

# International Study Group on the Relations Between HISTORY and PEDAGOGY of MATHEMATICS NEWSLETTER

AN AFFILIATE OF THE INTERNATIONAL COMMISSION ON MATHEMATICS INSTRUCTION

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1995 April 3 - 5 Gregynog, Wales  
Residential meeting of the British Society for the History of Mathematics. (See inside for more details.)

1995 April 6 - 9 Boston  
Annual meeting of the National Council of Teachers of Mathematics and of the Americas Section of HPM. (See inside for more details.)

1995 April 19 - 23 Melbourne  
This ICMI Regional Conference, entitled a Regional Collaboration in Mathematics Education, will be held at Monash University in Melbourne. The main aim of the conference is to address the issues, problems and mechanisms concerning regional collaboration. For more information, contact Conference Secretariat, 144 Jolimont Road, East Melbourne, 3002, AUSTRALIA (Phone: 61 3 654 7533; Fax: 61 3 654 8540).

1995 April 24 Toronto  
One-day Conference in the History of Mathematics. (See inside for more details.)

1995 June 14 - 18 Nuremberg  
Meeting of the Fachsektion Geschichte der Mathematik of the Deutsche Mathematiker-Vereinigung. For information, contact Prof. Dr. Michael Toepell, Junkerstrasse 33, D-80689 München, GERMANY

1995 June 30 - July 4 Cairns, Australia  
International meeting of HPM. The theme of the meeting is ethnomathematics and the Australasian region. (See inside for more details.)

1995 July 8 - 13 Besançon, France  
Interdisciplinary Summer University on the History of Mathematics. (See inside for more details.)

1995 July 24 - 29 Bergen  
PDME III, Political Dimensions of Mathematics Education Conference, will take place in Bergen, Norway. The official languages of the conference will be English and Spanish. For further information, contact Stief Mellin-Olsen, Institutt for praktisk pedagogikk, University of Bergen, N-5020 Bergen, NORWAY (Phone: 47 5 544830; Fax: 47 5 544852; email: [mellin-olsen@psych.uib.no](mailto:mellin-olsen@psych.uib.no)).

1995 September 16 - 17 Oxford  
Autumn residential meeting of the British Society for the History of Mathematics. The topic will be Mathematics in Victorian Britain. The mathematical activity in various centres will be discussed: Cambridge, Oxford, London, and in military colleges, schools and societies; as will the work of many British mathematicians of the late 19th century. For more details, contact John Fauvel at the address above.

1995 October 29 - November 3 Minneapolis  
Third International History, Philosophy and Science Teaching Conference. (See inside for more details.)

1996 January 10 - 13 Orlando  
Annual meeting of the American Mathematical Society and the Mathematical Association of America. (Details on sessions of interest to readers will be forthcoming in the next Newsletter.)

1996 April 25 - 28 San Diego  
Annual meeting of the National Council of Teachers of Mathematics and of the Americas Section of HPM.

1996 July 14 - 21 Seville  
ICME-8. Details will be forthcoming. To receive the first announcement, send your name and address to ICME-8, Apartado de Correos 4172, E-41080 Sevilla, SPAIN.

1996 July 24 - 30 Braga, Portugal  
Quadrennial International HPM meeting in connection with ICME. (See inside for more details.)

### **Residential Conference of the British Society for the History of Mathematics**

This BSHM meeting in Wales, April 3-5, 1995, provides an opportunity for all those interested in history of mathematics research to spend some time together talking about current research interests, about the practice of the history of mathematics, and learning about the historical tradition of studying the history of mathematics in Britain over the past three centuries - from Wallis (John: 1616-1703) to Wallis (Peter: 1918-1992). Some of the speakers include Ivor Grattan-Guinness (Middlesex University), "The study of history of mathematics in Britain;" David H. Fowler (University of Warwick), "British historians of Greek mathematics;" John Fauvel (Open University), "Historians of mathematics in the early 19th century;" Adrian Rice (Middlesex University), "Augustus De Morgan, historian of mathematics;" and Tom Whiteside (University of Cambridge), "Historians of Newton." There will also be contributions

from research students from the UK and abroad as well as talks by senior researchers on methodological and other aspects of historical research today.

The residential cost is £100 for the three days and two nights. For further details, contact Colin Fletcher (Department of Mathematics, University College of Wales, Penglais, Aberystwyth SY23 3BZ, UK - phone: 0970 622757).

### **International HPM Conference in Cairns**

The International HPM Conference in Cairns, Australia will meet from June 30 to July 4, 1995. The theme for the plenary addresses will be Ethnomathematics and the Australasian region, but individual papers may address any issue pertinent to history, pedagogy and mathematics. Abstracts of 250 words are required by June 1 for presentations. Send them to George Booker at the address below. Plenary addresses will be given by Ubiratan D'Ambrosio (Brazil), Alan Bishop (Australia), Uenuku Fairhall (New Zealand), and Monte Ohia (New Zealand), among others. Florence Fasanelli (U.S.A.) will chair a panel to discuss directions for HPM followed by sessions to include comments and suggestions from all participants.

The conference will begin at 5:00 pm on Friday, June 30 with a plenary address, followed by a reception. Saturday, Sunday, and Tuesday are full days with plenaries and the presentation of individual papers, while Monday is scheduled for a full day excursion to the Great Barrier Reef. There will also be a conference dinner on Sunday night with free time in the other evenings to explore the many and varied restaurants in Cairns. The conference will be held at the Cairns Colonial Club Resort Conference Centre, in the style of an historic Australian homestead, set in tropical gardens and totally self-contained. The registration fee is Aus \$320 (approximately US \$240) for the five days, provided this is paid by May 1. After that, the fee will be \$350. The registration fee will include the cost of lunch Saturday - Tuesday, all morning and afternoon teas Friday - Tuesday, the opening Reception and the closing function, and an excursion to the Great Barrier Reef on Monday, which includes breakfast and lunch. A set of abstracts of all plenaries and papers will be provided at the conference.

The full day excursion to the Great Barrier Reef will be on a luxuriously appointed, large Catamaran which takes up to 350 people. We are hoping that there will be enough participants and accompanying persons at the conference to have exclusive use of a boat. The excursion would then begin with breakfast on board, include a presentation by marine biologists, all refreshments, and the use of snorkel gear, underwater observatory and semi-submersible for coral viewing at the outer reef some 150 km from Cairns. The return will be by Coach along a very scenic coastal road with beaches on one side, tropical rainforest on the other. Accompanying persons can be included on this excursion at a cost of Aus \$125 per adult, \$62.50 per child.

The conference has been timed to allow local teachers and other interested parties to attend the Friday night opening and the plenaries and papers during the weekend. The cost for this is \$130, which includes the conference abstracts, the Reception, lunch, morning and afternoon teas. For a single day's attendance (Saturday, Sunday or Tuesday), the cost is \$60 which includes lunch, morning and afternoon teas, but no other social activity. Participation on the excursion is available for the accompanying person's rate of \$125. The conference dinner will be a seafood, barbeque buffet at the Radisson Plaza Hotel on the Cairns Pier, overlooking the ocean. Cost, including wine, dessert and coffee, is \$35 per person.

Cairns airport is served by many domestic and international flights daily. The airport is approximately 10 km from the city, with the conference venue halfway between the

city and the airport. The Cairns Colonial Club meets all incoming flights with courtesy coaches.

The Cairns Colonial Club resort contains 3 restaurants, 2 bars, 3 large swimming pools, and various other recreational facilities, including children's play areas. It offers a range of accommodations: \$89 per night for a standard room with a double and a single bed; \$108 for a deluxe room with a queen bed; \$136 for a 1 bedroom suite with one double and two singles or four singles; and \$145 for a superior room with two queen beds. To secure accommodations, mail, phone, or fax your request to Ozaccom Pty Ltd, P.O. Box 301, Fortitude Valley, Qld 4006, AUSTRALIA; tel: 61 7 854 1611; fax: 61 7 854 1507. Specify that you will be attending the meeting of the International Study Group on the Relations Between History and Pedagogy of Mathematics. Indicate the type of room you want, your arrival and departure dates, and enclose one night's deposit or your credit card information (with signature). They will send you a confirmation upon receipt of your request.

To register for the conference, complete the form on page 14 and send it to George Booker, Institute for Learning in Mathematics and Language, Griffith University, Nathan, Queensland 4111, AUSTRALIA or fax it to him at 61 7 875 5686.

### **History of Mathematics Conference at York University**

A one-day Conference in the History of Mathematics will be held at York University on Monday, April 24, 1995, in honour of a retiring colleague and long-time member of the Canadian Society for the History and Philosophy of Mathematics. There will be four one-hour speakers: J. Lennart Berggren (Simon Fraser University): "Mathematics and her Sisters in Medieval Islam;" Aditi Gowri (University of Southern California): "Symbol and Sublimation: The Unconscious Life of Mathematics;" Judith Grabiner (Pitzer College): "Maclaurin Among the Molasses Barrels: Mathematics and Society in 18th-Century Britain;" and Gregory Moore (McMaster University): "The Emergence of Abstract Vector Spaces and Modules, 1888-1936."

If you are interested in attending, or want more information, including abstracts of the talks, please contact Israel Kleiner, Dept of Mathematics and Statistics, York University, North York, Ontario M3J 1P3, CANADA; tel: 416-636-5250; fax: 416-736-5757; email: kleiner@vm1.yorku.ca.

### **Université d'Été Interdisciplinaire: Histoire des Mathématiques**

La Commission inter-IREM "Epistémologie et Histoire des Mathématiques" se propose d'organiser la 7ème université d'été sur l'histoire des mathématiques à Besançon, 8 au 13 juillet 1995. Cette université d'été est ouverte aux professeurs de collèges, de lycée, aux universitaires, aux formateurs d'enseignants et aux membres de l'inspection des disciplines suivantes: mathématiques, philosophie, sciences physiques et histoire.

Les contenus de la formation sont:

- la construction historique du savoir mathématique dans son contexte scientifique, culturel, philosophique et social;
- les apports didactiques de l'épistémologie et de l'histoire des mathématiques: obstacles épistémologiques, rôles des problèmes, de la conjecture, de la rigueur, de l'évidence, de la démonstration et de l'erreur;

- les rapports entre sciences, cultures, techniques, et sociétés;
- l'introduction d'une perspective historique dans l'enseignement des mathématiques.

Parmi les thèmes qui seront abordés lors de l'université d'été, il y aura:

- les mathématiques et la réalité;
- les philosophes et les mathématiques;
- les mathématiques et le hasard, histoire des probabilités et des statistiques.

La tenue de l'université d'été sera annoncée dans un Bulletin Officiel, à paraître au printemps 1995. Les candidatures devront être déposées selon les indications et le calendrier donnés au Bulletin Officiel. Pour obtenir des renseignements, s'adresser à Evelyne Barbin, IREM, Université Paris 7, 2 place Jussieu, CP7018, 75251 Paris cedex 05; tel: 44 27 53 83; fax: 44 27 56 08 ou Yves Ducel, IREM, UFR des Sciences et des Techniques, 16 route de Gray - La Bouloie, 25030 Besançon cedex; tel: 8166 6192; fax: 8166 6199.

**História e Educação Matemática: Deuxième Université d'Été Européen sur Histoire et Épistémologie dans l'Éducation Mathématique; ICME-8 Satellite Meeting of the International Study Group on the Relations Between History and Pedagogy of Mathematics**

General Information

From 24 to 30 July 1996 the city of Braga, in northern Portugal, will host a major international conference on mathematics education. The main purpose of this conference is to bring together mathematics teachers and educational researchers from all over the world, to share their insights and experiences in using history of mathematics in the mathematics classroom. This meeting is timed to follow the International Congress on Mathematics Education, ICME-8, which is being held in Seville, Spain, July 14-21, 1996, so that many possible international participants will already be in Europe. Thanks to the generosity of the University of Minho, the costs are set at a very low level to try to ensure that no participant is unable to attend on financial grounds. In addition, it is hoped that further funding can be found to support the attendance of teachers from the Third World.

Braga-96 has two particular dimensions:

- It is the second European Summer University - the first was organized by the Institut de Recherche sur l'Enseignement des Mathématiques (IREM) and held in Montpellier, France, in 1993 - which is a movement to bring together teachers from many countries to develop their knowledge and share their experiences of history and epistemology in mathematics education.
- It is the principal quadrennial meeting of the International Study Group on the Relations Between History and Pedagogy of Mathematics. The previous one was held in Toronto, Canada, in 1992. This study group is devoted to understanding and promoting the use of history of mathematics in mathematics teaching.

The HEM Braga 96 meeting is organized by the Portuguese Association of Teachers of Mathematics (APM) and by the Department of Mathematics of the University of Minho and is supported by the Portuguese Society of Mathematics and by the Rector of the

University of Minho.

## Activities and Themes

The main activities of the meeting are first, a series of introductory lectures on the history of mathematics in which leading scholars and historians paint a picture of the development of mathematics down through the ages - or some themes in this story - especially designed for busy mathematics teachers from around the world who have not had much time or opportunity to study the history of mathematics themselves. And second, a series of practical workshops on the use of history in the mathematics classroom - enseignement des mathématiques - in which teachers and researchers with experience in using history share their knowledge and expertise of classroom activities with other teachers. These sessions complement the introductory history lecture series by showing what can be achieved for pupils in the classroom by a historically informed and enriched teacher. They will include workshops using mathematical texts from the past. A third major component of the activities are short talks by participants, on themes that they are keen to explore and share with others. These might be in connection with poster sessions, or might be free-standing, and are a very good way for delegates to find others with common interests and enthusiasms. In addition to the introductory lecture-course on the development of mathematics, Braga-96 will have its own particular themes. A few themes will be selected by the Programme Committee and it is expected that they will play major roles in focusing some of the activities. Some of the proposed themes that are being discussed by the P.C. are the following: Navigational mathematics and the age of discoveries, Mathematical cultures all over the world, Mathematical proofs in history, Mathematics and technics, Mathematics and Art, Mathematical modelling, Mathematics and reality, Epistemological obstacles. Themes are not a straightjacket, and contributions will be welcomed which do not fall readily into a theme; but it is hoped that having a finite number of themes will enable a focusing of participants' energies and attentions. This will lead to solid progress, both for teachers who seek helpful experiences to take back to their schools with them, and also for the researchers and educationists who will return home inspired by the feedback from teachers around the world.

## Programme Committee

Ubiratan d'Ambrosio (Brazil), Evelyne Barbin (France) (joint chair), Florence Fasanelli (USA), George Booker (Australia), Jean Doyen (Belgium), Maria Fernanda Estrada (Portugal), John Fauvel (UK) (joint chair), Fulvia Furinghetti (Italy), Paulus Gerdes (Mozambique), Jesus Hernandez (Spain), Victor Katz (USA), Jan van Maanen (Netherlands), Carlos Sá (Portugal), Luis Saraiva (Portugal), Gert Schubring (Germany), Man-Keung Siu (Hong Kong), Eduardo Veloso (Portugal).

## Language Issues

We expect hundreds of teachers from all over the world, speaking many languages. The official languages will be English, French and Portuguese, but speakers in other languages will be allowed if they have transparencies in a second "official" language and a translator/summarizer in French or English; speakers in one of the "official" languages must also have transparencies in another of those languages. All speakers will be instructed to speak slowly and simply. Transparencies and texts for workshops must be sent in advance to be translated into Portuguese (final dates will be settled in the second announcement).

## Social Programme

A social programme, including a conference dinner and an excursion to the nearby

Natural Parque of Gerez, is being prepared by the local organization. It is hoped and planned that these two main social events can be budgeted for so as to make them available to everyone. A special programme will be devised for accompanying persons.

### Practical Information

The meeting will be held at the University of Minho, in Braga, from July 24 to July 30, 1996, with registration beginning Tuesday, July 23, in the afternoon. ICME-8, in Seville, will close July 21 at noon, so ICME participants will have plenty of time to go from Seville to Braga. Bus transportation from Seville to Lisbon will be available on the afternoon of July 21. There are frequent trains from Lisbon to Braga.

Meals and the main accommodation will be at the University of Minho facilities and campus residences and will be included in the registration fees. Accommodations will also be available at hotels.

We are trying to get funds to support a few participants from developing countries.

Proceedings will be published and given to everyone registered for the meeting.

Braga, in the province of Minho

The province of Minho is situated at the north-western corner of Portugal. The river Minho, which has given its name to the region, is the natural border between the provinces of Minho in Portugal and Galicia in Spain. The population is slightly over one million. Braga, the administrative center of the region, is an old imperial Roman city - it counts more than 2250 years in the annals of its history - and one of the oldest Christian towns. The climate in the region is mild and temperate; spring and autumn are very mild and pleasant; in winter the temperature rarely drops to 0°C and summers are not excessively hot.

The meeting will be organized by the Portuguese Associação de Professores de Matemática (APM) and by the Department of Mathematics of the University of Minho.

Please register your interest and request a second announcement of the meeting by sending a note with your name, address, phone, fax and e-mail to Eduardo Veloso, APM, Escola Superior de Educação de Lisboa, Rua Carolina Michaelis de Vasconcelos, 1500 Lisboa, PORTUGAL. You may also send the information by fax to 351 1 7166424 or by e-mail to [veloso@telepac.pt](mailto:veloso@telepac.pt). Please specify the language of your preference - English, French or Portuguese - for the second announcement.

### **History of Mathematics in Iran**

Mohammad Bagheri

Iranian mathematicians have made a great contribution to the legacy of Islamic (medieval) mathematics, yet the history of mathematics as presently understood is rather a young discipline in Iran. The first Persian book dealing with the history of mathematics, entitled *A history of mathematics from 3000 B.C. to Khayyam's period*, written by the late Dr. Gh. H. Mossāheb - a leading Iranian mathematician - was published in 1938. During the last decades, the most active and influential figure in the history of mathematics has been Mr. A. Gh. Ghorbāni, whose numerous works on the subject are especially important for introducing primary and secondary Iranian and Western sources. His book, *A biography of Islamic period mathematicians*, is a master key for Iranian researchers. His *Būzjāni-Nāmeḥ* on the life and works of Abu al-Wafā al-Būzjāni, an Iranian mathematician and astronomer who flourished in the 10th century, won the Iranian yearbook medal in mathematics in 1994. Another mathematician, Mr. Parziv

Shahriāri, has written and translated scored of books on the history and pedagogy of mathematics. He has been the editor of the Persian mathematical journal *Reconciliation with Mathematics*, which stopped publication recently because of financial problems.

In the meantime, some western books on the history of mathematics have been translated into Persian and published in Iran, of which I may mention H. W. Eves' *An Introduction to the history of mathematics*, D. E. Smith's *History of mathematics*, and J. L. Berggren's *Episodes in the mathematics of medieval Islam*, the latter being published recently. These books are useful both for their contents and their underlined methodology, but are generally weak in the field of Islamic mathematics, including the Iranian mathematical legacy as its major part.

Since most Iranian scientists in the Islamic period wrote in Arabic, then the dominant scientific language, they are erroneously known as Arab mathematicians in the West. Conversely, the insufficient familiarity of present mathematicians in Iran with the Arabic language causes severe difficulty in their access to the legacy of Iranian mathematics directly.

The history of mathematics is studied in the mathematics department of Sharif University of Technology, the history of science department in the Encyclopedia Islamica Foundation, and the department for the history and philosophy of science in the Institute for Cultural Studies and Research, all in Teheran. Due to lack of satisfactory relations and cooperation between internal and external researchers, many original works done in Iran remain out of sight of Western scholars.

I work on the scientific legacy of Kūshyār ibn Labbān Ghīli, the Iranian mathematician and astronomer (fl. c. A.D. 1000), whose works are written in Arabic and translated into or commented on in Persian, Hebrew, Chinese, Turkish, German, English, French, and Russian. His millenium was held at Ghilān University in his birthplace, the Ghilān province of Iran on the southern coast of the Caspian Sea in March, 1988, during the 19th annual Iranian mathematics conference.

The Iranian Mathematical Society was established in 1969 and organizes an annual mathematics conference in March every year. Some articles on the history and pedagogy of mathematics are usually submitted to each conference. The 1995 conference will be held in Kermān city of Iran from March 28 - 31. For participation, it is possible to contact the Organizing Committee, 26th Annual Iranian Mathematics Conference, Shahid Bahonar University of Kerman; tel and fax 98-341-263244; email aimc26@irearn.bitnet

### **The History of Mathematics in the English Class**

Gilberto Diaz-Santos

Many universities around the world have implemented courses of English as a Foreign Language (EFL), which enable undergraduates to develop reading and writing skills for academic needs and success. Such courses are linked - in different ways - to the content-subjects of the students' majors, and EFL is learned mainly through reading specialized materials. This is reason enough why mathematics is not an attractive area for the majority of EFL teachers who still regard equations and theorems as part of a past we wouldn't like to revisit.

However, teaching EFL to math undergraduates should not be understood as only dealing with higher and pure mathematics. For three years now, I have successfully used reading passages on historical and general aspects of mathematics to teach my pupils the reading and writing skills they need to work with materials in English. Fortunately for the students, the EFL class has given them a humanized vision of their

major, something which - for many different reasons - is often skirted by content-subject instructors. In this way, we have dealt with topics such as the legend around the problem of the duplication of the cube, the studies made by the Pythagorean school concerning the relationship between music and numbers, and - among others - we have also considered the details on the dispute promoted by disciples of Newton and Leibniz in relation to the discovery of the differential calculus.

In addition to classroom reading, students are required to present a final essay in which they may deal with a) biographical data of outstanding mathematicians, as well as of those who are little known; b) main thrusts of mathematical schools of ancient times; c) how mathematics has been related to the different cultures and linked to the developments in other disciplines; d) solutions given to major problems in the field; and e) some of the *whys* of mathematics, among others.

All during their research projects, students will have to read in English - sometimes in Spanish too - from several sources and go through a revision process of their writing before they present their finished work orally in a two-day seminar organized at the end of the semester.

With great pleasure and satisfaction, I have realized how productive this approach has been for my pupils. As an EFL teacher, I wanted to attain the objectives of my subject but without having to go too deep in mathematics - a really fascinating but sometimes an incomprehensible subject for my colleagues and me. I thought I would be much safer dealing with historical accounts on the development of my pupils' specialty, and it turned out that beyond strategies to read and write in English, I have contributed to provide them with a cultural knowledge and a different vision of their science. I am glad I have helped them see how many problems posed in mathematics will be better understood if they are traced back to their roots.

Professor Gilberto Diaz-Santos teaches EFL to mathematics and computer science undergraduates at the University of Havana, Cuba. He is currently working on the development of several ideas to make stronger links between mathematics and EFL

### **Third International History, Philosophy and Science Teaching Conference**

The Third International History, Philosophy and Science Teaching Conference will be held at the University of Minnesota, Minneapolis, from October 29 to November 2, 1995. It follows the very successful First conference held at Tallahassee in 1989 and Second conference held at Kingston in 1992. The conference will be held in association with the U.S. History of Science Society's annual conference, occurring October 26-29, 1995.

The purpose of the Conference is to promote:

- The dissemination of lessons, units of work, and programs in science and mathematics, at all levels, that have successfully utilized history, philosophy, and sociology.
- Improvement of science and mathematics education by utilizing the history, philosophy, and sociology of science and mathematics.
- Collaborations among communities of scientists, mathematicians, historians, philosophers, cognitive psychologists, sociologists, science and mathematics educators, museum professionals, and school and college teachers.
- The inclusion of appropriate history, philosophy, and sociology of science and

mathematics courses in science and mathematics teacher-education programs.

- Discussion of purposes of science and mathematics education, and their contribution to the intellectual and ethical development of individuals and cultures.

The Conference call is for proposals that will provide:

- Illustrations and critiques of curricular and instructional applications of history, philosophy, and sociology of science.
- Insights into science, mathematics, and education as related to specific cultures and contexts.
- Results from collaborations between researchers and teachers.
- Theoretical analyses of issues in science, mathematics, and education.
- Researched based insights into science, mathematics, and education.

Proposals for individual contributed papers, paper sets, workshops, discussion groups, and interactive exhibits of curricular and instructional materials related to the purposed of the conference are now being accepted. Five copies of the proposal should be sent to Fred Finley at the address below. The proposals should include a cover page with the title, author name(s), institutional affiliation(s), address(es), telephone and fax number(s), and e-mail address(es) and a 500 word abstract of each proposed paper, session, or exhibit description. The deadline for receipt of proposals is March 15, 1995. Details about conference registration fees, housing, and social events will be sent with the conference brochure in July. The approximate fee will be \$200. Proposals should be sent to Professor Fred Finley, IHST Conference Chair, Department of Curriculum and Instruction, College of Education, 370 Peik Hall, 159 Pillsbury Drive S.E., University of Minnesota, Minneapolis, MN 55455, U.S.A. Professor Finley may also be contacted by fax at 612-624-8277 or by email at finleyfn@vx.cis.umn.edu. For general information about the conference, contact Catherine Ploetz, Professional Development and Conference Services, University of Minnesota, 218 Nolte Center, 315 Pillsbury Drive S.E., Minneapolis, MN 55455, U.S.A.; fax: 612-626-1632; email: cploetz@mail.cee.umn.edu.

### **Americas Section of HPM Meeting in Boston**

The Americas Section of HPM will meet as usual in connection with annual meeting of the National Council of Teachers of Mathematics. HPM will meet on Friday, April 7, 1995 from 5:30-7:30 pm. As of this writing, the room for the meeting had not been assigned. Please check at the information desk on the 2nd level of the Hynes Convention Center. There will also be flyers posted with the meeting room information, and these will be available at many of the NCTM talks listed below on Thursday and Friday.

Although the program for the HPM meeting has not been completely finalized, among the speakers will be Charles Jones, "Insights into Pedagogy from History: Support for the New Learning,"; Art Johnson, "The History of Mathematics in Modern Media,"; Barnabas Hughes, George Booker, and Jaime Carvalho e Silva. You will not want to miss this lively and informative session, as well as the dinner afterwards.

The annual NCTM meeting takes place from Thursday, April 6 to Sunday, April 9. There are many sessions in the general NCTM program which may well be of interest to readers of this Newsletter. Among them are #63: Carol G. Ropp and Madeleine M.

Hoss, "Conversations with Famous Mathematicians - Inspire Your Students," Thursday, 10:30-11:30; #78: Thomas J. Fernsler, "Triskaidekaphobia! A Convicted Mathematics Historian Reveals the Dark Side of Numbers - 13," Thursday, 10:30-11:30; #96: Betty B. Long, "Creative Ways to Use Mathematical History to Enrich Your Mathematics Classes," Thursday, 10:30-12:00; #270: Claudia Zaslavsky, "Multicultural Mathematics Educations: Equity, Excellence, Curriculum, Pedagogy," Thursday, 3:00-4:00; #376: Victor J. Katz, "Mathematics History Modules for Teaching Secondary School Mathematics," Friday, 10:30-11:30; #466: Lowell F. Lynde, Jr., "Girolamo Cardano - Sixteenth-Century Physician and Superb Mathematician," Friday, 12:00-1:00; #490: Karen Dee Michalowicz, "Connecting Great Women and Men of Mathematics to Middle School Math," Friday, 12:30-2:00; #543: Teri Perl, "Women and Mathematics: Explore the Past! Spotlight the Present! Build the Future!," Friday, 1:30-2:30; #582: Erica Dakin Voolich, "Using Biographies to 'Humanize' the Middle School Classroom," Friday, 2:30-4:00; #612: Anthony V. Piccolino, "Integrating Multicultural Activities into the Secondary School Mathematics Classroom," Friday, 3:00-4:00; #736: Greisy Winicky and Nitsa B. Movshovitz-Hadar, "Preparing High School Teachers for Enhancing the Beauty of Mathematics," Saturday, 10:30-11:30; #738: Lawrence H. Shirley, "Mathematical Heritage, Diversity, Connections, and Potential: History of Mathematics," Saturday, 10:30-11:30; #878: Art Johnson and Susan S. Camiel, "Let Lovelace and Newton Motivate Your Students - Use History in Any Mathematics Class," Saturday, 1:30-2:30; and #885: David M. Furuto, "Motivate Your Students - Use History to Make Mathematics Meaningful," Saturday, 1:30-2:30.

As was noted in the last Newsletter, the Americas section of HPM is now becoming formally affiliated with the NCTM. As part of this process, we have agreed to begin collecting dues to support the organization, rather than continuing to rely on the generosity of various people and institutions. The dues are a very reasonable \$10 per year. We need your support through this dues payment if this Newsletter is to continue to be distributed. Please send your check, made out to HPM, to the treasurer, Sherry Cox, 532 C Fleetwood Ct., Kingsport, TN 37660. She can also be reached by email at slcox@aol.com.

### **CSHPM in Montreal**

The annual meeting of the Canadian Society for the History and Philosophy of Mathematics will take place June 3-5, 1995 in Montreal in connection with the Learned Societies Conference. The meeting will be held at the Université du Québec à Montreal. There will be a special session on the history of mathematics around 1900 chaired by Thomas Archibald; among the speakers are Israel Kleiner, Abe Shenitzer, Craig Fraser, and Erwin Kreyszig. Proposals for papers in this session should be sent to him by February 28 at Acadia University, Wolfville, Nova Scotia, B0P 1X0, CANADA or by email to tom.archibald@acadiau.ca. or for the regular sessions to Jim Tattersall at Mathematics Department, United States Military Academy, West Point, NY 10996 or to Jerry Lenz at Mathematics Department, St. John's University, Collegeville, MN 56321, USA. For information on registration or membership, contact Glenn van Brummelen, King's College, 9125 50th St., Edmonton, AB T6B 2H3, CANADA; email: gvanbrum@kingsu.ab.ca

### **Institute in the History of Mathematics and Its Use in Teaching**

The Mathematical Association of America, with funding from the National Science Foundation, will sponsor an Institute in the History of Mathematics and Its Use in Teaching, designed to increase the presence of history in the undergraduate mathematics curriculum, beginning with a three-week summer program at The American University in Washington, DC, June 5 - 23, 1995. The NSF will support room

and board for the 40 participants, faculty members at colleges and universities, who will do additional work at their home campuses during the year and then return for an additional three weeks in June, 1996.

The Institute, directed by V. Frederick Rickey and Victor J. Katz, will prepare participants to teach an undergraduate course in the history of mathematics and to incorporate historical issues into all of their teaching. During the first summer, participants will take part in a general survey course in the history of mathematics, a course in historiography, reading of original sources, discussions of ways of teaching courses in the history of mathematics, demonstrations of ways of using history in the teaching of mathematics courses, and field trips to two major rare book libraries. They will also do some limited research and give presentations during the final week.

During academic year 1995-96, participants will continue their research, discuss them via an email network to be set up, use history in teaching their mathematics courses, and, if possible, teach a course in the history of mathematics. During the summer of 1996, they will take part in many new activities, including short courses on ethnomathematics, nineteenth-century mathematics, American mathematics, women in mathematics, African-American mathematicians, and methods of using original sources in class.

Applications are strongly encouraged from faculty teaching at small institutions, at minority-serving institutions, and at institutions that prepare secondary teachers. For more information and an application form, contact V. Frederick Rickey by email at [rickey@maa.org](mailto:rickey@maa.org), Victor Katz by telephone at 1-800-331-1622, or write to the Institute at the Mathematical Association of America, 1529 18th St. N.W., Washington, DC 20036.

### **Histoire d'Infinis: Actes du Colloque Inter-IREM Epistémologie de Brest**

La question de l'infini intervient dans l'histoire des mathématiques comme un élément à la fois perturbateur et moteur. Au cours d'une longue histoire, les mathématiciens rencontrent l'infini, essayant de l'éviter ou osant l'affronter. Depuis les géomètres grecs qui ne veulent pas faire usage de l'infini dans leurs démonstrations, parce que, comme l'écrit Proclus, "l'infini est insaisissable par la connaissance scientifique," jusqu'aux mathématiciens qui considéreront, comme H. Weyl, que "les mathématiques sont la science de l'infini," la lutte pour saisir l'infini est longue et passionnante. Les difficultés et les obstacles sont souvent mal repérés dans nos classes de collèges et de lycées, mais la question de l'infini rarement explicitée est parfois là, tapie dans nos salles de cours.

Les Actes du 9<sup>ème</sup> colloque inter-IREM proposent quelques moments de l'histoire de l'infini, ou plutôt des infinis, tant il faudra de temps pour appréhender toutes les facettes du monstre que l'on croit enfin maîtrisé. Nombre, continu, grandeur, dérivée ou intégrale, algorithme, géométrie perspective ou géométrie du hasard: comment éviter de penser l'infini? comment ne pas vouloir l'éclairer?

Tous les articles de ces Actes sont autant d'invitations à une réflexion sur l'infini, réflexion nécessaire à celui qui enseigne les mathématiques. Le but de cet ouvrage, tout comme celui du colloque, n'était pas de viser une exhaustivité, mais de faire naître un intérêt chez le lecteur ou le participant, et de faire connaître les travaux historiques des IREM. Ces Instituts organisent tous les deux ans un colloque sur un thème historique: on peut parier que dans les années à venir le thème sera de nouveau à l'honneur.

## Sommaire

Préambule: L'idée d'infini, quelle histoire . . .

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2. Nombre, continu et infini: de Zénon à Cantor. L'infini paradoxal de Zénon d'Elée, la dialectique de l'espace et du nombre; Comment les *Eléments* d'Euclide traitent du continu sans recourir à l'infini; Faire la droite avec des points; Statut du nombre et détermination de l'infini; De la difficulté d'être omniscient.
3. Aires et volumes: sans ou avec l'infini. Le volume de la pyramide par Eudoxe de Cnide; Les progression de l'infini: rôles du discret et du continu au 17ème siècle; Présentation de l'*Arithmetica infinitorum* de John Wallis; Séries et quadratures chez Leibniz.
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5. L'enseignement de l'analyse: la question de l'infini. Eclairages historiques pour l'enseignement de l'analyse; Prenons la tangente avant de dériver.
6. Algorithmes, calculatrices et infini. Une approche de l'irrationalité; algorithme d'Euclide et fraction continue; L'infini n'est pas programmable; Un comportement étrange des calculatrices; L'émergence du concept Fractal; Les élèves de collège doivent-ils ignorer les algorithmes de calcul ou de constructions où un nombre fini d'étapes ne suffit pas pour trouver le résultat?
7. Géométrie projective et infini. Le projectif ou la fin de l'infini; La notion de "point de fuite" comme obstacle épistémologique.
8. Probabilité et infini. Huygens: l'espérance et l'infini.

*Histoire d'infinis*, ed. IREM de Brest, 150 FF (plus frais de port) disponible dans les IREM ou à commander à: IREM de Brest, UFR Sciences et Techniques, BP 452, 29275 Brest Cedex, FRANCE.

### **The Last Problem in *Lilavati***

R. C. Gupta

The *Lilavati* is the most popular work on ancient Indian or Hindu mathematics. Ever since its composition by Bhaskara II (b. A.D. 1114) about the middle of the twelfth century, it has been used (and is still being used) as a text book in Sanskrit medium schools and colleges. It was through H. T. Colebrooke's famous translation of 1817 that the West became familiar with it.

The last problem in *Lilavati* is on permutations and combinations. Take the nine digits 1 to 9 (0 is excluded). We know that the total number of  $n$ -digit numbers formed using these digits (repetitions being allowed) will be  $9^n$ , because each positional place can be occupied by any of the said nine digits. But Bhaskara's problem was to find the total number of those  $n$ -digit numbers in which the sum of the digits was a given fixed quantity, say  $S$ . In other words, the problem is to find the total number of numbers of the form

$$d_1 d_2 d_3 \dots d_n, \quad 1 \leq d_i \leq 9 \quad (1)$$

such that for any such digital representation,

$$d_1 + d_2 + d_3 + \dots + d_n = S. \quad (2)$$

Such problems are not usually treated in modern textbooks, but they are found in India since the early days. Here we shall give two elegant methods to tackle them. Bhaskara's own solution to his problem is that the required number of arrangements will be

$$(S-1)(S-2)(S-3) \dots (S-n+1)/(n-1)! = C^{S-1}_{n-1}, \text{ if } S < n+9. \quad (3)$$

To illustrate his rule, Bhaskara takes an example in which  $n = 5$  and  $S = 13$ , and gets the answer 495 (which is correct). However, as is usual with ancient Hindu texts, he has not given any proof of his solution, although he may have known one as indicated by the restriction in (3). A proof of Bhaskara's formula follows from the following simple lemma:

LEMMA: The number of ways in which  $r$  similar balls can be placed in  $n$  compartments (empty cases allowed) is equal to  $C^{n+r-1}_r$ .

This lemma is easily proved by considering the  $n$  compartments formed by placing  $n-1$  dividing boundaries, each of which is represented by the capital letter **I**; e.g., one case in which 13 balls are distributed over 5 compartments (formed by 4 **I**'s) may look like

oooo**I**ooo**I****I**looooo

Then the required number of ways of placing the  $r$  balls (o) variously in the  $n$  compartments will be the same as the total number of arrangements of  $n-1+r$  letters, of which  $n-1$  are of one kind (**I**) and the rest of the other kind (o). This is a standard exercise; the answer is

$$(n-1+r)!/(n-1)!r! = C^{n+r-1}_r,$$

which proves the lemma.

For Bhaskara's problem, the  $n$  compartments may be taken to be the  $n$  positional places (to be filled by digits instead of balls). Now we can imagine the digits or the single digital numbers 1 to 9 to be represented by the corresponding number of vertical strokes (as was done by the Egyptians or Indus Valley people about 4000 years ago). For example, the 5-digit number 23125 will be represented as

||**I**||**I**||**I**||**I**||**I**||.

The only difference is that here empty space is not allowed. This is equivalent to having only  $S - n$  "strokes" to be distributed over the  $n$  places, so that  $r = S - n$ . Thus the required number of arrangements will be

$$C^{n+S-n-1}_{S-n} = C^{S-1}_{S-n} = C^{S-1}_{n-1},$$

as given by Bhaskara. The condition  $S < n + 9$ , or  $S - n < 9$ , is obvious here as no digit can exceed 9, and hence the number of additional "strokes" which can be placed in any compartment is necessarily less than 9.

Now we will work out the problem without the above restriction. For this we take another approach. We know that the total number of ways in which a score of  $S$  points can be depicted in a throw of  $n$  ordinary dice (each having six faces marked by dots or numbers 1 to 6) is equal to the coefficient of  $x^S$  in the expansion of

$$(x^1 + x^2 + x^3 + x^4 + x^5 + x^6)^n.$$

Similarly, if we take dice with nine faces each, marked by numbers 1 to 9, the total number of ways in which a score of  $S$  points will appear is the coefficient of  $x^S$  in

$$(x^1 + x^2 + x^3 + \dots + x^9)^n. \quad (4)$$

Here the score  $S$  is the sum of the numbers shown on the  $n$  faces of the dice thrown. These faces may be treated as cells or positional places on which any of the digits 1 to 9 may appear. For example, when 5 dice (each having nine faces) are rolled, the score sum 13 may appear as

$$[2][3][1][2][5].$$

With such an analogy, the total of  $n$ -digit numbers (formed from the digits 1 to 9) in which the digital sum is  $S$ , will be the coefficient of  $x^S$  in (4), or the coefficient of  $x^{S-n}$  in

$$(1 + x + x^2 + x^3 + \dots + x^8)^n.$$

With some simplifications, the required number will be the coefficient of  $x^{S-n}$  in  $(1-x^9)^n(1-x)^{-n}$  or in where we have used the result

$$n(n+1)(n+2)\dots(n+t-1)/t! = C^{n+t-1}_{n-1}.$$

The coefficient of  $x^{S-n}$  can now be easily collected in the above product of two series. Corresponding to  $r = 0, 1, 2, \dots$ , the values of  $t$  will be  $S-n, S-n-9, S-n-18, \dots$ . Thus the required number of  $n$ -digit numbers with fixed digital sum  $S$  will be given by

$$C^n_0 \cdot C^{S-1}_{n-1} - C^n_1 \cdot C^{S-10}_{n-1} + \dots + (-1)^r C^n_r \cdot C^{S-9r-1}_{n-1} \dots \quad (5)$$

where

$$n-1 \leq S-9r-1, \text{ or } r \leq (S-n)/9. \quad (6)$$

COROLLARY: Under Bhaskara's restriction (3), the value of  $r$ , by (6), will be less than unity. Hence only the first term in (5) will be taken in this case, and the required answer will be as given by him.

Example 1: Let  $S = 20$  and  $n = 5$ . Here we have by (6),  $r \leq 5/3$ , so that we can take  $r = 0, 1$  only. The answer will be, by (5),  $1 \cdot C^{19}_4 - 5 \cdot C^{10}_4 = 2826$ .

Example 2: Let  $S = 45$ ,  $n = 5$ . In this case, we get  $r \leq 40/9$ , so that  $r = 0, 1, 2, 3, 4$ . The required answer will be

$$C^{44}_4 - 5 \cdot C^{35}_4 + 10 \cdot C^{26}_4 - 10 \cdot C^{17}_4 + 5 \cdot C^8_4 = 1.$$

This is correct, since the only 5-digit number with digital sum 45 will be 99999.

### Have You Read?

Ronald Calinger, ed.

This column welcomes references from across the history or pedagogy of mathematics, as well as other works with sections that have potential for encouraging and motivating students to learn mathematics better or that enrich courses. Please send citations with complete bibliographic information to the section editor c/o Department of History, Catholic University of America, Washington, DC 20064, U.S.A.

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