The Student Mathematical Communicator

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Edited by Joanne Colling

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www.cms.math.ca/Students

CMS Student Committee: Who Are We?

We are a committee of the Canadian Mathematical Society (CMS), composed of undergraduate and graduate students from across Canada. Our goals are to address issues relevant to Canadian mathematics students.

What can we do for you?

- Get information on conferences, workshops and general announcements with our listservs.

-Chat with other math students on our web forum : *student.cms.math.ca/forum*

-Attend CMS meetings, where we organize student academic and social events.

-Attend the annual Canadian Undergraduate Mathematics Conference CUMC

-Apply for funding from us to have a student social at your regional conference.

-Keep informed of current math news through our biannual Newsletter: Mathematical Communicator

To learn more about what we can do for you, check us out @ *http://* ***cms.math.ca/students***

Message from the Chairs

The start of a new year is always exciting around universities and at the Studc we are also excited about the possibilities of 2009 as we have many new faces and ideas for the committee. This year we hope to expand students' involvement in our committee and your knowledge of our activities. Were you aware that there's funding available if your university is hosting a conference with student activities? Have you seen our website and newly minted discussion forum? There is much going on and we hope to get you sharing in it as we are here for you. We would like to extend a special to the students at University of Toronto who hosted this past summer's CUMC. It was an undeniable success that every one enjoyed. We are very much looking forward to next which will be hosted by Carleton University in 2009. Please have a great 2009 and be sure to look for representatives from the Studc at both the CUMC and the CMS Summer Meeting, we look forward to meeting as many of you as possible.

-Jenna G. Tichon & Iva Halacheva, Studc Co-chairs

Some Things in Life are Free

Contributor: Kseniya Garaschuk

Are you thinking of organizing a conference or a seminar at your University? Need some financial support?

There are numerous sources. Start with MITACS Student Advisory Committee - up to $400 in sponsorship funds are available for each project to help you organize talks for students in fields related to mathematics or computer sciences.

For more info or to submit a proposal contact SAC chair at **SAC_chair@mitacs.ca**.

You could also qualify for funding through our regional conferences program and receive up to $125 for a student social event. However, we only sponsor four events a year, so if you're interested please contact studc@cms.math.ca for more details.

You can also look at past CUMCs and check out their sponsors to find which institutes are interested in funding students' events.

Do not hesitate to contact anyone - the possibilities are endless.

Young Canadian Mathematicians Go Abroad!

Contributor: Kseniya Garaschuk

This year the International Mathematical Olympiad (IMO) was held in Madrid, Spain, July 10th to 22nd. The Canadian team placed 22nd out of 97 competing countries with all Canadian students bringing home medals (4 bronze and 2 silver). The highest our young mathematicians ever ranked was 7th out of 30 in 1981, the first IMO in which Canada competed. Next year the 50th IMO will take place in Bremen, Germany. Good luck!

Pure Math vs. Applied Mathematics

Contributor: Bradley Charles Dart

As a math student, I frequently get asked whether I'm studying pure or applied mathematics. Not only is it a point of curiosity for those asking, but it is sometimes a point of judgement. As someone who has taken a variety of pure and applied mathematics courses I realised that this is an evident divide among them.

Most mathematics departments have separate degree programs in pure and applied mathematics. The "applied" student typically takes differential equations, calculus, modeling, dynamical systems and similar courses. Often they study a natural science as well where their mathematics knowledge is immediately applied.

"Pure" students typically study more abstract material, such as algebra, topology, set theory and may be concerned with logic or philosophy.

Many traditionally pure mathematics disciplines are applied in science and mathematics, and to understand how to use mathematics properly in an application, a basic grasp of the underlying theory is required. Of course, there is some very ugly and mindless mathematics and some that lacks a "robust sense of reality," but the main difference, in my experience, is the attitude.

Applied mathematicians value usefulness and reward accuracy and efficiency. Pure mathematicians value novelty, rigour and insight and look for generality. My humble opinion is that although they differ in their emphasis, they both have equal importance and value.

The value of applicable mathematics is more easily explained to a layman than the value of abstract mathematics. The fact that engineers and accountants use mathematics is widely recognized and the impact that such disciplines have in peoples' lives is obvious.

Now clearly, the utilitarian value of pure mathematics doesn't compare to that of applied mathematics. The merit of pure math, on the other hand, may only be apparent to those who have studied it. Not only does it form the theoretical basis for applied mathematics, it is a pleasurable and challenging intellectual endeavour.

Moreover it has a place as an art and creative activity. The concept of mathematical beauty is an old one, but probably widely misunderstood or ignored. It is not primarily visual beauty but an abstract and intangible one. Plato believed in another realm of perfect forms, including mathematical objects.

Although you don't have to agree with this, there is a sense that mathematics has a certain sense of perfection, especially when a mathematical theory is a simple, elegant and powerful one.

As Bertrand Russell said, *"Mathematics, rightly viewed, possesses not only truth, but supreme beauty — a beauty cold and austere, like that of sculpture, without appeal to any part of our weaker nature, without the gorgeous trappings of painting or music, yet sublimely pure, and capable of a stern perfection such as only the greatest art can show."*

So, even useless mathematics can have importance and nobody can scoff at the practical significance of mathematics. Hopefully, in the future, this division of mathematics won't be as evident. Learning to appreciate both sides of such a grand discipline, as far as I am concerned, is an incredibly worthwhile activity.

Des idées qui changent le monde

Contributor: Olivier Lafleur

De tous temps, le mathématicien a été celui qui apporte une réflexion, une contemplation, mais surtout, un point de vue inattendu sur le monde. On peut penser à Galilée, qui a révolutionné le monde de son époque en mettant en valeur la thèse de Copernic ou à Cantor, qui a introduit l'idée qu'il y avait plusieurs infinis.

Le but de cet article est de vous faire réaliser à quel point les mathématiciens, bien qu'on leur associe souvent une image de l'abstraction froide, ont inspiré et ont créé de belles choses dans notre société, de façon très concrète et humaine. Ces idées ont, la plupart du temps, une résonance encore aujourd'hui dans le monde actuel.

Prenons, pour commencer, l'exemple d'Alan Turing, mathématicien britannique, qu'on considère comme l'inventeur de l'informatique. Il a le premier, conçu une machine théorique, qui porte aujourd'hui son nom, qui se veut être une machine de calcul universel. Sans ce mathématicien, qui sait si nous pourrions utiliser nos ordinateurs et faire de puissants calculs qui nous permettent de cerner un tout petit peu mieux des tonnes de phénomènes qu'il était impensable de calculer à la main.

Si nous retournons aux temps de la Grèce Antique, Pythagore a été celui qui a inventé la portée musicale, propulsant et standardisant ainsi l'écriture de la musique, lui donnant un essor et une propagation hors du commun. Encore aujourd'hui, ce soutien est utilisé à travers le monde et permet aux musiciens, ni plus ni moins, de communiquer entre eux.

À plus petite échelle, et dans un monde que je connais (peut-être) un peu mieux, le mathématicien québécois Jean-Marie De Koninck, en plus d'être reconnu comme un vulgarisateur hors pair des mathématiques, est celui qui a initié Opération Nez Rouge, le service de raccompagnement si populaire au Québec. Ce service est maintenant offert dans beaucoup de pays francophones et a un impact très positif, permettant de diminuer le nombre d'accidents sur la route durant le temps des fêtes.

Nous pourrions nommer des mathématiciens pendant des heures, mais ce qu'il faut retenir de cette idée, c'est que beaucoup de mathématiciens ont pris, à diverses époques, des positions de leaders positifs, d'instigateurs et d'inspirateurs d'idées révolutionnaires. Ces idées ont parfois été appliquées dans leur champ de travail, mais certains ont aussi appliqué de brillantes idées à l'extérieur de celui-ci.

Dans le futur, ce sera à nous (que vous soyez mathématicien ou pas) de créer le futur, d'être ceux qui inspirent, qui travaillent sur des idées « folles » qui révolutionneront le monde et seront très utiles aux générations futures. À nous de créer des projets qui changent le monde !

Math in Quantum Computing

Contributor: Nathaniel Johnston

Given that you are the type of person who reads CMS student newsletters, you have likely heard the term "quantum computer" a fair amount in the news lately. It seems that every few weeks another professor, research group, or Vancouver-based start-up makes another giant leap towards making quantum computers as commonplace and real as toaster ovens. However, most of us don't really know what a quantum computer *is* – and I'm no different. I may have spent the last two and a half years of my life working on finding methods of error correction for quantum computers, but I won't pretend that I truly understand what makes quantum computers do what they do. Quantum mechanics is beyond me – I just like the math.

In fact, that's *why* I like math. Mathematics is the universal language that allows me to solve real-world problems using a simple set of rules. It doesn't matter that the idea of something being both 0 and 1 at the same time makes no real sense to me, nor does it matter that two particles a million kilometres apart being able to instantly affect each other seems ludicrous in my head. All that matters is that I remember my second-year linear algebra and have a healthy supply of paper – everything else follows from that, and therefore it must be true.

Mathematics is one of the very few things in this world that we can be absolutely sure of working as intended. There won't be a glitch that causes the Pythagorean theorem to stop working for a day, there won't be a new study released that indicates that sin(x) may not be a continuous function after all, and there won't be a beam breaking somewhere deep within the real numbers that ruins their completeness. As long as we don't do something silly like make a sign error or forget to carry a one, we know that what we have derived is true, even if we don't ourselves understand the full implications of that truth.

Consider, for example, a problem that was originally introduced to me by Christopher Fuchs of the Perimeter Institute and that has since cropped up repeatedly in my reading: In the d-dimensional complex vector space C^d, is it possible to find a set of d^2 vectors such that each vector has Euclidean length equal to 1 and the absolute value of the inner product of any two distinct vectors from that set is equal a common constant?

This question looks like it might come from an undergraduate linear algebra textbook, but in fact it is an unanswered problem, the resolution of which would have large implications for quantum information theory. Even if you'd never seen the word "quantum" before reading this article, you would be quite capable of understanding and working

MITACS Industrial Math Summer School 2008

Contributor: Natasha Richardson

This summer thirty undergraduate students from around the world came to Simon Fraser University for the MITACS Industrial Math Summer School. I had the incredible privilege of being one of these thirty students

The summer school ran from July 14 – Aug 8, 2008. Over four weeks, we worked in teams of five on an industrial math problem submitted by a company. The problems varied in scope and included topics such as finance, image processing and queuing theory.

In order to solve these problems we were required to synthesize the mathematics that we were learning as part of our undergraduate coursework with novel concepts specific to the problems. In addition, we had to work closely with the companies, meeting their requirements of practicality as well as optimality. The summer school culminated with a final presentation of our solutions.

The backgrounds of the thirty students were just as varied as the industrial problems. The areas of study of the participants included pure and applied mathematics, computer science, engineering, physics, statistics and business finance. Moreover, participants came from all across Canada and other universities in the United States, Hong Kong, Mexico and Germany. The diversity of all of our backgrounds allowed for dynamic and successful team building and problem solving.

For the four weeks we were housed by MITACS in the townhouses at SFU Residences. I really cannot describe the experience of having everyone live together for a month; all I can say is that it was incredibly awesome. The summer school would not be the same without this component.

What were the best parts? Learning in an environment that centered on investigation and innovation instead of around midterms and final exams. Getting an idea of what it is to work on industry problems and what I can do with my math degree when I graduate. Working and living with amazing math students from around world, who I would otherwise never have met.

Interested students for the upcoming summer school should definitely apply. Keep an eye out for the application form in early March 2009 on the MITACS website.

Contribute to Our Newsletter!

Would you like to see your article featured in the Fall edition of our newsletter? If so the deadline for this is May 1, 2009. Send your submissions to *student-editor@cms.math .ca*

Math: Something to think about

Contributor: Joanne Colling

For most of a student's educational career they are required to take some form of math. The majority reaction to this requirement is that of frustration and having worked with many high schools I have seen that students perceive math as an impossibly difficult course, where only an "elite" few see it as easy or fun.

Why is high school math seen this way? Is it the way it is taught or tested on? Personally, I think that there are so many ways that math could be taught in an interesting and engaging way that would encourage students to like math or at the very least see it as learnable. However, traditionally math is taught at a base level, with emphasis on learning techniques and memorizing formulas, instead of the excitement of problem solving.

So unfortunately with this attitude, students head off to post-secondary education where most students, if they pursue science, are required to take a math course, again.
Here the perception of math shifts slightly, with the emphasis in math on problem solving and proofs, which is refreshing.

However, as a whole mathematics are still surround in great mystery, with those studying it being praised for pursuing such a hard subject, but often questioned as to what they could possibly hope to accomplish with math practically. But, this is far from the facts as math can be applied to so many areas such as the sciences and law as the problem solving behind math, makes its students very versatile and adaptable people.

Therefore, when you are talking about math, put away your pre-conceived notions about it, because with math there is so much more to consider.

CUMC

This past July the 2008 Canadian Undergraduate Mathematics Conference was held at the University of Toronto to great success. With over 150 participants it was one of the largest to date with students from all across the country.

The 2009 CUMC will be held July 8th-11th by Carleton University in Ottawa. It is a great way to meet fellow math students, learn about other universities and get experience giving a presentation at a conference.

If you've never gone before, this is a great year to start. Be sure to check with your department for funding opportunities. Hope to see you there!

Join Our Mailing List

Want info on everything involving math? Okay, we can't promise we have everything concerning math, but if you would like to receive notices and information about scholarships, conferences, graduate schools, job openings, and just about anything else useful to Canadian mathematics students, we can help. Our mailing lists are designed specifically for undergraduate and graduate math students. You can gain access to all the information you need by going to: *www .cms.math.ca/Students/Listserv* and joining our mailing list today!

Congratulations to David Pritchard!

You were the first to correctly solve last issue 's problem and send in his solution to us. The problem was as follow s. Let S(p) be the length of the curve $y = x^p$ for $0 < x < 1$. Show that S(p) is an increasing function of p for $p > 1$.

Solve me. This Issue's Problem

Suppose (x, y, z) is any point in the regular tetrahedron with vertices (-1,-1,-1), (-1,1,1), (1,-1,1), (1,1,-1).Prove that $x^2 + y^2 + z^2 + 2xyz < 1$

Send solutions to: student-editor@cms.math.ca
The first correct solution to be submitted will be published with the name of its author in our upcoming spring 2008 newsletter.

Thank You for Reading the Student Mathematical Communicator!