt to commence in disappointment." ~ Alfred North Whitehead
- "The pleasure we obtain from music comes from counting, but counting unconsciously. Music is nothing but unconscious arithmetic." ~ Gottfried Leibniz
- "Whatever your difficulties in mathematics, I can assure you mine are far greater." ~ Albert Einstein

Fleron points out that students nearly always complain that the majority of the quotations relating to mathematics come from white males. This presents an excellent opportunity to discuss why most famous mathematicians were men, and debate whether similar cultural constraints still hold true. This can also be transformed into an opportunity to inspire students with stories of accomplished female mathematicians like Sophie Germaine.

Setting aside time to discuss quotations provides an opportunity to address issues that might otherwise go unremarked. One teacher told me about a time she was upset by a (female) student wearing a T-shirt bearing the slogan, "Pretty girls don't do math," but never had the opportunity to adequately address the issue (D. Richer, personal communication, 27 June 2007). Having regular time set aside to discuss quotations related to mathematics and/or education would provide an opportunity to address issues like this as they arise.

Feeling More Adventurous?



The Measurers, a painting by an unidentified Flemish artist from c. 1550–1600, is housed in the collection of The Museum of the History of Science in Oxford. Students could be asked to consider a picture like this when discussing what it means to be a mathematician.

Gulikers & Blom (2002) describe several open-ended investigations that an adventurous teacher might consider conducting with a class. Burns (1997) presented his class with a reproduction of a Babylonian clay tablet, and asked: "Here is a piece of what appears to be mathematics, from the Babylonians of c.1750 BC. What could it be about?" Proia & Menghini (1984), together with their students, attempted an investigation in which they considered the question, "Why do we find the elliptical form in architecture only in the baroque period?" (They determined that this demonstrated the sometimes surprising influence of contemporary scientific discoveries over both mathematics and the arts.) Gulikers & Blom offer other intriguing suggestions, although some of these will fall outside the curriculum

and/or the comfort zone of many mathematics teachers.

Twelve Ways to Use the History of Mathematics

Teachers wanting to broaden the types of discussions they have in their mathematics classes need not go so far out on a limb. For those looking for a more subtle way to incorporate history (and the discussions that arise from it) into the classroom, Barrow-Green & Fauvel (2000) compiled a list of 12 ways to use the history of mathematics in the classroom:

1. Mention past mathematicians anecdotally.
2. Provide historical introductions to concepts which are new to students.
3. Encourage students to understand the historical context; in other words, the historical problems which were answered by the concepts they are learning.
4. Use the skills specific to history-learning to broaden students' repertoire of skills (library use, essay-writing).
5. Encourage students to develop critical understanding of what they are learning.
6. Challenge computer use and critically evaluate search results.
7. Devise homework exercises using mathematical texts from the past.
8. Devise classroom exercises using mathematical texts from the past.
9. Promote dramatic activity which reflects mathematical interaction.
10. Set projects about local mathematical activity in the past.
11. Devise the pedagogical approach to a topic in sympathy with its historical development.
12. Give or recommend a book to a student for private study.

Conclusion

There is a wide range of options for teachers who wish to encourage more varied dialogue in their mathematics classes. I hope that this article has provided a convincing argument for encouraging greater dialogue, as well as some suggestions on how to get started. By treating the student as a whole person, and by showing the more human side of both the teacher and the subject, we can strengthen the bond with our students, draw in students who previously felt excluded by the sterility of mathematics classes, and increase the engagement and the success of all of our students.

References

Barrow-Green, J., & Fauvel, J. (1999). *What can mathematics teachers do with history?* [Electronic version]. Retrieved 20 June 2007 from **mcs.open.ac.uk/jebg2/**.

Boaler, J. (2000). Mathematics from another world: Traditional communities and the alienation of learners. *Journal of Mathematical Behavior* 18 (4), 379–397.

Boaler, J., & Staples, M. (2008). Creating mathematical futures through an equitable teaching approach: The case of Railside School. *Teachers' College Record* 110 (3): 608–645.

Civil, M., & Planas, R. (2004). Participation in the mathematics classroom: Does every student have a voice? *For the Learning of Mathematics* 24, Article 1, 7–12.

Fleron, J.F. (October 1998). Quotations for every mathematics class. *The Mathematics Teacher*, 91; 7.

Gordon Calvert, L.M. (2001). *Mathematical conversations within the practice of mathematics*. New York: Peter Lang.

Gulikers, I., & Blom, K. (2002). A historical angle: A survey of recent literature on the use and value of history in geometrical education. *Educational Studies in Mathematics*, 47: 223–258.

Keay, J. (2000). *The great arc: The dramatic tale of how India was mapped and Everest was named*. New York: Harper Collins.

McDaniel, M. (April 2003). Not just another theorem: A cultural and historical event. *The Mathematics Teacher*, 96; 4.

Paulos, J.A. (1995). *A mathematician reads the newspaper.* New York: Basic Books.

Ransom, P. (1993). Astrolabes, cross-staffs, and dials. *Mathematics in School* 22(4), 2–8.

Ransom, P. (1995). Navigation and surveying: Teaching through the use of old instruments. *Histoire et Epistémologie dans l'Education Mathématique*, IREM de Montpellier, pp. 227–239.

Schoenfeld, A.H. (1994). Reflections on doing and teaching mathematics. In A.H. Schoenfeld (Ed.), *Mathematical thinking and problem solving* (pp. 53–70). Hillsdale, NJ: Lawrence Erlbaum Associates.

Sivasami, K. (2003). *The great trigonometrical survey of India* [Electronic version]. Retrieved 2 May 2008 from www.positionmag.com.au/MM/content/2002/MM21/feature_2/.

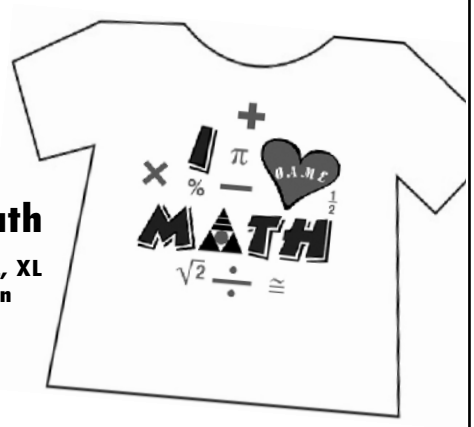
Skemp, R.S. (1987). Relational understanding and instrumental understanding. In R.S. Skemp, *The psychology of learning mathematics* (pp. 152–163). Hillsdale, NJ: Lawrence Erlbaum Associates.

The Measurers [Image]. Retrieved 5 May 2008 from **www.mhs.ox.ac.uk**.

The use of the cross-staff [Image]. Retrieved 5 May 2008 from **www.mhs.ox.ac.uk**.

Thomson, M. D. (2001). Informal student-faculty interaction: Its relationship to educational gains in science and mathematics among community college students. *Community College Review*, 29; 35. ▲

OAME T-SHIRTS



I Love Math

Available in M, L, XL 4-colour design in white only.



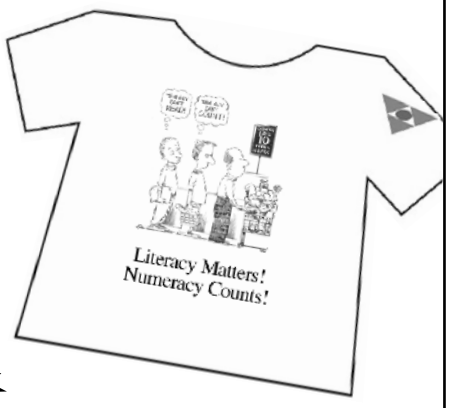
NEW

Math will rock your world!

Available in S, M, L, XL red & white design in black only.

Literacy Matters! Numeracy Counts!

Available in M, L, XL in white only.



$15.00

$15 each. Price includes taxes. Shipping and handling extra.

Order by mail, fax or on-line:

OAME

or Order ON-LINE www.oame.on.ca

Do not send cash or cheque. You will be invoiced with shipping and handling costs added.

▲ Directors' Dialogue

ANN MICHELE STENNING



Ann Michele Stenning is a mathematics teacher at South Secondary School with the Thames Valley District School Board. Having finished her Masters of Education degree in Curriculum Studies, she is currently assisting other parent volunteers with the development of weekly literacy activities, which she and other moms provide to "at-risk" students.

Board of Directors Meeting, June 6–7, 2008, Holiday Inn Select, Toronto Airport

Board of Directors Meeting

Anna Jupp, OAME's new president, welcomed new board members. Anna then discussed the ways in which mathematics has changed and how OAME has been a leader in facilitating this change. Anna would like to spend the next year discussing OAME's relationships—with chapter representatives, with the Ministry of Education, and with parents. Our meetings over the next year will require that we reflect on our past relationships and brainstorm ways of building on current relationships and forging new ones.

Anna continued with a discussion of a meeting with the Ministry of Education, OMCA, and OAME. The two math organizations were asked to partner together to assess the learning needs of mathematical leaders, which would include any educator who teaches others and make changes to his or her practice. To begin this feedback, board members shared information about the initiatives their boards had introduced in the past and what board members needed to further their educational growth. Some of the school board initiatives already in place include the Lift Program, which uses technology to help struggling students in TCDSB, co-teaching, Lesson Study, professional learning communities for feeder schools and associated high schools, and PD sessions that develop an understanding of math. Durham DSB uses math coaches, and they, along with SCDSB and WECDSB, use interactive whiteboards. Many school boards are also working to improve student success in the transition years and are developing units that

address the principles of Differentiated Intelligence. Board members suggested the following: training on the use of SMART boards, subsidized AQ courses, and PD that elaborates on the application of Differentiated Intelligence in the classroom.

After the discussion, Anna Jupp had board members participate in a Friday evening carousel entitled "Connecting the Dots to Stay Connected." During this time, board members heard information on the following topics: *Growing Up Mathematically*, making custom e-mails, OAME's website, OAME's *Gazette*, OAME's *Abacus*, OAME's creation of GPS (Guiding Principles for Success) committee, OAME's annual conference, and OAME's constitution.

Saturday's board meeting began by discussing OAME's constitution. In small groups, board members heard the recommendation that OAME's structure be altered to include fewer members. Key discussion areas focused on the size of the executive and the possibility of inviting stakeholders from universities, community colleges, faculties of education, and the Ministry of Education to join OAME's board meeting. Many ideas and questions were raised, and plans were made to further discuss the topic of constitutional reform within OAME.

The board approved the agenda, the minutes of the last meeting in February 2008, and the Financial Report for 2007–2008. Jacqueline Hill spoke about the Leadership Conference in February 2008, and then motions were discussed. The Board voted on a motion to increase the mileage rebate from $0.35/km to $0.45, given the past increases in gasoline costs. The motion was passed. Jacqueline Hill then shared with the Board members the various accomplishments of Marilyn Hurrell as she finishes her job as Editor of the *Gazette*. Board members heard updates on OAME 2008 from one of the co-chairs, Connie Quadrini. Connie mentioned the first-ever electronic brochure, which was well received. She also mentioned the use of a common lunch hour to ensure that all of the delegates would be free to hear the two keynote speakers. OAME 2009 is now accepting session proposals until September. OAME 2009 will be held at Carleton University while the tulip festival is on. Jacqueline provided the highlights of the Ontario Math Olympics (OMO) 2008, held in Peterborough in May. The teams of elementary students participated in team-building exercises, the creation of a team chant, individual competitions, playing math games, and solving math puzzles. Board members were told that plans for the Leadership Conference in 2009 are underway. Jacqueline Hill then asked the board members to identify gaps in the curriculum for inclusion in the work being completed by the Curriculum Revision Committee. This information will inform future curriculum revisions.

Curriculum-Based Discussions:

Grades K–6

Anna Dutfield reported that they discussed the mandate of supporting the chapters of OAME more effectively and improving the JK–6 website within the OAME website. Possible uploads of the Rekenrek resource was discussed, and members will bring their own resources for uploading to the next meeting.

Grades 7–9

Trish Steele reported that Marilyn Fox had field-tested the *Path in Flight Project* and that the accompanying student work would be shared at next October's meeting. Plans for the next two years include a review of material and websites appropriate for Grades 7–9. These will be posted on OAME's website and published in the *Gazette*. Meanwhile, October's meeting will focus on the direction of OMO and the selection of student work from the *Flight Path* lesson.

Grades 10–12

As chair, Paul Alves began the discussion by having everyone introduce themselves. The remaining time was spent discussing the creation of a "survival guide" for math teachers. This guide would include resources that list where to find teaching materials, assessment and evaluation resources, technology, Ministry of Education initiatives, and so on.

The guide would be organized according to course and academic level.

Chapter Reps Meeting

The chapter rep chair, Greg Clarke, had everyone introduce themselves and welcomed new chapter reps. The OAME director, Sue Hessey, showed reps the new OAME T-shirts and buttons that are for sale. Sue reminded chapter reps to inform her of new memberships in a timely fashion, and Greg showed everyone how to contact current and lapsed OAME members using the OAME database. Sue circulated the request forms needed when asking for an OAME promotion case, and information on the role of chapter reps was distributed to new chapter reps.

Chapter Reports

CHAMP – Rep: Shaun Knowles (shaun.knowles@

peelsb.com). This past year, CHAMP celebrated the Fall Event (2007), math contests, Awards Night, bidding for OMO 2012, reorganizing the website, and event planning for Fall 2008. Once again, our Fall Event was well received by our members and welcomed guests. The workshops were well attended by over 100 elementary and secondary teachers. At our next Fall Event (October 21, 2008), we look forward to having Trevor Brown as our keynote speaker. Look out for our flyer, coming soon! On May 22, 2007, CHAMP held its annual math contest awards ceremony. It was a great chance for students, parents, and teachers to celebrate the top contest writers. The evening also honoured the top two teams from the CHAMP Math Olympics trials; these teams went on to compete in the Ontario Math Olympics. Over 100 students were very excited to receive awards and be recognized for their outstanding achievements. Our meetings are held at the Dufferin-Peel Catholic School Board offices on the first Thursday of the month. We welcome you to join our exciting and enthusiastic executive team.

COMA – Rep: Pat Kehoe

COMA's annual Spring Forums were a big success again this year. The secondary forum provided teachers with an opportunity to attend sessions on new curriculum resources. Trevor Calkins presented "Creating Teachable Moments" to the elementary teachers. Judy Loschmann and Cathy Hill, our local Math Olympic Co-chairs, and their hard-working committee hosted another very successful local Math Olympics on April 12. There were 60 teams in attendance, representing three different school boards. For the first time, the committee compiled the activities, assembled them in a booklet, and made them available to parents and coaches. The OAME 2009 conference will be held in Ottawa from May 14–16, 2009 at Carleton University. Mark those dates on your calendar and plan to attend the annual conference next spring in the nation's capital. As well, the COMA council will be inviting all COMA members to attend our annual Fall Social in late September. Please plan to attend.

GOLDEN – Rep: Laura Tonin

We held our annual mini-conference at Brock University in April. Our theme this year was "Math: Just for the Fun of It!" There was a good turnout, and the teachers who attended enjoyed learning from presenters such as Jacqueline Hill and Richard Hoshino. As usual, Brock provided a delicious dinner. Our executive is already planning for OAME 2010! The conference is still untitled, but "Mathematics Uncorked" is currently the most popular choice. Hence, a trip to one of Niagara's wineries will definitely be one of the social events!

GVMA – Rep: Rob Gleeson

We have been preparing for our fall conference on October 23 and hope to have workshops on different aspects of the curriculum. We are preparing exams/summative activities for Grade 11 and Grade 12 courses and are considering a document to help the transition from Grade 8 to Grade 9 math.

ISOMA – Rep: Diane Lang

The highlight of ISOMA's program for Spring 2008 was a very successful and fun evening attended by approximately 80 elementary and secondary school teachers. John Mighton gave an inspiring talk, in which he shared his philosophy and belief that everyone can be successful at learning mathematics. Using personal anecdotes, he described the advantages of continuous assessment through a layered development of skills and concepts. Although most of John's work is aimed at elementary students, there were plenty of applications available for intermediate- and senior-level mathematics. ISOMA will be hosted by Branksome Hall, under the leadership of Edith Louie, in October 2008. If ISOMA chapter members have any special requests, or would like to offer their help, please contact Edith, or your chapter rep, Diane Lang. We are also looking for some new leadership on the ISOMA Executive. The time commitment is as little or as much as you want, and it's great to be part of the OAME team.

MAC^2 – Rep: Michele Walma

A small, but mighty, Fall mini-conference in two locations featured keynote speaker Marian Small. MAC^2 supported a set of local parent workshops in the Barrie-Midland-Orillia area, offered by Simcoe County DSB, with keynote speaker Trevor Brown. Trevor is scheduled to return to the Barrie area in October 2008 for our Fall mini-conference. MAC^2 is proud to announce its new executive: Patricia Steele as president, Danielle Blair as past president, Jeff Irwin as treasurer, Lyn Vause as co-secretary (looking for an assistant), and Michele Walma as chapter rep. During the AGM, a motion was put forward to create a new position called the "Technology and Website Coordinator." Greg Clarke will fill the position. Greg will implement *Adobe Connect* and/or video conferencing in order to allow MAC^2 members from distant areas of the chapter to take part in meetings without long and/or dangerous travel during the year.

NOMA – Rep: Carol Lemmon

On a Saturday afternoon in May, over 70

students from Grades 7 and 8 enjoyed a morning of "funtastic" mathematics, using everything from technology to manipulatives to paper and pencil. Colourful name badges and loot bags were hot commodities. This event was held only through the hard work of many volunteers from NOMA: teachers, parents, students, and teacher candidates. Thanks to all. We are now in the midst of recruiting speakers for the NOMA fall conference, which will be held October 17, 2008. Watch for conference details and proposal applications online.

NWOAME – Rep: Tom Boland

NWOAME has had an exciting year. At the end of February, we hosted a conference called "Focus on Math: Success in Our Classrooms." We were thrilled to attract many speakers and publishers from all over the province. Thank you to all who attended. Jacqueline Hill and Mary Lou Kestell gave wonderful keynote addresses, and 120 teachers from across the region attended. We also hosted our regional Math Olympics in April and sent four winners to the provincial competition in Ottawa. We have a new executive in place and are currently planning a number of events for what looks to be a very busy year ahead.

PRMA – Rep: Sandra Jean Price

OMO 2008 was held at Trent University on May 30/31. The event was a huge success and much fun was had by all. Thank you to our chapter executive and the many volunteers who made this possible. Also, thank you to all of our sponsors, especially Union Gas, Esso Kids Foundation, The University of Ontario Institute of Technology, Desjardins Securities, and Lazer Graphics. We are looking forward to hosting our Annual General Meeting on June 16, and hope to welcome some new faces to our executive.

QSLMA – Rep: Robert Sherk

Our chapter has been busy with the organization of our local OMO and with keeping members informed about OAME activities. Our local OMO was a great success. It was organized by Queen's Ph.D. student Jill Lazerus, with the help of two of Queen's Faculty of Education math curriculum classes, the support of Geoff Roulet, and the MSTE group at Queen's. Twenty-two schools participated, and the first-place team from St. Mary's in Brockville attended the provincial OMO in Peterborough with sponsorship from QSLMA.

SAME – Rep: Debbie Drape

No report.

SWOAME – Rep: Nicholas Cevalier

SWOAME is currently preparing a proposal to host OAME 2011.

TEAMS – Rep: Laurissa Werhun

Teams for the provincial OMO were selected through the local TEAMS OMO competition, held April 12, 2008. We had 104 students compete for 12 spaces, and we are pleased to announce that one of our teams placed third at OMO. Many thanks to Anthony Meli and Michele Goveia for preparing our team for competition. Discussions regarding the location of OMO 2011 have already begun. TEAMS held a very successful mini-conference, and the tentative date for the Fall mini-conference is November 6, 2008. Currently, a web newsletter is being sent to all current TEAMS members with information about upcoming events and recommended resources, such as WebLinks. TEAMS is also working on a new web page to better serve the needs of our members.

WOMA – Rep: Ann Michele Stenning

WOMA hosted its Spring mini-conference entitled "Math That Clicks." The event, which drew almost 100 people, offered educators two one-hour sessions and supper. Many also stayed into the evening to hear a presentation on the use of clickers. Clickers were used by everyone at the presentation in an attempt to demonstrate how the technology could be used in the classroom.

Y^{4}MA – Rep: Ada Cartaginese

This year's conference was held from May 8–10, 2008 at the Sheraton Parkway North in Richmond Hill. It was well attended, with over 1000 delegates and presenters. Delegates had over 200 sessions to choose from, and topics included differentiated instruction, assessment, the mathematical processes, curriculum connections, and social justice. The many hospitality events were also well attended. The annual OAME Awards Banquet honoured mathematics educators and two award recipients. Each received a SMARTBoard™ for excellence in teaching. Delegates enjoyed two very powerful keynote addresses: one on differentiated instruction (with a focus on inclusive teaching), and the other on the impact of mathematical literacy on social justice. The conference was a great success, and we thank all those who attended. We would also like to thank Connie Quadrini and Gina Micomonaco, the conference co-chairs, for their hard work and commitment, as well as the committee members, volunteers, and presenters. ▲

▲ 2008-2009 OAME Board

OAME website www.oame.on.ca

Direct General Inquiries to:
EXECUTIVE DIRECTORS
Dave & Sue Hessey

PRESIDENT
Anna Jupp

PAST-PRESIDENT
Jacqueline Hill

PRESIDENT-ELECT
Beverly Farahani

VICE-PRESIDENTS
Gordon Cooke

Lynda Ferneyhough

Anne Yeager

CHAPTERS & REPRESENTATIVES
CHAMP: **Shaun Knowles**

COMA - **Pat Kehoe**

GOLDEN - **Laura Tonin**

GVMA - **Robert Gleeson**

ISOMA - **Diane Lang**

MAC^2 - **Michele Walma**

NOMA - **Carol Lemmon**

NWOAME - **Tom Boland**

PINE RIDGE - **Sandra Jean Price**

QSLMA - **Robert Sherk**

SAME - **Debbie Drape**

SWOAME - **Nicholas Chevalier**

TEAMS - **Laurissa Werhun**

WOMA - **Ann Michele Stenning**

Y^{4}MA - **Ada Cartaginese**

DIRECTORS -TERM EXPIRING 2009
Anna D'Armento

Anna Dutfield

Paul Gautreau

Duncan Leblanc

Laurie Moher

Walter Whiteley

DIRECTORS -TERM EXPIRING 2010
Dennis Caron

Glynnis Fleming

Cathy Hall

Connie Quadrini

Silvana Simone

Trish Steele

DIRECTORS -TERM EXPIRING 2011
Paul Alves

Jan Crofoot

Merilyn Fox

Sue Melville

Bill Otto

Dwight Stead

Lynn Strangway

NCTM REPRESENTATIVE
Laurie Moher

WEBSITE CO-ORDINATOR
Gregory Clarke

GAZETTE EDITOR
Stewart Craven

ABACUS CO-EDS
Mary Lou Kestell

Kathy Kubota-Zarivnij