

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

AN AFFILIATE OF THE INTERNATIONAL COMMISSION ON MATHEMATICS INSTRUCTION

No. 29

July 1993

HPM ADVISORY BOARD

John Fauvel, CHAIR
Mathematics Faculty
The Open University
Milton Keynes MK7 6AA
England, UK

Victor J. Katz, EDITOR
Department of Mathematics
University of the District of Columbia
4200 Connecticut Ave. N.W.
Washington, DC 20008 USA

George Booker AUSTRALIA; Jacques Borow-
czyk FRANCE; Ubiratan D'Ambrosio BRAZIL
(former chair); Florence Fasanelli USA (for-
mer chair); Lucia Grignetti ITALY; Hans
Niels Jahnke GERMANY; Maasouma Kazim
EGYPT; Israel Kleiner CANADA; Osamu Kota
JAPAN; Jan van Maanen NETHERLANDS;
Mohini Mohamed MALAYSIA; V. Frederick
Rickey USA (Americas Section chair); Edu-
ardo Veloso PORTUGAL

Calendar

1993 July 19 - 23
Montpellier
First European Summer University on the History of
Mathematics, organized by Evelune Barbin, Françoise
Lalande, and Yves Nouaze. (See inside for more

details.)

1993 August 2 - 7
Munich
Second Gauss Symposium, to be held at Ludwig-
Maximilians-Universität München. (See inside for
more details.)

1993 August 2 - 6
Bogotá
Fourth International Colloquium on the History and
Philosophy of Science. (See inside for more details.)

1993 August 15 - 19
Vancouver
Joint Summer Meeting of the American Mathematical
Society and the Mathematical Association of America,
in conjunction with the Canadian Mathematical
Society. (See inside for more details.)

1993 August 22 - 29
Zaragoza
Nineteenth International Congress of History of
Science. The Congress will consist of Symposia,
which will address themes of special interest, Scientific
Sections devoted to the various branches and periods
of the history of science and technology, and Poster
Sessions. (See inside for more details.)

1993 August 26 - 27
Tokyo
Second International Conference on Cultural History
of Mathematics. Contact Professor Shin Watanabe,
Faculty of Marine Science and Technology, Tokai
University, 3-20-1 Orito, Shimizu-shi, 424 JAPAN.
Tel: 0543-34-0411 or 0543-48-3629; Fax: 0543-34-
0862 or 0543-48-3629.

1993 September 18 - 19 Oxford
Annual residential meeting of the British Society for the History of Mathematics. The theme for the meeting is the History of Computation. (See inside for more details.)

1993 September 29 - October 1 Newcastle
Third Australian History of Mathematics Conference. For information, contact Bob Berghout, Department of Mathematics, University of Newcastle, Callaghan, NSW 2308, AUSTRALIA. Tel: 049 21 5546; Fax: 049 21 6898.

1993 November 11 - 14 Santa Fe
Annual meeting of the History of Science Society. Contact the program chairs, Paul Lawrence Farber, Department of History, Oregon State University, Corvallis, OR 97331-5102, USA; fax: 503-737-2434; e-mail: farberp@ccmail.orst.edu; or Margaret J. Osler, Department of History, University of Calgary, Calgary, Alberta T2N 1N4, CANADA; fax: 403-289-8566; e-mail: mjosler@acs.ucalgary.ca.

1994 January 12 - 15 Cincinnati
Annual meeting of the American Mathematical Society and the Mathematical Association of America. (See inside for more details.)

1994 March 28 - 31 Winchester, England
HIMED 94 (History in Mathematics Education) to be held at King Alfred's College in Winchester. (See inside for more details.)

1994 April 13 - 16 Indianapolis
Annual meeting of the Americas Section of HPM in connection with the annual meeting of the National Council of Teachers of Mathematics. More details will be forthcoming, but abstracts for presentations may be sent to Erica Voolich, 244 Summer St., Somerville, MA 02142.

1994 May 14-18 Nancy
Congres International Henri Poincaré will be held at the Archives of the Centre d'Etudes et de Recherche Henri-Poincaré. (See inside for more details.)

From the Chair

John Fauvel

Where are we going? One theme that has been raised several times in recent conversations is this: are we a small band of isolated enthusiasts or the tip of an ever-expanding tree? And indeed, who are "we"? My feeling, from a range of meetings and conversations over the past months, is that there are many more people who are quite strongly interested in the history of mathematics and curious about its use in mathematics education than surface as members of formal societies or as readers of this *Newsletter*. I believe we can move forward in confidence that many teachers across the world are in principle quite supportive of the possibilities of relating history and pedagogy of mathematics, and open-minded about its results. But, not to be complacent, it is worth thinking about how we come across to colleagues in general.

How do we relate -- how do *you* relate -- to colleagues who are teaching mathematics with no historical input? In terms of institutional dynamics, there can be an interesting relation between those promoting the pedagogic use of history of mathematics and other members of staff. Here is territory ripe for misunderstandings! And not at only one educational level: my friend Helen who is exploring history of mathematics with primary-school children (8 to 10 year olds) is viewed with a mixture of emotions by some of her teaching colleagues just as much as those at a later educational stage.

These thoughts were stimulated by a visit I paid at the end of April to Reinhard Laubenbacher and David Pengelley in New Mexico. Their course based on original sources, *Great theorems: The art of mathematics*, was described in the last *Newsletter* (28, pp. 9-10). It is interesting that a course seen by its progenitors as a mathematics course is seen by other colleagues as a history course. And, of course, student perceptions of such a course cover a wide range which depends on their expectations and backgrounds, as Daniel Otero drew attention to in describing his historical calculus course (*Newsletter* 28, pp. 7-9). In evaluating the progress of the HPM movement it

would be useful to consider questions of institutional dynamics — how HPMers are regarded, whether supported and seen as central to a department's mathematics teaching or as marginal eccentrics to be humoured! If you have any feelings, perceptions or experiences of this issue, do consider writing them down and sharing them with other readers of the *Newsletter*.

I end with two remarks openly addressed to the Editor, Victor Katz. First, congratulations on the new look of the *HPM Newsletter*. The added flexibility of a desktop publishing system is a noticeable development. Secondly, further congratulations on the publication of your textbook, *A History of Mathematics: An Introduction* (HarperCollins, 1993). For those who have not yet seen a copy, this is undoubtedly the best available text at college level, alert to the latest results of modern historical scholarship, yet clearly written with deep pedagogic concern permeating every new feature of the book. I don't know how Victor finds the time to write a book of such painstaking quality as well as to edit our *Newsletter* and do all the other things he does, but we continue to be greatly in his debt.

From the Editor

I would like to add a word to John's note on where we are going. In the United States, at least, we (whoever we are) are making progress in introducing more and more people to the use of history in teaching. As one example among many, Don Albers, the Associate Executive Director of the Mathematical Association of America, recently convened a meeting of visiting historians in Washington to give him advice as to how and where the M.A.A. could incorporate more history into its many activities. Many suggestions were offered and will be acted upon, and the group will continue to give advice. Among the M.A.A.'s forthcoming publications are two books dealing with history and pedagogy. One is *Learn from the Masters*, the proceedings of a conference on the use of history in teaching held at Kristiansand, Norway in 1988. The second, which will (hopefully) appear in January, 1994 in time for the annual meeting, is the book, edited by Ron Calinger, arising out of the HPM meetings held in Toronto and Quebec in

August of 1992. Look for — and purchase — these books; share them with your colleagues; and use them in your classroom. You and your students will all benefit.

HIMED 93

Costel Harnasz

After finding my way down into the bowels of Birkbeck College (London) on the morning of April 24, and encountering the usual group of people also hunting for the starting location, success was achieved as a pair of doors opened up into a foyer where already groups of familiar (and new) faces were chatting, drinking tea and coffee, or browsing through the books on display. Some of the main functions of such a day were already well under way! Once inside, Harkness Hall is a rather attractive modern low roofed lecture theatre, and it was in there that we were warmly welcomed by Steve Russ as the formal part of the day began. Together with co-organiser Sue Burns, Steve explained that the workshops would provide opportunity to work on draft materials prepared as part of new 'A' levels in mathematics and for us to make comments on them. Of course, there would be ideas to bring away for our teaching.

But first we were given a talk by Karine Chemla, on *Algorithms in Chinese Mathematics*, based on material contained in the most important book of the ancient Chinese mathematical tradition, the *Nine Chapters on the Mathematical Art*, and the commentaries written on it by Liu Hui in the 3rd century. She brought us up to date with recent discoveries, and it was interesting to note how this algorithmic theme was to be reiterated during the day, in one form or another (and incidentally will form a central theme of our History of Computation conference this autumn). Later on Karine told me that she had flown in that morning from Strasbourg, where she had been one of the organisers of a European Science Policy conference!

From there we split into our various workshops. These were, for the morning and afternoon sessions (with names of organisers in parentheses)

- Babylonian (Gerry Van der Heuvel & Anko Haven)
- Greek (Peter Ransom)
- Arabic (George Joseph)
- Navigation (Peter Ransom)
- Descartes (Paul Templaar)
- Calculus (Paul Garcia)
- Abstract Structure (Ruth Farwell)
- Statistics (Jan Dangerfield)
- Enterprising Maths (John Deft)

As is typical of HIMED, there was a pronounced international flavour. Besides Karine, I am thinking of the participation of the contingent from Holland, and it was in one of their sessions that I tried to decipher the content of a Babylonian tablet, noting along the way a section on the "square root algorithm." Of personal interest, and this is one of the things that makes conferences for me, I discovered material on the astronomy of the period which I'd not come across before, and I was able to discuss and get the references first hand. In my next session, I enjoyed taking part in one of the three activities available, which was making a "structure diagram" of one of Euclid's propositions, i.e., building a network which showed the propositions upon which it was dependent, ultimately rooted in the bedrock of axioms and definitions. Again, personal interest was awakened when I discovered that this exercise was one that Thomas Hobbes, who is buried near my home town of Mansfield, had carried out of his own accord some 350 years ago, with the result that "this made him fall in love with Geometry." Algorithms popped up again in the form of Proclus' methods for finding Pythagorean triples and turning them into programs on the latest hand-held graphics calculators. There was also an activity around an audio tape which featured an account of the death of Hypatia, and my next session in fact began with a dramatised account of the birth of calculus which Paul Garcia went to immense effort to prepare by contacting the BBC. Again a personal interest story here, when I discovered that the actor playing Leibniz - Albert Welling - was somebody I'd once been in a play with while at university! That apart, the significant feature is the emergence of a growing body of mathematical material in this dramatic form, and I recalled that excellent session at the History and Pedagogy of

Mathematics conference in Toronto last year when Gavin Hitchcock enlivened us with a series of playlets on episodes in the history of mathematics.

Alas, one can't go to everything, and all too soon it was back to Harkness Hall for tea and the last minute "shall I buy that book or not?" I gave a talk about certain issues that arose in conjunction with the invention of the circular slide rule in the early 17th century. Finally, Sue Burns rounded the day off with an account of the latest developments and considerations concerning the use of calculators in the classroom today. So, a day that had begun in China centuries ago had brought us neatly to the here and now!

CSHPM in Ottawa

Tom Archibald

The Canadian Society for the History and Philosophy of Mathematics had its Annual Meeting at Carleton University in Ottawa from May 30 to June 1, 1993. Twenty-three papers on a variety of subjects were presented, and this year there was a special emphasis on the philosophy of mathematics.

The following talks contained material of special interest to readers of this *Newsletter*. William Anglin (Luther College, Regina, Saskatchewan) discussed various interpretations of the clay tablet Plimpton 322 which contains certain Pythagorean triples. Samuel Kutler (St. John's College, Annapolis, MD) discussed a method for producing Pascal's triangle based on a Platonic injunction. P. Rajagopal (York University, Toronto) presented a survey of South Indian work on infinite series, 1400-1600, and discussed the differences of the Indian tradition from the European one.

There were two talks on the history of the calculus of variations, by Erwin Kreysig (Carleton University, Ottawa) and Craig Fraser (University of Toronto). In other areas of the history of mathematics, K. L. Hill (University of Toronto) discussed infinity and continua in the work of Barrow and Wallis; Jim Tattersall (Providence College) surveyed the contributions (or lack of them) of

William Whiston, Newton's successor in the Lucasian chair; Tom Archibald (Acadia University, Nova Scotia) spoke on the transmission of French techniques to England in the early nineteenth century, with special emphasis on the work of George Green; and Martin Muldoon (York University, Toronto) spoke on the mathematical interests of Eamon de Valera.

A talk aimed specifically at the classroom presentation of the concept of marginality (as used in economics) was presented by Thomas Bartlow (Villanova University, PA). Abe Shenitzer (York University, Toronto) presented a survey of major conceptual developments in integration theory from antiquity to the 20th century. This paper reflected joint work with J. Steprāns.

Next year's meeting of the society will be held in Calgary, Alberta from June 4 to June 6. The Society welcomes new members, who may present papers at the meeting and who will receive the *Proceedings* of the Annual Meeting and a Newsletter.

Americas Section of HPM

Karen Michalowicz

The Americas Section of HPM met in connection with the annual meeting of the National Council of Teachers of Mathematics in Searde from March 31 to April 3, 1993. The first session of HPM was on Friday evening, April 2. At that time, Barnabas Hughes, Fred Rickey, and Karen Michalowicz spoke.

Barnabas Hughes' talk on *The book of more or less* discussed ancient applications of algebra. Fred Rickey gave a slide show using overheads created from illustrations in a number of rare mathematics texts. Karen Michalowicz spoke on the history of the abacus and its use in the middle school classroom.

On Saturday, the HPM members met with the International Study Group on Ethnomathematics. Discussion centered around the role of history in Ethnomathematics. By the broad definition of Ubiratan D'Ambrosio, the history of mathematics is

only one small facet of Ethnomathematics. D'Ambrosio considers such ideas as the mathematics of the carpet layer to be a part of ethnomathematics.

Following the HPM/Ethnomathematics meeting, Fred Rickey, Duane Deal, Erica Voolich, and Karen Michalowicz met to discuss the application for NCTM affiliation. Affiliation with NCTM would entitle the Americas section of HPM to have an NCTM delegate and to have input into information printed in programs and in the *NCTM News Bulletin*. It is believed that information printed in the annual program and the *Bulletin* will encourage more membership among secondary teachers. The group looked at a constitution prepared by Jerry Johnson and made some modifications. A copy of the proposed constitution will be printed in a future issue of the *Newsletter*. Comments will be requested so that a final copy of the constitution can be approved at the HPM meeting in Indianapolis in April, 1994. Fred Rickey and Karen Michalowicz will take care of the paper work and any other dealings with the NCTM.

First European Summer University: History and Epistemology in Mathematics Education

The first European Summer University organized by the IREM (Institutes of Research into Mathematics Education) is taking place in Montpellier (in the south of France) from July 19 - 23, 1993. This Summer University is intended for teachers of mathematics from schools, colleges and universities, and those engaged in research into the history or didactics of mathematics, as well as teachers of philosophy, history and physical sciences.

The Summer University is intended both for those who have no experience in using historical approaches in the teaching of mathematics and for those who already have some experience in this field. If this approach is new for you, you will receive guidance and share in the experiences of other teachers who have explored the use of history in their teaching. If you are already involved in using history, you will find many other colleagues in the field with whom to exchange ideas and experiences. The mixture of workshops and general lectures by eminent scholars

will provide a rich environment to give everyone a solid grounding in the historical approach to teaching. A Certificate of successful course completion will be provided.

The official languages of the Summer University will be French and English.

The program involves five plenary lectures: *On Mediterranean Mathematics*, by Christian Houzel; *On the History of Algebra*, by Jens Høyrup; *On the History of Geometry*, by Jean-Claude Pont; *On Comparisons between Mathematical Teaching in France and in Great Britain from a Historical and Cultural Point of View*, by Bruno Belhoste and Leo Rogers; and *On Ethnomathematics*, by Ubiratan D'Ambrosio.

The program (not definitive) also involves:

- Workshops on the historical construction of mathematical knowledge through the reading of original texts. These workshops will be presented by Evelyne Barbin, Otto Bekken, Joëlle Delattre, Michel Guillemot, Gilles Itard, IREM du Mans, J. Pierre Legoff, Michel Levard, M:ATH, Henri Plane, Luis Radford, Karin Reich, Steve Russ, and Klaus Volkert.

- Workshops on reports of experiences of introducing a historical perspective into the teaching of mathematics. Presenters include Neil Bibby, Anne Boye and J. Luc Le Chevalier, J. Pierre Friedelmeyer, Jean-Paul Guichard, Costel Harnasz, IREM de Toulouse, IREM de Poitiers, Marjolein Kool, M:ATH, Peter Ransom, Roland Rosenfeld, Jacky Sip, Constantinos Tzanakis, and Greisy Winicki.

- Workshops on reports of courses in the history of mathematics for initial and inservice teacher training. Speakers include Gertrudes Amaro, Michel Ballieu, Jacques Borowczyk, Eliane Cousquer, J. Michel Delire, IREM de Caen, IREM de Nantes, and Danièle Scheier.

- A panel on the place of the history of mathematics in mathematical teaching and the curriculum of many European countries, including France, Germany, Greece, Great Britain, Italy, the Netherlands, and Portugal.

- A panel on the place of the history of mathematics in initial and in-service teacher training in many European countries, including Denmark, Belgium, France, Germany, Great Britain, Italy, and the Netherlands.

- Talks on the relationship between mathematics education and the culture in which it occurs (including the history of mathematics education) by Ali Assem, Annie Barte, Jaroslav Folta, Jean Dhombres, Marie-Josée Durand-Richard, Athanasios Gagatsis, Hélène Gispert, Marta Menghini, Mariano Hormigon, Albert Krayer, Luigi Pepe, Siegbert Schmit, and Harm Jan Smid.

- Talks on the relationship between epistemology and didactic and pedagogical questions by Faiza Assem-Medjber, Benaouada and Mohamed Bennaceur, Didier Bessor, Rudolf Bkouche, Pier Luigi Ferrari, Athanasios Gagatsis and Yoannis Thomaidis, Shin Huyn Sung, Nikos Kastanis and Stéphanie Zionpoulou, Manfred Kronfeller, Marisa Krysnika-Grand'-Henry, Rachid Bebbouchi, and Anna Sfar.

- Talks on the history of Mediterranean mathematics by Didier Bessor and J. Pierre Legoff, Sabine Koelblen, and J. Luc Verley, talks on ethnomathematics by André Cauty, Isabel Soto, and Gelso Knijnik, and talks about the historical construction of mathematical knowledge by Rachid Bebbouchi, Luis Morello Armella, Guillermina Waldegg, and Michel Serfati.

During your stay, you can visit the beautiful and old town of Montpellier and the beaches of the Côte du Languedoc and attend the celebrated Music Festival.

The registration fees are 500 FF (including some lunches). Accommodations are available in a Campus residence. The price for a single room is 300 FF for five nights. Breakfast costs 12 FF and dinner costs 30 FF. To register, please call or fax IREM de Montpellier, Université d'été, Université de Montpellier II, Place Eugène Bataillon, 34095 Montpellier Cedex, FRANCE. Tel: (33) 67 14 33 83; Fax: (33) 67 14 39 09.

2nd Gauss Symposium

The theme of this symposium, to be held from August 2 - 7 at the Ludwig-Maximilians-Universität München, is the direct and indirect thrust of Gaussian works in all areas of mathematical sciences. Among the sections of interest to readers of this *Newsletter* are A.0, Mathematical Education, chaired by Lisa Hefendehl-Hebeker (Lehrstuhl für Didaktik der Mathematik, Universität Augsburg, Universitätsstraße 10, W-8900 Augsburg, GERMANY) and A.1, History of Mathematics, chaired by Ivo Schneider (Institut für Geschichte der Naturwissenschaften Ludwig-Maximilians-Universität, Deutsches Museum, Postfach 26012, W-8000 München 26, GERMANY). Among the speakers in the latter section are E. Knobloch (Berlin), J. von Plato (Helsinki), K. Reich (Stuttgart), and H. Wussing (Leipzig). For more information, contact Dr. Michael Toepell, Mathematisches Institut, Universität München, Theresienstraße 39, W-8000 München 2, GERMANY.

Fourth International Colloquium on Philosophy and History of Mathematics

El propósito de estos eventos es estimular en Colombia y demás países latinoamericanos el estudio de la historia, la filosofía y la enseñanza de las matemáticas en su estrecha relación con las dos disciplinas anteriores. Los temas centrales del Coloquio son:

- Matemáticas y Filosofía
- Filosofía de la Matemática
- Historia de las Matemáticas
- Historia de la Lógica
- Historia y Pedagogía de las Matemáticas

Se pretende igualmente servir de estímulo a los investigadores en las áreas en referencia.

Además de Coloquio, que tendrá lugar entre el 2 y 6 de agosto de 1993 en la Universidad Nacional de Colombia, en Santafé de Bogotá, se realizarán entre el 26 y 30 de julio de 1993 cursillos introductorios, con una intensidad de dos horas diarias, en los temas del Coloquio. A la fecha están

programados los siguientes cursillos:

1. *El Cálculo de Chevalieria Cauchy*, por el doctor Ivor Grattan-Guinness del Middlesex Polytechnic, Gran Bretaña.
2. *Tendencias actuales en filosofía de las matemáticas*, por el doctor Javier de Lorenzo de la universidad de Valladolid, España.
3. *La prueba matemática en Grecia*, por el doctor Luis Vega Reñón, Universidad a Distancia, Madrid.
4. *El uso de la historia en la pedagogía de las matemáticas*, por la doctora Florence Fasanelli, SUMMA, USA.
5. *Haciendo historia de las matemáticas*, por el doctor Alejandro Garciadiego, UNAM, México.
6. *Temas de filosofía de la matemática*, por el doctor Francisco Rodríguez Consuegra, Universidad de Barcelona, España.

For more information, contact Victor S. Albis, Sociedad Colombiana de Matemáticas. Tel: (571) 2216829; Fax: (571) 2686780; Email: FILOSOFI@UNALCOL.bitnet

AMS-MAA Summer Meeting in Vancouver

The annual joint summer meeting of the American Mathematical Society and the Mathematical Association of America will take place August 15-19 in Vancouver. Among events of interest to readers of this *Newsletter* is an MAA contributed paper session in the history of mathematics, organized by Fred Rickey and Jim Tattersall, which will take place on Monday and Tuesday afternoons, August 16 and 17. The speakers and their topics include Reinhard Laubenbacher and David Pengelley, *Sophie Germain's contributions to Fermat's Last Theorem: Some unanswered questions*; Francine Abeles, *The birth of the automatic calendar*; Richard Pfeifer, *The remarkable tenacity of random triangles*; Daniel E. Otero, *A chronology of the duplicatrix*; Herbert E. Kasube, *The*

role of the history of mathematics in the undergraduate curriculum; Ernest J. Manfred, *A history of stereographic projection*; Kay Gura, *Using history to spark interest in mathematics for liberal arts students*; Leon Harkleroad, *Rozsa Peter: New findings*; Steven H. Heath, *The history, logic, and arithmetic of a well-known mathematical object - the baseball box score*; Kailash K. Anand, *Canadian women in mathematics from the early nineteenth century to the present time*; Kaila Katz, *Standard sources cited for historical material used in mathematics and computer science texts and journals: An evaluation*; Leonard Feldman, *Crystal to microchip: A brief history of elementary algebra texts*; P. Rajagopal, *Two derivations from the Tantrasangraha of Nilakanta (1444-1543)*; George Kung and Dale M. Rohm, *At random: Bertrand's paradox in probability and simulation*; and Dona Henderson and Clare Wagner, *Why do we use that?*

XIXth International Congress of History of Science

The 19th International Congress of the History of Science will take place in Zaragoza, Spain from August 22 - 29, 1993. Much of the program will be of interest to historians of mathematics. Symposia dealing with mathematics, which will have several invited speakers each, include "Some aspects of mathematics in the 20th century," organized by Pierre Dugac (France), Jean Mawhin (Belgium), and Jean-Paul Pier (Luxemburg); "Arts and mathematical sciences," organized by Eberhard Knobloch (Germany) and Kirsti Andersen (Denmark); "Logic and the foundations of mathematics (1885-1905)," organized by Ivor Grattan-Guinness (Great Britain) and F. Rodriguez-Consuegra (Spain); "The impact of the computer on the sciences," organized by Javier Echeverria (Spain) and William Aspray (U.S.A.); "History of model theory," organized by H. Sinaceur (France), Gabriel Sabbagh (France), and H. Jerome Keisler (U.S.A.); "Mathematization of the biological, economic and social sciences," organized by Giorgio Israel (Italy) and Claude Menard (France); "Algebra and curves: 16th-17th centuries," organized by E. Giusti (Italy) and Henk Bos (The Netherlands); "The theory of parallels up to the end of the 19th century," organized by Alberto Dou (Spain), Boris A. Rosenfeld (U.S.A.), and Jean-Claude Pont (Switzerland); "Mathematical and philosophical aspects of probability

theory between 1800 and 1950," organized by Ivo Schneider (Germany) and Marisol de Mora (Spain); "The historical role of algebraic and discrete methods in infinitesimal calculus," organized by Craig Fraser (Canada) and Niels Jahnke (Germany); "Formation of mathematical schools in the 19th and 20th centuries," organized by Sergei Demidov (Russia) and Mariano Hormigon (Spain); "Pre-columbian mathematics, astronomy and modes of thought," organized by Leonel Aldana Morales (Guatemala) and Michael Closs (Canada); "Ethnomathematics and ethnohistory and the recovery of the history of science," organized by Ubiratan D'Ambrosio (Brazil) and Paulus Gerdes (Mozambique); "Analysis and synthesis in mathematics: philosophy, history and historiography, a methodological discussion," organized by Michael Otte (Germany) and Marco Panza (Switzerland); and "Historiography of history of mathematics," organized by Joseph Dauben (U.S.A.) and Christoph J. Scriba (Germany).

There will also be scientific sections of short papers. The ones in mathematics include "Mathematics in antiquity," "Medieval mathematics," "Mathematics in early modern Europe," "Probability and statistics," "Mathematics and applications," "Mathematics in the 19th century," and "Mathematical trends in the 20th century."

For more information, contact Comité Organizador del XIX Congreso Internacional de Historia de la Ciencia, Facultad de Ciencias (Matemáticas), Ciudad Universitaria, 50009 Zaragoza, SPAIN; tel: (76) 357180; fax: (76) 565852; e-mail: ichts@cc.unizar.es.

British Society for the History of Mathematics Autumn Residential Meeting

The theme of the annual BSHM residential meeting, to be held on September 18 and 19 at Rewley House, University of Oxford, is The History of Computation. Among the speakers are Bill Aspray, *von Neumann*; Martin Campbell-Kelly, *Victorian data-processing*; Mary Croarken, *L.J. Comrie: a centenary talk*; Willem Hackmann, *Computational instruments in the Museum of the History of Science*; Eduardo Ortiz, *From tables to algorithms*; Steve Russ, *The history of*

algorithms Ian Stewart, *The unfolding of chaos* Doron Swade, *Charles Babbage* Glan Thomas, *Boole and AI* John Tucker, *On the history of software*, and Sister Benedicta Ward, *Bede and the computus*. For more information, contact John Fauvel at the address on the first page.

AMS-MAA Annual Meeting

The 1994 joint annual meeting of the American Mathematical Society and the Mathematical Association of America, to be held January 12-15, 1994 in Cincinnati, will again have events of interest to readers. As mentioned in the editorial, it is hoped that the M.A.A. publication of the volume growing out of the HPM meetings in Toronto and Quebec will be available. All participants from those meetings in attendance at Cincinnati will be invited to get together for a reunion. There will also be an A.M.S. special session in the history of mathematics which is being organized by Victor Katz and Tom Archibald. The papers are by invitation, but anyone who is interested in presenting may contact one of the organizers by September 1. They can best be reached by email: vkatz @ udevax.bitnet or archi @ ace.adaiau.ca.

HIMED 94

A residential conference on the value and use of history in mathematics education will be held at King Alfred's College, Winchester, England on March 28-31, 1994. It is the fifth annual event designed to bring together researchers and teachers at all levels of education to explore issues around the educational use of history of mathematics. Past meetings in this series have established the fruitful interplay between those interested in the history of mathematics from a variety of perspectives.

The conference is from Monday to Thursday, the week before Easter, in this very beautiful and historic cathedral city in southern England. The programme is to contain a rich variety of workshops to explore the themes of the conference in particular case studies. Suggestions and proposals for workshops are invited. We welcome contributions at all levels of mathematics education (primary, secondary and

tertiary) as well as sessions relating to the needs of trainee teachers and in-service work. This is an opportunity to try out materials you may be developing, as well as sharing ideas which have worked for you in the past. Workshop sessions are open-ended and flexible – in particular, the range of activities could cover talks and dramatic events as well as workshops (in the sense of sessions where the participants work together on an activity plan). We invite proposals for activities – an abstract of a proposed talk or an outline of a proposed workshop or of some other kind of session – for consideration by the programme committee. The time-module will be 45 minutes, although some double sessions of 90 minutes will be possible.

HIMED 94 is organised by the British Society for the History of Mathematics. We hope that some assistance with expenses for workshop leaders will be available. Proposals should be sent, by 31 August 1993, to Pat Perkins, 5 Tower Road, Orpington, Kent BR6 0SG, U.K.

Congres International Henri Poincaré

Récemment fondé à Nancy, le centre d'archives et de recherche Henri Poincaré organise en Mai 1994 son premier congrès international. Ce congrès sera divisé en deux sections. La première traitera de la logique non-frégéenne en rapport avec le pragmatisme et la phénoménologie; la seconde sera consacrée à l'étude des travaux de Poincaré, et notamment de ses conceptions sur la physique mathématique, l'espace et la géométrie. Pour de plus amples informations, écrivez à l'adresse suivante: Archives – Centre d'Etudes et de Recherche Henri-Poincaré (ACERHP), Université de Nancy II, F-54 000 Nancy, FRANCE. Fax: (33) 83 96 23 47; e-mail: heinzman@plg.u.-nancy.fr.

Research Group on the History of Mathematics at the Federal University of Paraná

Clóvis Pereira da Silva, Departamento de Matemática - UFPR, Caixa Postal 19081, 81531-970, Curitiba - PR, BRAZIL

This report reviews the activities of a research group working at the Department of Mathematics of

the Federal University of Paraná. Permanent participants of this group are Dr. Clóvis Pereira da Silva, scientific supervisor; Dr. Alvino Moser; Dr. Ubiratan D'Ambrosio; Dr. Potiguara A. Pereira; Dra. Circe Mary Silva da Silva; M.Sc. Edson Andretta; M.Sc. Maria Salett Biembengut. The group is engaged in activities which will be fully described below.

RESEARCH CONCERNING THE HISTORY OF BRAZILIAN MATHEMATICS

This research focuses mainly on the history of Brazilian mathematics (university and secondary school levels), because it is important for Brazilian scientists to rescue our scientific memory as a country of the third world. The group of Curitiba is studying, for instance, the influence of Comte's positivist ideology in the development of Brazilian mathematics from 1850 to 1930. The group is also studying the influence of foreign mathematicians who came to Brazil from 1934, for example, Luigi Fantappiè, Giacomo Albanese, Gabrielle Mammana, Luigi Sobrero, André Weil, Oscar Zariski, Jean Dieudonné, Alexander Grothendieck, Jean A. F. Delsarte, Antônio A. Ribeiro Monteiro, Manuel Saluar Nunes, and José Morgado, among others.

The group is studying in particular the contributions of Joaquim Gomes de Sousa, Otto de Alencar Silva, Manoel Amoroso Costa, Lélío Gama, and Theodoro A. Ramos to the development of Brazilian science. The guiding idea is to trace some fundamental trends which can be detected in the historical development of European science when seen within the context of the physical and mathematical sciences, and to study various attempts to transfer these same to our context in the 19th century.

This conceptual framework focuses attention on the development of mathematical science in Portugal and Italy, for instance, in the University of Coimbra in the 16th, 17th, 18th and 19th centuries, in which were studied the first "lentes" of the Royal Military Academy of Rio de Janeiro, founded in 1810. The group will study the influence of Antônio A. R. Monteiro and the group of Recife (the Portuguese) in the development of mathematics in Brazil from 1945.

With respect to a link between Brazilian and Italian mathematics, this will be demonstrated by the study of the influence of Luigi Fantappiè (who was Volterra's student), Giacomo Albanese, Gabrielle Mammana and Luigi Sobrero in the development of Brazilian mathematics. For instance, Fantappiè was the initiator of the mathematics library of the University of São Paulo.

THE SEMINAR ON HISTORY OF MATHEMATICS

Starting with the academic year of 1993, the group of Curitiba has organized a seminar with lectures on the history of Brazilian mathematics. Leading mathematicians have planned to promote the exchange of ideas among mathematicians and historians of mathematics.

SCIENTIFIC COLLABORATION

The research group has interest in maintaining working relationships with several scientists abroad, in particular with Portuguese scientists. Finally, the group of Curitiba is interested in maintaining contact with research groups on the history of mathematics of other countries.

ARCHIVAL RESEARCH

The group of Curitiba intends to promote a project to organize the files of Brazilian mathematicians. This project is under the direction of Dr. Clóvis Pereira da Silva in collaboration with the archivists from the Federal University of Paraná.

The Mahāvīra-Fibonacci Device to Reduce p/q to Unit Fractions

R. C. Gupta, Department of Mathematics, Birla Institute of Technology, P.O. Mesra, Ranchi-835215, INDIA

It is well known that unit fractions were widely used in ancient Egypt. The *Rhind Mathematical Papyrus* of about 1650 B.C. contains a remarkable table in which the fraction $2/N$ has been expressed as a sum of unit fractions for each odd value of N from 5 to 101. Such a table was needed for the

Egyptian dyadic arithmetical process of multiplication and division through duplation and mediation. A few entries in the table are these [1]:

$$\frac{2}{5} = \frac{1}{3} + \frac{1}{15} \quad (1)$$

$$\frac{2}{13} = \frac{1}{8} + \frac{1}{52} + \frac{1}{104} \quad (2)$$

$$\frac{2}{43} = \frac{1}{42} + \frac{1}{86} + \frac{1}{129} + \frac{1}{301} \quad (3)$$

How the table was obtained is not explained in the *RMP*. It has been discussed by a number of scholars, and several suggestions have been made. But no single rule has been found so far which will enable us to derive all the entries of the table. However, it is believed that the Egyptians knew and used a set of rules for the purpose. For example, it is easily seen that all the entries for the fractions of the type $2/3n$, where $n = 3, 5, 7, \dots, 33$, follow the trivial decomposition

$$\frac{2}{3n} = \frac{1}{2n} + \frac{1}{6n} \quad (4)$$

It must be noted that the representation of any fraction is not unique. For example, in addition to (2), we also have

$$\frac{2}{13} = \frac{1}{7} + \frac{1}{91} \quad (5)$$

$$\frac{2}{13} = \frac{1}{9} + \frac{1}{24} + \frac{1}{936} \quad (6)$$

and so on. And it is not clear as to why one form was preferred out of the infinitely large number of possible decompositions.

Now we describe an elegant method for reducing any given fraction p/q ($q > p$) to a sum of unit fractions in a systematic way. Mahāvīra in his famous compendium *Gayitasārasaṅgraha* (circa A.D. 850) gives the following rule in this connection [2]:

The denominator (of the given fraction) when combined with an optional number (say, x) and then divided by the numerator so as to leave no remainder, becomes the denominator

(say, r) of the first numerator (which is one). The optional number divided by this (that is, r) and by the denominator of the given fraction is the remaining term which may be similarly treated further (if needed).

That is, we add a suitable number x to q such that $q + x$ becomes exactly divisible by p . Let $(q + x)/p = r$. Then the above rule states that

$$\frac{p}{q} = \frac{1}{r} + \frac{x}{rq} \quad (7)$$

In case the second term on the right hand side is not a unit fraction, it can be subjected to a similar treatment.

Example 1: Let $p/q = 2/5$. Taking $x = 1$, we see that $q + x (= 6)$ is divisible by $p (= 2)$. Thus $r = (q + x)/p = 3$, and hence by (7),

$$\frac{2}{5} = \frac{1}{3} + \frac{1}{15}$$

which is the same as the *RMP* result (1).

Example 2 (from Mahāvīra): Let $p/q = 3/7$. consider $7 + x$. We take $x = 2$ to make $7 + x$ divisible by 3. Thus $r = 9/3 = 3$, and by (7),

$$\frac{3}{7} = \frac{1}{3} + \frac{2}{21} \quad (8)$$

Now consider the fraction $2/21$. We can easily see that by applying (7) with $x = 1$ here, we get

$$\frac{2}{21} = \frac{1}{11} + \frac{1}{231}$$

Hence (8) becomes

$$\frac{3}{7} = \frac{1}{3} + \frac{1}{11} + \frac{1}{231} \quad (9)$$

Example 3: Take $p/q = 2/13$. Here $q + x = 13 + x$. If we take $x = 1$ (the minimum value), we shall get

(5) by using Mahāvīra's rule (7). But if we take $x = 3$, we get by (7),

$$\frac{2}{13} = \frac{1}{8} + \frac{3}{104}. \quad (10)$$

Similarly, $3/104$ can be reduced in different ways. However, we get (2) from (10) by the trivial decomposition

$$\frac{3}{104} = \frac{2+1}{104} = \frac{2}{104} + \frac{1}{104}. \quad (11)$$

Nevertheless, it is but natural and logical to choose the minimum value of x in applying Mahāvīra's rule (7). A simple procedure will be to increase the denominator q by choosing x from the set $1, 2, 3, 4, \dots$ successively, and stopping when $q+x$ becomes just a multiple of p . In this case the first term $1/r$ in (7) will represent the largest unit fraction which can be separated from p/q . Also to get the other terms the following practical device may be applied directly:

$$\begin{aligned} \frac{3}{7} &= \frac{3}{9} + \left(\frac{3}{7} - \frac{3}{9} \right) = \frac{1}{3} + \frac{2}{21} \\ &= \frac{1}{3} + \frac{2}{22} + \left(\frac{2}{21} - \frac{2}{22} \right) \\ &= \frac{1}{3} + \frac{1}{11} + \frac{1}{231}. \end{aligned}$$

Fibonacci (about A.D. 1200) is said to have used such a device in his *Liber Abaci* [3].

REFERENCES

1. R. J. Gillings, *Mathematics in the Time of the Pharaohs* (Cambridge: MIT Press, 1975), p. 50.
2. M. Rangacharya (ed. and trans.), *Āpītasārasaṅgraha* (Madras: 1912), chapter III, verse 80.
3. E. Sondheim and A. Rogerson, *Numbers and Infinity: A Historical Account of Mathematical Concepts* (London: Cambridge University Press, 1981), p. 11.

Historical Connections in Mathematics

AIMS Educational Foundation has just released Volume 2 of *Historical Connections in Mathematics* by Wilbert Reimer and Lucretia Reimer. This book is a collection of resources to help teachers increase interest and deepen understanding of mathematics by placing it in historical and human context. This collection includes biographical information, famous quotations, fascinating anecdotes, and more than 80 illustrations from the lives of ten mathematicians: Thales, Euclid, Heron, Hypatia, Banneker, Babbage, Galois, Lovelace, Kovalevsky, and Ramanujan. Each chapter includes an attractive 8½ by 11 inch portrait of the mathematician and four or five ready-to-use classroom activities related to the work of the mathematician. These reproducible activity sheets invite students to participate in critical thinking, pattern recognition, hands-on learning experiences, and a variety of problem solving techniques.

The book (appropriate for grades 4-10) offers creative suggestions for integrating math history into teaching and for making linkages with other disciplines such as science and language arts. Complete solutions to the activity sheets and a useful list of references are included.

The Reimers, both professors at Fresno Pacific College, Fresno, California, are also the authors of *Mathematicians Are People, Too*, published by Dale Seymour Publications in 1990, and Volume 1 of *Historical Connections*.

Historical Connections: Volume 2 is available for \$14.95 (U.S.) from AIMS Education Foundation, P.O. Box 8120, Fresno, CA 93747, USA. Tel: (209) 255-4094; Fax: (209) 255-6396.

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.

- Addison-Wesley, *Multiculturalism in Mathematics, Science and Technology: Readings and Activities and A World of Mathematics, Science, and Technology Wall Chart* (Reading, MA.: Addison-Wesley, 1992). The first is a book of readings and activities designed for secondary students which include the history and accomplishments in science and mathematics of people that have generally been underrepresented in school materials. The second is a wall chart which provides a visual sample of the contributions to mathematics, science, and technology of both women and men, from various cultures around the world, in the distant past and in recent times.
- Ascher, Marcia, "Before the Conquest," *Mathematics Magazine* 65 (1992), 211-218.
- Ayoub, Raymond, "What is a Napierian Logarithm?" *The American Mathematical Monthly* 100 (1993), 351-364.
- Detlefsen, Michael, ed., *Proof and Knowledge in Mathematics* (New York: Routledge, 1992).
- Diagne, Souleymane Bachir, *Boole, 1815-1864: L'oiseau de nuit en plein jour* (Paris: Beilin, 1989).
- Gaukroger, Stephen, ed., *The Uses of Antiquity: The Scientific Revolution and the Classical Tradition* (London: Kluwer Academic Publishers, 1991).
- Gilmer, Gloria, Soniat-Thompson, Mary, and Zaslavsky, Claudia, *Building Bridges to Mathematics: Cultural Connections* (Reading, MA.: Addison-Wesley, 1992). These are kits available for grades K-8 as supplements to *Addison-Wesley Mathematics*. Each kit includes an activity card for each chapter of the relevant text. The activities strengthen mathematics skills while celebrating cultural contexts, settings, and contributions to mathematics from people of diverse cultures and eras in history.
- Grande, John Del, "The Method of Archimedes," *Mathematics Teacher* 86 (1993), 240-243.
- Grant, Hardy, Kleiner, Israel, and Shenitzer, Abe, eds., *Proceedings of the CSHPM/SCHPM 17th Annual Meeting*, Vol. 4 (Kingston, Ontario: Queen's University, 1991). Among the papers in these proceedings are Ann Hibner Koblitz, "Historical and Cross-Cultural Perspectives on Women in Mathematics"; Israel Kleiner, "Emmy Noether: Highlights of Her Life and Work"; Sharon Kunoff, "Women in Mathematics: Is History Being Rewritten?"; J. J. Tattersall, "Women and Mathematics at Cambridge in the Late Nineteenth Century"; Francine Abeles, "A Geometric Approach to Arctangent Relations for Pi"; Thomas Archibald, "La théorie du potentiel et des approches aux fondements d'analyse"; Louis Charbonneau & Jacques Lefebvre, "L'Introduction à l'art analytique (1591) de François Viète: programme et méthode de l'algèbre nouvelle"; Craig Fraser, "The Emergence and Consolidation of Lagrange's Analysis, 1770-1776"; Alejandro Garcíadiego, "Bertrand Russell's Emotional State circa 1901-1902"; M. A. Malik, "Mathematization of Motion: Calculus vs. Analysis"; Abe Shenitzer, "Algebra and Algebraic Number Theory, 1800-1870"; and Glen Van Brummelen, "The Computation of the Chord Table in Ptolemy's *Almagest*". This volume and future volumes can be obtained through membership in the CSHPM.
- Grosholz, Emily R., *Cartesian Method and the Problem of Reduction* (Oxford: Clarendon Press, 1991).
- Hugh of St. Victor, *Practical Geometry*, trans. by Frederick A. Homann (Milwaukee: Marquette

- University Press, 1991).
- Kolmogorov, A. N. and Yushkevich, A.P., eds., *Mathematics of the 19th Century*, trans. by A. Shenitzer (Boston: Birkhäuser, 1992).
 - Kramer, Joel L., ed., *Perspectives on Maimonides: Philosophical and Historical Studies* (Oxford: Oxford University Press, 1991). Distributed in the United States by B'nai B'rith International, Washington, D.C.
 - Martinovic, Ivica, "Theories and Inter-theory Relations in Boskovic," *International Studies in the Philosophy of Science* 4 (1990), 247-262. Please note that the Croatian Philosophical Society in Zagreb has launched *Studia Boscovichiana*, an international yearbook for multidisciplinary research on all aspects of the life and work of Rugjer Josip Boscovic (1711-1787) and his times. Those wishing to contribute research papers, notes, and reviews for consideration are asked to contact the editor, Professor Ivica Martinovic, for further information at *Studia Boscovichiana*, Institute of Philosophy, University of Zagreb, Avenija Vukovar 54, HR-41000 Zagreb, CROATIA
 - Mathias, A. R. D., "The Ignorance of Bourbaki," *The Mathematical Intelligencer* 14 (1992), 4-13.
 - Mueller, Ian, ed., *Peri Ton Mathematon, Apeiron*, vol. 24 (Edmonton, Alberta: Academic Printing and Publishing, 1992).
 - Napier, John, *Rabdology*, trans. by William Frank Richardson (Cambridge: MIT Press, 1990).
 - Oliver, Bernard M., "Heron's Remarkable Triangle Area Formula," *Mathematics Teacher* 86 (1993), 161-163.
 - Ormsby, Eric L., ed., *Moses Maimonides and his Times* (Washington: The Catholic University of America Press, 1989).
 - Preston, Richard, "Mountains of Pi," *The New Yorker*, March 2, 1992.
 - Rescher, Nicholas, *G. W. Leibniz's Monadology: An Edition for Students* (Pittsburgh: University of Pittsburgh Press, 1991).
 - Rickey, V. Frederick, "How Columbus Encountered America," *Mathematics Magazine* 65 (1992), 219-225.
 - Rodriguez-Consuegra, Francisco A., *The Mathematical Philosophy of Bertrand Russell: Origins and Development* (Boston: Birkhäuser, 1991).
 - Shanker, S. G., *Gödel's Theorem in Focus* (London: Routledge, 1990).
 - Shea, William R. and Spadafora, Antonio, eds., *Interpreting the World: Science and Society* (Canton, MA: Science History Publications, 1992).
 - Thomaidis, Yannis, "Aspects of Negative Numbers in the Early 17th Century: An Approach for Didactic Reasons," *Science & Education* 2 (1993), 69-86.
 - Wilson, Robin, "Greek Mathematics I," *The Mathematical Intelligencer* 4 (1992), 76.
 - Zaslavsky, Claudia, *Multicultural Mathematics: Interdisciplinary Cooperative-Learning Activities* (Portland, OR: J. Weston Walch, 1993). This reproducible book contains 58 activities designed for children in grades 6-9, emphasizing numbers and patterns, especially with respect to representations, calculations, and geometric designs used by different people throughout the world. Each of the activities includes cultural, historical, or other background information, an explanation of the mathematical concept, problem-solving activities and examples that are ideal for cooperative learning, and a "Think About This" section to encourage critical thinking and further exploration. Call 1-800-341-6094 to order for \$20.95 (U.S.).

The *Newsletter* is the communication of the International Study Group on the Relations Between History and Pedagogy of Mathematics, an affiliate of the International Commission on Mathematical Instruction. It is edited and produced in the Department of Mathematics, College of Physical Science, Engineering and Technology, University of the District of Columbia, Washington, DC 20008, U.S.A. and printed and mailed with funds supplied by U.D.C. and other educational establishments throughout the world. The *Newsletter* is available free of charge upon request and may be entirely or partially reproduced with acknowledgement.

Distributors:

U.S.: Editorial Office

Canada: M. A. Malik (Concordia University, Montreal, Qué H4B 1R6)

Mexico: Alejandro Garcíadiego (UNAM - contact at José M. Velasco 71, Del. Benito Juárez, 03900 Mexico, D.F.)

South America: Geraldo Pompeu, Jr. (Departamento de Matemática, PUCCAMP/Campus I, sn 112 km, Rodovia SP 340, 13100 Campinas SP, Brazil)

Australia: George Booker (Faculty of Education, Griffith University, Brisbane, Queensland 4111)

New Zealand: Andy Begg (SMER Centre, University of Waikato, Private Bag 3105, Hamilton)

United Kingdom: John Fauvel (Mathematics Faculty, Open University, Milton Keynes MK7 6AA)

France: Evelyne Barbin (IREM Paris Nord, Université Paris XIII, Avenue Jean-Baptiste Clément, 93430 Villetaneuse Cedex)

Austria: Manfred Kronfeller (Institut für Algebra und Diskrete Mathematik, Technische Universität Wien, Wiedner Hauptstraße 8-10/118, A-1040 Wien)

Germany and Eastern Europe: Roland Stowasser (Technische Universität Berlin, Straße des 17. Juni

136, 1000 Berlin 12, Germany)

Belgium and the Netherlands: Jan van Maanen (Rijksuniversiteit Utrecht, Mathematisch Instituut, Budapestlaan 6, Postbus 80.010, 3508 TA Utrecht, The Netherlands)

Scandinavia: Bengt Johansson (Institutionen för ämnesdidaktik, Göteborgs universitet, Box 1010, S-431 26 Mölndal, Sweden)

Spain and Portugal: Eduardo Veloso (Associação de Professores de Matemática, Rua Major Neutelde Abreu 11, 1500 Lisboa, Portugal)

Italy: Luciana Bazzini (Departimento di Matematica, Università de Pavia, Strada Nuova 65, 27100 Pavia)

Greece, Turkey and the Balkans: Nikos Kastanis (Department of Mathematics, Faculty of Sciences, Aristotle University of Thessaloniki, 54006 Thessaloniki, Greece)

Israel: Anna Sfar (The Science Teaching Centre, The Hebrew University of Jerusalem, Givat Ram, 91904 Jerusalem)

South Asia: R. C. Gupta (Department of Mathematics, Birla Institute of Technology, P. O. Mesra, Ranchi-835 215, India)

Japan: Osamu Kota (Faculty of General Education, Rikkyo University, 3-34-1, Nishi-Ikebukuro, Toshima-Ku, Tokyo 171)

Malaysia: Mohini Mohamed (Dept. of Science and Technological Education, Universiti Teknologi Malaysia, Karung Berkunci 791, 80990 Johor Bahru, Johor)

Other East Asia: Gloria Benigno (Bukidnon State College, 8700 Malaybalay, Bukidnon, Philippines)

Southern Africa: Paulus Gerdes (C. P. 915, Maputo, Mozambique)

Other Africa: J. O. C. Ezeilo (National Mathematical Centre, Private Mail Bag 118, Abuja, Nigeria)

Elsewhere: U.S. Editorial Office.