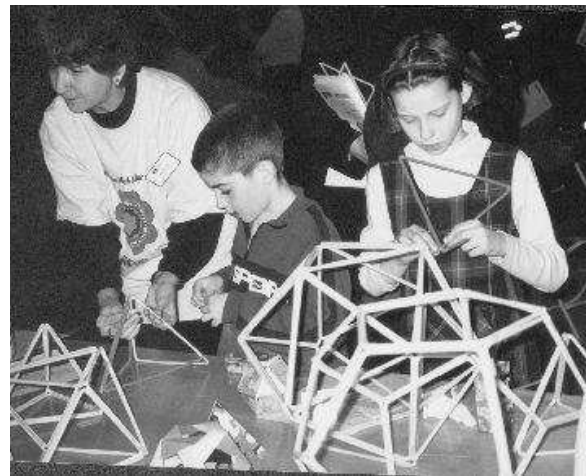


VI. MATHEMATICS EDUCATION PROGRAMME

Students at Sir James Douglas enjoy
Math Mania in 2001.



Students discuss math with Akbar Rhemtulla (University of
Alberta) during the 2001 PIMS Graduate Information Week.

The participants of the Esso-CMS-PIMS
Summer Math Camp for High School
students outside East Academic Annex
at SFU.



Initiatives for K–12 Students

PIMS continues to provide fun and innovative education activities for elementary and high school students. These include mathematics competitions and math fairs.

Activities for Elementary Schools

The following four activities took place for elementary schools students in 2001/02.

Math Mania

Math Mania is part of PIMS “Alternative Math Education” programme where Faculty and Staff from the PIMS Universities present “fun” methods for teaching math and computer science to children (and adults!) using games and art. It takes place at elementary schools in Victoria BC. Typically included in the presentations are soap bubble demonstrations, constellations as 2D networks, geometry and paper,

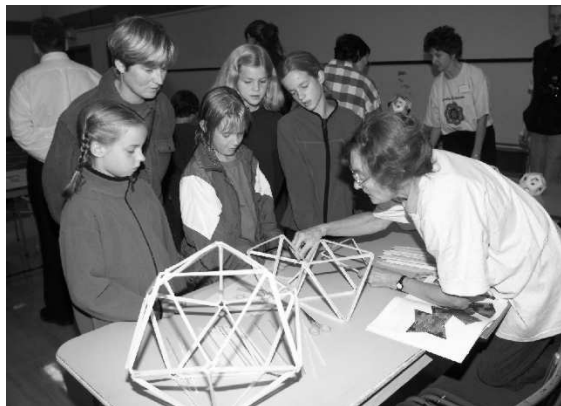


Photo courtesy of *Victoria Times Colonist*.

Pauline van den Driessche (PIMS-UVic) holds the attention of some Cordova Bay Elementary students.

The Set Game, a binomial probability experiment using pennies, and exciting geometrical models from straws and paper. Other demonstrations involve chess games, parallel algorithms of network sorts, and recursive methods in mathematical puzzles. These events attract around 300 students and parents each evening.

The Math Mania events in 2001/02 were:

- February 28, 2001: **Sir James Douglas Elementary School, Victoria**
- October 2, 2001: **Sooke Elementary School, Victoria**
- January 30, 2002: **Oaklands Elementary School, Victoria**
- May 28, 2002: **Lampson Street Elementary School, Victoria**
- October 9, 2002: **Happy Valley Elementary School, Victoria**

The enthusiastic volunteers who participated in these events included James Andersen, Peter Anderson, Kathy Beveridge, Charlie Burton, Jeff Campbell, Kelly Choo, Mike Crowle, Florin Diacu, Malgorzata Dubiel, Rod Edwards, Irina Gavrilova, Mike Fellows, Denton and Marilyn Hewgill, Elies Hoepner, Reinhard

Illner, David Leeming, Shaun Pack, Jan and Paul Nienaber, Elena Prieto, Geoff Schmidt, Pauline van den Driessche and Julie Zhou.



Making bubbles with Dr. Denny Hewgill.

Mathematics Unplugged

This annual event is a Student Mathematics Conference which takes place at Westwood Elementary School, a school of approximately 250 students in Coquitlam BC. All the students attend a full day math conference, including workshops chosen by themselves following a keynote address. Workshops are presented by all levels of instructors, including university professors, school district personnel, school staff, parents and Science World staff.

The main goal of this event is to lay an enjoyable and fun foundation for further mathematical awareness and engagement, which can last a lifetime. The other goals of the conference are to:

- utilize expertise from the community
- show students that Mathematics occurs in all aspects of everyday life, and in other subject areas
- show students that Mathematics is more than what they can find in school textbooks
- give students lots of hands-on experience by keeping the number of students in workshops small (20 or less)

Six sessions of Mathematics Unplugged have been held to date. PIMS has supported this event since it began.

Mathematics Unplugged VI took place on April 26, 2001. The event is styled just like an adult conference with a keynote speaker followed by workshops for the students to attend during the day. The keynote speaker has a difficult job to do as he/she needs to be able to hold the attention of students from K–G5 for at least 30 minutes and make it fun and interesting. This year every student went home with a tangram set, and a copy of the Tangram story.

Klaus Hoechsmann, PIMS Education Coordinator, helped plan the conference and visited the school on the day. The conference was a success with the students who participated in it. One student replied when told it was time to go out to recess, *“Oh, do we have to go out to recess, Math Unplugged is so much more fun!”*

Elementary Math Nights

Elementary Math Nights are held at schools in the Calgary area. Volunteers from Mount Royal College and the University of Calgary assisted the teachers to guide participants through a variety of activities. Activities such as map colouring, games on graphs, dominating sets of graphs, Fibonacci numbers, binary numbers, patterns in Pascal’s triangle, the travelling salesman problem, and finite state automata may be included.

The success of these evenings can be directly attributed to the enthusiasm and skill of the volunteers: Rob Petzold, Jean Springer, Laura Marik, Peter Zizler, Scott Carlson, and Sharon Friesen.

The Elementary Math Nights took place on:

- February 13, 2001: **Science Alberta School, Calgary**
- February 22, 2001: **Sunnyside Community School, Calgary**
- May 15, 2001: **Westmount Elementary School, Strathmore**

MathClick Workshops

In the summer of 2001, PIMS organized and hosted two MathClick Workshops for children at PIMS-UBC. On August 28 and August 31, 2001, thirty-two grade 5–7 students attended these full-day mathematics immersion experiential events. MathClick workshops are not only for the mathematically talented; in fact, the main intention is to awaken children’s latent talent and interest by showing them that mathematics can be also playful and intriguing. Students in these workshops engaged in a genuine mathematical inquiry in a very encouraging environment that promoted a feeling of surprise and ample opportunity for success.

Klaus Hoechsmann (PIMS Education Facilitator) and one of the workshop instructors co-authored the mathematical content for the workshop programme. The workshops were taught by Edel Vo and Natasa Sirotic from Collingwood School and assisted by Wendy Dorn from the Burnaby School District and Janet Martin, a graduate student at the UBC Faculty for Education.

Judy Dalling, the parent of MathClick participant Eleanora, attests that this single-day workshop can be truly transformational and can dazzle a child to the extent of completely reconditioning her or him for success in mathematics. She wrote, “*Last August I enrolled my 10 year-old daughter Eleanora in the one day MathClick workshop. Her record at elementary school was poor in all areas. In Grade 5 math, socials and science she had a C average, and getting her to complete assignments was impossible. After taking the MathClick workshops her attitude completely changed. She realized that she was capable of much greater things. She has not missed one day of school this year, and she has replaced the C’s on her report card with A’s. When asked, Eleanora credits these changes to your encouragement in the workshop. Thanks you for helping her realize her potential. What a difference a day can make!*”



Participants in one of the 2001 MathClick Workshops.

PIMS has continued these highly successful workshop in 2002, with workshops taking place on August 27 and 30. This year all the students went home with certificates of participation.

Activities with High School Students

The PIMS education panel organizes a number of events aimed at high school students. Here we describe one such event. The two sections that follow this one, Mathematics Competitions and PIMS Math Fair Programme, highlight many other PIMS activities for high school students.

Junior High Math Nights

These biannual events are organised by **Dr. Peter Zizler** of Mount Royal College, Calgary. From January–March, 2002 on six consecutive Mondays, students, parents and teachers at Mount Royal College are provided with the opportunity to engage in mathematical exploration. The event took place again in October 2002, this time on six consecutive Tuesdays. The emphasis of these evenings was to dispel the myths that mathematics is a set of facts innate to certain individuals and that mathematics is *not* an experimental discipline.

Discussions took place under the following titles:

Facts About Five: This evening was a potpourri of topics about the number five, including 5 by 5 magic squares, Pentagonal numbers, Tessalation of the plane using various polygons including pentagons, compass and straightedge constructions, and Ramsey theory.

Map Colouring: This evening the question of how many colours are needed to colour a planar map was asked and also applications to some scheduling problems were investigated.

Sorting out Sorting: Sorting algorithms, their benefits, and their drawbacks were discussed.

The Secret of NIM: This evening, analysing NIM and similar games with a view towards developing winning strategies was the topic.

Nothing But 0’s and 1’s: This evening an exploration of number systems with different bases was on the agenda.

Mathematics Competitions

Traditionally, mathematics skill and interest can be uncovered in students by exposure to challenging mathematical exams and contests. PIMS sponsors Alberta and BC participation in a number of such national and international competitions.

CMS Regional Math Camps

To identify and nurture future members of the Canadian team for the International Mathematical Olympiad, the CMS, Esso and PIMS sponsor this yearly event to which students in grades 8–10, as well as exceptional elementary grade students, are invited based on merit. Topics in Combinatorics, Number Theory, Algebra and Geometry will be covered at the difficulty level of the Olympiad. This is part of a long-range goal of the CMS to develop mathematical talent in Canadian students to compete on the world stage.

2001 Esso-CMS-PIMS Summer Math Camp, SFU, June 25–29, 2001

This camp was organised by **Malgorzata Dubiel** and **Petr Lisonek** (SFU) and was designed for students from grades 10–11. Participation in the Camp was by invitation only, based on recommendations from teachers, and results of various mathematics competitions.

The activities consisted of talks and problem sessions given by the SFU Mathematics and Statistics faculty and graduate students, a Campus tour, and a visit to the SFU Engineering labs. Twenty-four students from 16 schools participated in the camp.

The following sessions were offered:

Len Berggren: *Lessons from the History of Mathematics*

Jonathan Borwein: *Exploring Math on the Internet*

Peter Borwein: *Much Ado about Pi*

Imin Chen: *Cryptography*

Luis Goddyn: *The Lonely Runner and Other Problems*

Mary Catherine Kropinski: *Swimming in Syrup*

Petr Lisonek: *Mathematics with Maple*

Carl Schwarz: *One Fish, Two Fish, Red Fish, Blue Fish*

Petr Lisonek: *Putnam Competition Problems*

Ronald Haynes: *An Algorithm to Compute the Roots of Polynomials?*

Mahdad Khatirinejad Fard: *Inequalities*

The session leaders also gave daily problems to the participants. The best solutions were rewarded with prizes.

The camp was supported by grants from the Canadian Mathematical Society, the Imperial Oil Charitable Foundation, PIMS and the SFU Department of Mathematics.

2002 Esso-CMS-PIMS Summer Math Camp, SFU, July 2–5, 2002

The second Esso-CMS-PIMS Summer Math Camp for High School students took place July 2–5, 2002, at the SFU-PIMS Site in the East Academic Annex.

Twenty-five students from schools across the Lower Mainland were selected to participate in the camp, out of almost 50 nominations sent by their teachers. For four days, they participated in exciting and challenging activities organized by the SFU faculty and graduate students. Two guest speakers were invited as well: **Lily Yen** (Capilano College) and **Branko Curgus** (Western Washington University).

2002 Esso-CMS-PIMS Summer Math Camp, U. Alberta, August 14–20, 2002

The annual Alberta Math Camp alternates between the U. Alberta and U. Calgary. This is the second time that it was held at the U. Alberta. The event is sponsored by ESSO and CMS, with additional support from the Faculty of Science at the U. Alberta, PIMS, the Edmonton Public School Board, and the Mathematical Council of the Alberta Teachers Association. The camp organizers were **Ted Lewis** and **Andy Liu**.

The camp is intended for students from grades 7–10. Twenty-four campers from Alberta and two campers from outside the province stayed in the Lister Hall Residence Complex for its duration. There were also three day students from Edmonton who attended.

The morning programme consisted of a three-hour workshop centered on a lecture. **Andy Liu** gave a lecture on *Coding*, **Hans Brungs** spoke about

The History of Mathematics, **Edit Gombay** talked about *Probability*, **Sudarshan Sehgal** gave a lecture on *Number Theory*, **Dragos Hrimiuc** spoke about *Diophantine Equations*, and **Volker Runde** gave a lecture on *The Banach-Tarski Paradox*.

The afternoon programme was a mixture of academic and extracurricular activities. On Sunday, the students wrote a three-hour contest. On Monday, the camp visited the Odysium, the former Edmonton Space Science Centre. The students were divided into groups for a team contest on Tuesday. On Wednesday, the camp visited a cornfield maze just outside Edmonton. Prof. Andy Liu offered an exhibition of part of his puzzle collection on Thursday. On Friday, the well-known magician, Jon Charles, gave a special performance at the camp.

The evenings were largely spent in the residence for social activities. The students were supervised by Mr. Gilbert Lee and Mrs. Joyce Pon, the mother of one of the campers. On Wednesday, after the cornfield maze, the camp visited West Edmonton Mall. On Thursday, the students had an eat-in consisting mainly of pizzas. On Friday, a banquet was held at the China Palace Seafood Restaurant.

Alberta High School Mathematics Competition

The Alberta High School Mathematics Competition is an annual two part competition taking place in November and February of each school year. There are book prizes for the first part, and cash prizes and scholarships for the second part.

PIMS provides funding to ensure participation for students across the province. The PIMS Awards Dinner for the 2000–2001 season was on April 11, 2001.

The 2001–2002 season marked the 46th year of the Alberta High School Mathematics Competition. In this two part competition, part I, with 1093 participants, occurred on November 20, 2001, and part II, with the top 69 competitors from part I, took place on February 6, 2002. The major prize winners attended the 2002 PIMS awards dinner, which was held in Calgary. The awards dinner will be held in Edmonton next year.

PIMS Elementary Grades Mathematics Contest

The annual **PIMS Elementary Grades Math Contest (ELMACON)** is open to students in Grades 5–7. It provides an opportunity for them to experience mathematics as an exciting sport. The contest is modelled after the successful *MathCounts* competitions. However, there are some important differences, because it is aimed at younger students, many of whom will likely “graduate” to *MathCounts* once they get to high school. There they will learn to work collaboratively in the Team Round, which has here been replaced by a Problem Solving Round. The latter not only relieves the competitive pressure for a while, but also affords an opportunity for learning some mathematics in a state of heightened awareness and motivation. The other rounds are designated Sprint, Target, and Countdown, each with their own special characteristics.

Both the 2001 and 2002 events were organized by PIMS under the guidance of Dr. Cary Chien of David Thompson Secondary School, in collaboration with the BCAMT and volunteers from Lower Mainland schools of all levels. About 50 on-site volunteers from the UBC Science Ambassadors Program, various schools throughout BC as well as some parents helped the organising committee stage the events.

The format of the contest followed the formula of previous years. Students competed in three divisions in the sprint, target and countdown rounds. The sprint and target rounds consisted of two sets of written questions which were evaluated immediately while contestants enjoyed refreshments and listened to a lively presentation of problem-solving strategies. The top 10 from the first two rounds went on to the Countdown round where the students “duelled” starting with the 9th and 10th. The winner of that contest then went on to “duel” with the 8th place holder. So the person who ranked 10th had the potential of winning the contest by beating the 9 people ahead of him/her one by one. The duelling consisted of answering math questions against the clock and sounding a buzzer. Eventually an overall winner was found.

The top ten finishers in each grade received a commemorative t-shirt and medal, together with a

stylish binder donated by the BC Association of Mathematics Teachers. The top three also received a trophy, and an electronic calculator donated by Sharp.

3rd ELMACON, UBC, May 26, 2001

Last year, 223 students participated in the third ELMACON, with 73, 80 and 70 students in grades 5, 6 and 7 respectively. It was a substantial increase from the previous year.

While the markers were ranking the kids in preparation for the countdown round Cary Chien gave a talk on strategies and common mistakes. A video tape of his talk and other parts of the contest will soon be available at www.pims.math.ca/elmakon/.

The top 10 winners of ELMACON 2001 were:

Grade 5: 1. Jimmy He, 2. Sherwin Kwan, 3. Aram Ebtekar, 4. David Lam, 5. Bryan Huang, 6. Simon T.H. Tseng, 7. Christin Chan, 8. Sara Hyunjung Kim, 9. Alan Tung, 10. Tiffany Le Gentil.

Grade 6: 1. Steven Karp, 2. Arthur Yip, 3. Arthur da Silva, 4. Jason Ng, 5. Connor Joseph Wagner, 6. Serena Ip, 7. David Di, 8. Rickey Tam, 9. Nestor Choi, 10. Sviatoslav Moldavanov.

Grade 7: 1. Sam Wang, 2. William Wanki Kim, 3. Diane Wu, 4. Steven Hermann, 5. Yoshiaki Sono, 6. Howard Yan, 7. Carter (Wan Jae) Lee, 8. Fanhao Meng, 9. Jeffrey Nguyen, 10. Isaac Tang.

4th ELMACON, UBC, May 25, 2002

The fourth annual ELMACON had a total of 229 competitors. There were 67, 80 and 82 children in grades 5, 6 and 7 respectively. The top 10 winners for 2002 were:

Grade 5: 1. Juno Jung (Nelson), 2. Aram Ebtekar (Glen), 3. Jeffrey Choi (John T Errington), 4. Karen Bennie Ho (Oppenheimer), 5. Nikita Zouev (Lynn Valley), 6. Jeffrey Yeh (Vancouver Montessorri), 7. Sophie Ji-Soo Kwalk (Canyon Heights), 8. Veronika Dikoun (Maywood Community), 9. Phil

Chang (Simon Fraser), 10. Yanga Zhu (Eric Langton).

Grade 6:

1. Alarica Tang (Kitchener),
2. Jimmy He (Pinewood),
3. Daniel Park (Kwayhquitlum Middle),
4. Bryan Huang (Osler),
5. Yuan Liang (Pitt River Middle), 6. Silviu Toderita,
7. Sherwin Kwan (Seaforth), 8. Jonathan Zhang (Oppenheimer), 9. Hank Duan (Maple Creek Middle), 10. Simon T. H. Tseng (Chantrell Creek).



2002 Grade 6 winners (l-r): Daniel Park, Jimmy He, Alarica Tang.

Grade 7: 1. James Chen (John T Errington), 2. Arthur da Silva (St. Paul's), 3. Anthony Chuang (Maple Lane), 4. Sebastian Crema (Boundary Community), 5. Jerome Li (Kwayhquitlum Middle), 6. Steven Karp (Kitchener), 7. Jeffrey Hsiung (Emily Carr), 8. Kevin Xiao (Confederation Park), 9. Mulin Yang (University Hill), 10. Javin Chen (Thunderbird).



Left photo: 2002 Grade 5 winners (l-r) Jeffrey Choi, Aram Ebtekar, Juno Jung. Right photo: 2002 Grade 7 winners (l-r) Anthony Chuang, Arthur da Silva, James Chen.

PIMS Math Fair Programme

Math Fairs are particularly suitable for students in Grades 7–12 who are looking for longer term projects to get a feel for the adventure of a self-directed exploration.

PIMS supports math fairs as part of the Greater Vancouver Regional Fair and the Calgary Youth Science Fair, as well as running its own Forever Annual Mathematics Exhibition in Vancouver and numerous math fairs in Alberta.

The Concept of a Math Fair

Unlike, say, sports or music, mathematics does not offer many extracurricular activities in school, except for various kinds of contests, which—for all their admirable motivating qualities—stress just one side of mathematics: the quick grasp. And yet, most mathematical work could be more aptly likened to a marathon than to a sprint. The steadfast persevering quest, so vital to the subject, is minimally represented in the school environment.

The use of science fairs as a vehicle for popularising and teaching mathematics might eventually prove to be a way of filling this void. It is still in its infancy—the wheel has not yet been invented. Mathematics is traditionally not a showy subject. When we get a problem to work on, we retreat into a corner like a squirrel with a nut and come back into the light of day only when we have cracked it. Sure enough, we need some time for quiet concentration. But must it be unrelieved solitary confinement? There ought to be a better way—and preparing projects for public display might help push us in the right direction.

The projects usually fall under one of the following three headings, although many will present a mixture of two or even all three of them.

Original Research: There are lots and lots of open problems in mathematics. However, most of them lie on the outskirts which can only be reached by air. Since the field is so old, most of the rocks near the centre have been turned over more than once, so finding something really new there is a very lucky break.

Nevertheless it happens now and again—and, hey, you never know!

Applications: There is an inexhaustible supply of problems of all shapes and sizes in science, in technology, and even in the arts. Many of them are close to home. The challenge here is to tease out the interesting ones (say, the geometry of rose petals) and not get bogged down in mere routine (like counting them) or too engrossed in extraneous activities (like smelling them).

Exposition: Again and again it happens that somebody gives an old hat a brand-new twist—and most of the time, a new insight comes with it. There are hundreds of ready made proofs of the Pythagorean Theorem, but some people are still rolling their own. The area of the regular dodecagon inside a unit circle (3 square units) had been known for many centuries before recent beautiful proofs were found.

Whichever flag it sails under, a project should always aim at engaging the visitors' minds, not only their eyes. In this connection, a low-tech, homespun implementation is sometimes more successful than a glitzy computerized one—which might impress without enlightening, unless special care is taken.

BC Science Fair Foundation

At the Greater Vancouver Regional Fair (GVRSF) PIMS supplies judges, mathematical expertise, and prizes. PIMS initiated the inclusion of a Mathematical Sciences exhibit category within the existing Science Fairs, which are organized and administered by the Science Fair Foundation of British Columbia. PIMS is committed to informing and involving mathematics teachers, giving presentations and workshops to groups of students, helping and providing assistance to students that have undertaken mathematics projects, judging the projects, and supplying the monetary awards.

Projects are judged as gold, silver or bronze based on a point system.

The 2001 GVRSF took place at UBC, April 5–7. It held 26 projects within the Mathematical/Computer Sciences exhibit category. Within this

category, there were 2 computer science projects while the others were all mathematical.

In terms of the grade-level distribution, there were 10 junior (grades 7, 8), 10 intermediate (grades 9, 10), and 6 senior (grades 11, 12) projects. Projects came from the following schools: University-Hill Secondary, Point Grey Mini School, Britannia Secondary School, York House, Collingwood School, Sir William Osler Elementary School, Windermere Secondary, and Vancouver Technical.



Gabrielle Arden with her project, *Forecasting Weather with Neural Networks*.

Although participation did not increase (there were 26 math projects last year as well) we have witnessed a significant increase in the quality of projects. Two of the projects made it into the Canada Wide Science Fair in Kingston, Ontario, and won multiple awards even at this very top level. These projects were, *Trees: A Math Lesson from Nature* by **Christine Pop** from Sir William Osler Elementary and *Calculating Equilateral Triangles within an Equilateral Triangular Grid* by **Mahmoud Bazargan** from U-Hill Secondary.

The special award judges for PIMS were David Boyd, Klaus Hoechsmann, Leah Keshet, and Sandy Rutherford.

The 2002 Math Fair project took place this year amidst the teachers' job action. Despite this obstacle, ten projects were entered in the Computational and Mathematical Sciences category at the 2002 Greater Vancouver Regional Science Fair (GVRSF) and of these, two were selected to attend the Canada-Wide Science Fair held in Saskatoon, Saskatchewan in May 2002. These students were **Gabrielle Arden**

of Burnaby South Secondary School and **Rochelle Leung** of York House School (pictured).

PIMS presented the following awards.

First: Rochelle Leung (York House): *Decrypting the math behind cryptography and its ciphers*

Second: Gabrielle Arden (Burnaby South Secondary): *Forecasting weather with neural networks*, **Frank Sun** and **Winnie Ho** (Windermere Secondary): *Matrices and cryptology*, **Harvey Zhang** (Burnaby North Secondary): *Inscribed triangles in circles and ellipses*

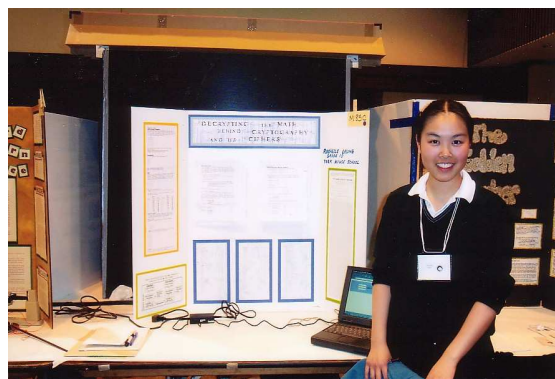
Third: Pearly Trinh and **Elaine Lee** (Windermere Secondary): *RSA algorithm cryptology*, **Galina Meleger** and **Kathryn Cheng** (York House): *The golden number*

The first prize winner received \$200, the second prize winners \$100 each, and the third prize winners \$50 each.

Considering there were only ten projects entered in the Computational and Mathematical Sciences category, it is noteworthy that the GVRSF judges selected two of these projects as part of the top ten projects at the entire science fair.

PIMS contributed \$2500 travel money to send the two winners to Saskatoon.

At the Canada-Wide Science Fair, Gabrielle Arden won a Gold Medal and a \$2000 scholarship to the University of Western Ontario in the Intermediate Computational and Mathematical Sciences category, and Rochelle Leung won a Bronze Medal and a \$1000 scholarship to the University of Western Ontario in the same category.



Rochelle Leung with her project, *Decrypting the Math Behind Cryptography and its Ciphers*.

Calgary Youth Science Fair

In 2001 and 2002 PIMS provided a prize at the Calgary Youth Science Fair. The prize consisted of \$100 and a plaque awarded for *Secondary project making major use of mathematics in the project.*

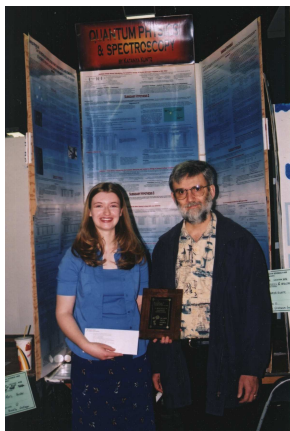


Michael Lamoureux (PIMS Deputy Director) presenting the plaque to the 2001 winner, Jonathan Sick.

On April 7, 2001 the winner was Jonathan Sick, a grade 9 student as Queen Elizabeth Junior High School. The project was *Sunspot Morphology and Magnetic Shear*, which explored how solar flare activity could be predicted based on observations of sunspots, which are dark, magnetically-active storms on the Sun. Jonathan went on to win the Intermediate

level at the National Youth Science Fair.

At this year's Calgary Youth Science Fair, which took place on April 10–13, 2002, the PIMS award went to **Katanya Kuntz**, a grade 11 home schooler from Alberta Distance Learning. Her project was called *Quantum Physics and Spectroscopy*. The objective of the project was to learn more about Quantum Physics and to test mathematical models of the atom (the Bohr theory and the Quantum theory) for their accuracy in predicting and explaining the atomic universe. Her Unified Hypothesis was "Spectroscopic signatures,



Katanya Kuntz & Gary Margrave (PIMS Site Director, U. Calgary) in front of her project.

other atomic characteristics, and atomic phenomena can be accurately predicted and explained by a mathematical model of the atom." She concluded that the Quantum theory is the best known model (so far) that is extremely accurate in predicting and explaining the atomic universe.

Forever Annual Mathematics Exhibition (FAME)

Students in the Greater Victoria School District took part in the fourth annual **FAME**, the **Forever Annual Mathematics Exhibition**, at S.J. Willis School on April 21, 2001. Last year, there were over eighty entries at three levels: Elementary (up to grade 7), Junior (grades 8–9) and Senior (grades 10–12). The event was organized by Wendy Swonnell, Betty Doherty, Betty McAskill and Tanis Carlow and was sponsored in part by PIMS.

The exhibits presented at FAME are judged for creativity, skill, dramatic value and mathematical thought. For the first time this year, every entrant was given an award—the categories being Distinction, First Class and Runner Up. A School trophy is presented at each level based on the best aggregate score of the top three projects. With more schools participating in FAME each year, this annual event will continue to attract outstanding mathematical exhibits from students in a wide range of grades.

The fifth Annual FAME took place at S.J. Willis Educational Centre on April 10, 2002. A total of 120 students participated in the events, with 20 elementary entries, 13 junior entries and 20 senior entries. Twelve students won Distinction Awards (score 90+/100). The winning schools (in terms of scores for the top 3) were Fairburn (elementary) and Lansdowne (junior and senior).

Some of the topics chosen this year were: *Optical illusions, Tower of Hanoi, The average sleeper, Numbers that make you go hmm, History of math in South America, Codes and ciphers, and Catapults and What is the fourth dimension?*

Fame is sponsored by PIMS, BCAMT, Greater Victoria Teacher Association and School District #61. The event was organized by mathematics teachers Betty Doherty of Lansdowne and Wendy Swonnell of Lambrick Park.

Elementary Math Fairs in Alberta

The yearly Math Fairs in elementary schools in the Edmonton area are gaining in popularity. Initiated upon requests by schools, and supported mainly by PIMS and the Edmonton Public School Board, the Math Fairs were held in previous years at Our Lady of Victories and Parkallen Elementary Schools. Last year, Clara Tyner and Terrace Heights Elementary Schools were involved.

The Edmonton Math Fairs are unique in that all students in the school participate. This event is about problem solving, not winning and losing. The schools themselves play a major role in the planning and thus the format can vary from school to school. In some Math Fairs, Education students from the University of Alberta were available to help, primarily by providing a “model” for a Math Fair that students can emulate in planning their own event. The extensive involvement of students in planning, staging and participating in the Math Fair may be one of the secrets of its success.

Prior to the Math Fair, students choose or are given problems to work on. They work in small groups to solve the problem and subsequently create a tabletop display. On the day of the Math Fair, spectators are invited to tackle the problem, with hints and guidance provided by students in charge. The displays are not poster sessions. Rather, the students are actively involved in the presentations.

PIMS/U. Alberta Math Fair, March 21, 2002

How often do you find grade school students happy to spend two and a half hours doing mathematics? This is what happened for about 450 students from elementary and junior-high schools in the Edmonton area on Thursday, March 21, at the PIMS/U. Alberta Math Fair. There were actually two parts to the activities—the fair itself, which was presented by the students of the Math 160 class, and a problem solving session conducted by Andy Liu.

The math fair was non-competitive, and presented mathematical puzzles for the visitors to try. The puzzles were very diverse, from river-crossing problems to the towers of Hanoi.

The math fair is part of the curriculum for Math 160 and has significantly revitalized the course. This

is the first time that the math fair took place on campus instead of at individual schools. Moving the fair here was prompted by both the popularity of the fairs and associated logistical problems of taking a Math 160 class to a school away from the campus. Holding it here solved some problems but raised several others. Renee Polziehn from the university outreach centre provided many useful suggestions.

PIMS/U. Alberta Math Fair, November 5, 2002

Just under seven hundred elementary and junior high students from twenty-five schools visited the PIMS/U. Alberta Math Fair on Tuesday November 5, 2002. This all day event was sponsored by PIMS and presented by the Math 160 students of Venera Hrimiuc and Ted Lewis, and was held in Dinwoodie Lounge in the Student Union Building. At the same time, Andy Liu ran a problem solving session for the children (which he dubbed the “math unfair”). The students spent about 2–2.5 hours at the event, splitting their time between the math fair and the problem solving session.

That’s a Good Problem!, Math Fairs in Calgary

That’s a Good Problem! is a collaborative project of PIMS, the Galileo Educational Network (GENA), and Mount Royal College in Calgary. It is based on the highly successful math fairs organised by Ted Lewis (PIMS Education Coordinator, University of Alberta). Teams of teachers from several Calgary-area schools were invited to a half-day workshop. The focus of the workshop was on teaching mathematics through explorations and investigations by working through a number of mathematical explorations, suggestions for introducing explorations to other teachers, organising and promoting a school math fair.

The teachers returned to their schools armed with Ted Lewis’ excellent booklet on how to run a math fair. Sharon Friesen of GENA and Indy Lagu (PIMS Education Coordinator, Calgary) made visits to the schools to work with the teachers and students before the math fairs.

After the math fairs, the teachers were invited for another half-day workshop to talk about problem solving, what worked and what did not with their

fairs, and future steps. Many of the teachers admitted that they were worried about how successful their math fair would be, but none were disappointed, and all thought of the math fair as an unqualified success. The many parents who attended the math fairs were also quite impressed. In all, seven schools participated, and all expressed an interest in repeating a math fair.

The math fairs took place as follows:

- February 28, 2002: **Pineridge Elementary School**
- March 19, 2002: **Strathmore High School**
- April 19, 2002: **C. Ian McLaren School, Black Diamond**
- May 16, 2002: **Glendale Elementary School**
- May 22, 2002: **Nellie McClung Elementary School**
- June 6, 2002: **Red Deer Lake Elementary School**

Half-day workshops were also held with teachers about the math fairs.

More information about the math fairs (including lots of photographs) can be found at www.galileo.org/math/sumtalk/index.html.

Dr. Friesen and Dr. Lagu are planning to involve 10 or 12 new schools in the project next year.

A Glimpse at 2003

**Math Mania Night,
George Jay Elementary School,
Victoria, January 28, 2003**

**Alberta High School Mathematics
Competition:
Part II of the 2002–2003 Season,
February 5, 2003,
Part I of the 2003–2004 Season,
November, 2003**

**PIMS Elementary Grades Math
Contest,
UBC, May 24, 2003**

**ESSO–CMS–PIMS Math Camp for
High School Students,
SFU, June 23–27, 2003**

**Summer Institute in Mathematics for
High School Students,
University of Washington,
July 22–August 2, 2003**

Initiatives with K–12 Teachers

With new mathematics curricula being developed across Western Canada, PIMS scientists have found considerable demand for teacher training and retraining. Teachers are also interested in exchanging ideas with academics.

PIMS Conferences on Changing the Culture

Organized by M. Dubiel (SFU), P. Hagen (Westwood Elementary), K. Heinrich (SFU), B. McAskill (BC Ministry of Education), E. Perkins (UBC), these conferences are intended to forge closer ties between the mathematics community, mathematics teachers and the industry. Erasing barriers between these communities and looking for common ground is an essential step in any attempts at changing the mathematics culture.

Changing the Culture IV, SFU Harbour Center, May 11, 2001

The Fourth Annual Changing the Culture Conference, brought together mathematicians, mathematics educators and school teachers from all levels to work together towards narrowing the gap between mathematicians and teachers of mathematics.

The theme was: *Writing, Speaking and Thinking Mathematics*. The conference participants—over 90 people from elementary and high schools, colleges and universities—explored connections between numeracy and literacy, mathematics and language, mathematics and literature, and how we can use language to teach mathematics.

There were two plenary talks:

Brett Stevens (PIMS/IBM PDF, SFU): *Mathematics and Literature: Cross Fertilization*

John Mighton (NSERC PDF, Fields Institute): *Breaking the Cycle of Ignorance*

Brett Stevens explored the mathematics in the works of Samuel Beckett, especially in his play *Quad*, inspired by the ideas of movement and freedom from Dante's *Divine Trilogly*; about Euler's work on Latin Squares and its impact on the works of George Perec and other French writers connected to the group *Oulipo*; and about his own work on *Gray Codes*, inspired by the play *Quad*.

John Mighton is the founder and coordinator of JUMP, Junior Undiscovered Mathematical Prodigies, an educational no-cost outreach programme for students who are doing badly in mathematics in school. This programme has been very successful and is rapidly gaining momentum in Toronto. John talked about his experiences with JUMP and how to make math accessible for kids whom the standard methods have not reached. John is also a Governor General's award-winning playwright. Robert LePage's latest film, *Possible Worlds*, was adapted from one of his plays, and he was a math consultant and actor in *Good Will Hunting*. He is also a professional mathematician at the Fields Institute. This talk was open to the general public.

Each participant was able to attend two of the following workshops:

1. JUMP: Junior Undiscovered Mathematical Prodigies program. Leader: John Mighton
2. Contextualizing Mathematics. Leaders: Brett Stevens and Karen Meagher

3. Connecting Early Numeracy and Literacy. Leaders: Cynthia Nicol and Heather Kelleher

For further information, see the webpage www.pims.math.ca/education/2001/ctc. Both plenary lectures are available via streaming video from this webpage.

Changing the Culture V, SFU Harbour Center, April 26, 2002

The Fifth Annual Changing the Culture conference took place April 26, 2002 at the SFU Harbour Centre campus. The conference was attended by 78 participants: Teachers from all levels, from elementary through university; student teachers and graduate students in mathematics and math education.

The theme of this year's conference was *Rigour and Intuition in Mathematics*. Two plenary speakers: **Ed Barbeau**, a mathematician from the University of Toronto, and **Brent Davis**, a Canada Research Chair in Education at the University of Alberta in Edmonton, presented their views on understanding mathematics and the respective roles of intuition and logic in the process of achieving it.

A lively panel discussion, chaired by **Klaus Hoechsman** (PIMS), addressed the topic in the afternoon. **Lin Hammill** (Kwantlen University College), **Christine Stewart** (SFU), **Günter Törner** (German Mathematical Society, DMV) and **Kirsten Urdahl-Serr** (School District 42, Maple Ridge), presented their views on the subject.

The participants were offered a choice of 3 workshops to enrich their experiences:

Sue Haberger (Centennial Secondary School): *The Moment of Proof*, which described methods and tricks she has developed and successfully used over the years to make students appreciate the need for rigour.

Natasa Sirotic (Collingwood School): *"Proofs" of Fallacies, or how to spot problems in seemingly flawless reasoning*.

David Lidstone (Langara College): *Intuition in Problem Solving*, which invited participants to test their mathematical intuition in a series of challenging problems.

PIMS Technology Workshops

Math Enrichment Activities in the UK: A talk by Chris Budd, SFU Burnaby Campus, August 8, 2001

Chris Budd is a professor of mathematics at the University of Bath and the Royal Institution, UK. The Royal Institution has been strongly involved in the popularization of mathematics and sciences in the UK by organizing public talks, contests and other activities. Chris himself, apart from being a distinguished researcher in applied mathematics, has been involved in many outreach events, including math camps, the UK Year 2000 poster campaign and what he calls the "Mathematics Magic Show", which he says was inspired by our Math in the Malls. He recently received a large grant in support of the enrichment activities. Chris Budd is also a coauthor (with C.J.Sangwin) of a book, "Mathematics Galore!" recently published by the Oxford University Press, containing material for workshops designed to generate enthusiasm for mathematics in students from the age 11 through to high school age. His talk was about his work with high school students and about how his workshops for students are organized.

Teacher Association Meetings

Annual meetings of teacher associations provide an important venue for connections between PIMS researchers and school teachers. PIMS participated in the big 2001 and 2002 October meetings of the British Columbia Association of Mathematics Teachers (BCAMT). PIMS had a display table there which was organised by Janet Martin in 2001, and by Janet Martin and Wendy Nielsen in 2002.

A Glimpse at 2003

Changing the Culture VI,
SFU Harbour Centre, May 2, 2003

Initiatives for Undergraduate Students

PIMS Graduate Weekends

This annual PIMS programme is unique in Western Canada, providing a forum in which talented undergraduates can preview and select the speciality which best suits their interests and ability. The payoff is many-faceted: Groups and laboratories are populated with better-matched students, students get the programmes they really want, and the strength of Western Canada's mathematical sciences is promoted.

PIMS Graduate Information Week, Universities of Alberta and Calgary, January 9–12, 2001

The PIMS Graduate Student Information Week was a great success. Twenty-four top fourth year undergrads in mathematics, statistics, and computer science from universities all across Canada arrived in Calgary on the Tuesday afternoon.

After a welcoming student/faculty mixer that evening, students were treated on Wednesday to a full programme of presentations about graduate studies at the U. Calgary, including talks by research groups in discrete math, analysis, industrial and collaborative mathematics, math finance, computer graphics, quantum computing, and several others.

The Dean of Graduate Studies, James Frideres, outlined some of the many attractions of studying at Calgary, while the PIMS Deputy Director, Michael Lamoureux, described the advantages of joining the PIMS team of western universities. The department's Director of Graduate Programs, John Collins, detailed the scholarship possibilities and amenities of each of the programmes. Gary MacGillivray gave a presentation on programmes at the University of Victoria. At a western-style dinner that evening,

the Associate Dean of Science, Robert Woodrow, discussed additional funding opportunities from the Government of Alberta that make graduate study in the province particularly rewarding.

After further informative sessions and meetings with faculty members on Thursday morning, the students went by bus to Edmonton that afternoon. Dick Peter, Dean of Science, and Peter Steffler, Associate Dean of Graduate Studies, along with faculty and graduate students from the departments of Computing Science and Mathematical Sciences, welcomed them to the University of Alberta campus at a banquet at the Faculty Club. Bryant Moodie, PIMS University of Alberta Site Director, gave a brief account of PIMS and its particular relevance to graduate studies in the mathematical sciences.

Friday morning activities were kicked off with a presentation by Bob Moody (U. Alberta) on "Graduate Studies in Mathematical Sciences: 2001". Jim Hoover (U. Alberta) talked about "The relationship between theoretical computer science and 'standard' mathematics". Presentations on graduate studies at PIMS universities were given by Denis Sjerne (UBC), Randy Sitter (SFU), Lorna Stewart (U. Alberta) and Jim Muldowney (U. Alberta).

After a lunch with local CS and MathSci faculty



Visiting students attend a talk at the University of Alberta.

and grad students, the visitors had a full afternoon of small group meetings, interviews and tours scheduled to address their individual interests. Over 100 meetings with local researchers and representatives of the other PIMS sites were arranged by PIMS staff. A farewell party and supper was held at the Varscona Hotel on Whyte Avenue.

Financial support for the seminar was provided by PIMS and each of the two host universities.

PIMS Graduate Information Weekend, SFU and UBC, January 12–13, 2002

On the weekend of January 12–13, PIMS together with SFU and UBC, hosted the Sixth Annual Graduate Information Weekend.

Twenty-eight potential graduate students with exceptional undergraduate records were invited from across Canada for a weekend in Vancouver, in order to be introduced to graduate programmes at UBC, SFU, U. Victoria, U. Alberta, and U. Calgary.

The result was two long but fruitful days of contact and information for the students, and unequalled opportunities for various groups in the Mathematical Sciences to present their programmes.

The programme at UBC started with introductions by George Bluman, the head of the Mathematics Department at UBC, and Dale Rolfsen, the UBC site director for PIMS. Ed Perkins gave an address relating his experiences as a graduate student.

The remainder of the day was filled with presentations from various research groups at UBC: Alan Wagner for Computer Science, Bertrand Clarke for Statistics, Jim Bryan representing algebraic geometry, David Brydges representing mathematical physics, Ian Frigaard representing applied mathematics, Izabella Laba representing analysis, Greg Martin representing number theory, and Laura Scull representing topology. During the afternoon there were campus tours and a chance for students and faculty to meet one-on-one.

On the social side there was a Saturday afternoon lunch at Hillel House on the UBC campus and in the evening there was a reception at the Graduate Student Centre, hosted by the graduate students in the UBC math department.

At SFU the following groups were represented. Applied and Computational Mathematics, Comput-

ing Science, Mathematics and CECM, and Statistics.

Presentations were made by Manfred Trummer (PIMS Site Director, SFU), Jonathan Driver (Dean of Graduate Studies, SFU), Dave Muraki (Applied Math), Imin Chen (Pure Math), Jon Borwein (CECM), Carl Schwarz (Statistics & Actuarial Sciences) and Torsten Möller (Computer Science).

The students were given tours of labs in Computing Science, Statistics and the Centre for Experimental and Constructive Mathematics, with plenty of time for informal contact between the students and potential programme advisors or supervisors.

IAM-CSC-PIMS Senior Undergraduate Math Modelling Workshop, PIMS-UBC & PIMS-SFU, February 17–18, 2001

Organizers: R. Russell (SFU) and B. Shizgal (IAM).
(See *Industrial & Scientific Training Programme* chapter.)

IAM-CSC-PIMS Senior Undergraduate Math Modelling Workshop, PIMS-UBC & PIMS-SFU, February 16–17, 2002

Organizers: R. Russell (SFU) and B. Shizgal (IAM).
(See *Industrial & Scientific Training Programme* chapter.)

Statistical Genetics and Computational Molecular Biology Workshop, University of Washington, December 16–18, 2001

Organizer: Elizabeth Thompson (U. Washington)
(See *Industrial & Scientific Training Programme* chapter.)

1st PIMS Mathematics of Biological Systems Summer Workshop, University of Alberta, May 11–19, 2002

Organizer: Mark Lewis (U. Alberta)
(See *Industrial & Scientific Training Programme* chapter.)

PIMS-MITACS-COE Undergraduate Industrial Case Study Workshop, Centre for Operations Excellence at UBC, May 25–27, 2002

Organizers: M. Puterman (Commerce and Business Admin, UBC) and Stephen Jones (COE, UBC).
(See *Industrial & Scientific Training Programme* chapter.)

A Glimpse at 2003

**5th PIMS Graduate Information
Weekend,
U. Alberta and U. Calgary,
January 7–11, 2003**

**IAM-CSC-PIMS Senior
Undergraduate Math Modelling
Workshop,
UBC and SFU, February 15–16, 2003**

**2nd PIMS-MITACS-COE
Undergraduate Industrial Case
Study Workshop,
UBC, May 2003**

**2nd PIMS Mathematics of Biological
Systems Summer Workshop
U. Alberta, May 2003**

Initiatives for Graduate Students

Graduate Industrial Math Modelling Camps

Each spring PIMS sponsors a five-day workshop for graduate students on industrial mathematical modelling. The goal of the **Graduate Industrial Math Modelling Camp** (GIMMC) is to provide experience in the use of mathematical modelling as a problem solving tool for graduate students in mathematics, applied mathematics, statistics, and computer science.

GIMMC is one of two components of the annual PIMS Industrial Forum. The other component is the **Industrial Problem Solving Workshop**. At this workshop, industrial and academic mathematicians work together to solve particular problems posed by industrial sponsors. Graduate students who are accepted to the Mathematical Modelling Camp are also invited to this Workshop.

Students work together in teams, under the supervision of invited mentors. Each mentor poses a problem arising from an industrial or engineering application and guides his or her team of graduate students through a modelling phase to a resolution. At the end of the workshop, reports are presented and a written summary of conclusions is made available for distribution.

Outstanding graduate students at both the Masters and PhD levels in the fields of mathematics, applied mathematics, statistics, and computer science, or related disciplines, are invited to apply.

4th PIMS Graduate Industrial Math Modelling Camp,
University of Victoria,
June 11–15, 2001

Organizer: Chris Bose (U. Victoria)
(See chapter on *Industrial Training Programme*.)

5th PIMS Graduate Industrial Math Modelling Camp,
Simon Fraser University,
May 18–23, 2002

Organizer: Mark Paulhus (U. Calgary)
(See chapter on *Industrial Training Programme*.)

3rd PIMS Fluid Dynamics Summer School
PIMS at the University of Alberta,
May 27–June 8, 2001

Organizers: B. R. Sutherland (U. Alberta) and
T. Bryant Moodie (U. Alberta)
(See chapter on *Industrial Training Programme*.)

4th PIMS Summer School in Fluid Dynamics,
PIMS at the University of Alberta,
July 28–August 9, 2002

Organizers: B. R. Sutherland (U. Alberta) and
T. Bryant Moodie (U. Alberta)
(See chapter on *Industrial Training Programme*.)

A Glimpse at 2003

6th PIMS Graduate Industrial Math.
Modelling Camp,
BIRS, May 17–22, 2003