Canadian Society

for History and Philosophy

of Mathematics

Société canadienne

d'histoire et de philosophie

des mathématiques

PROGRAM/PROGRAMME

17th Annual Meeting/17e Congrès Annuel
May 27-29 27-29 mai 1991
Queen's University, Kingston, Ontario

Program/Programme

Monday May 27/lundi 27 mai

9:30 *Craig G. Fraser*, President, CSHPM/SCHPM
Welcome

JOINT SPECIAL SESSION: WOMEN IN MATHEMATICS/SESSION SPÉCIALE COOPÉRATIVE: LES FEMMES ET LES MATHÉMATIQUES
9:10-15:30
(Presider, Morning: *Craig C. Fraser*)

9:40 *Craig C. Fraser*:
Introduction of guest speaker

9:45 *Ann Hibner Koblitz*, Guest Speaker
Women in Mathematics: Historical and Cross-Cultural Perspectives

10:45 *Israel Kleiner*
Emmy Noether: Highlights of her Life and Work

11:45 LUNCH/DÉJEUNER
(COUNCIL MEETING/RÉUNION DU CONSEIL)
(Presider, Afternoon: *Israel Kleiner*)

14:00 *J.J. Tattersall*
Women and Mathematics at Cambridge

14:30 *M.A. Pathan*
Lilavati

15:00 *Sharon Kunoff*
Women in Mathematics. Is History Being Rewritten?

15:30 TEA & COFFEE/THÉ ET CAFÉ

REGULAR SESSION/SESSION ORDINAIRE 16:00 – 17:30

16:00 *R. Godard*
Condorcet et la mathématique sociale et politique

16:30 *Sylvia M. Svitak*
The Contributions of the Spearman-Thomson Debates to the Mathematical Theories Underlying Factor Analysis

17:00 *Siegfried Thomeier*
Some Mathematical Questions in the Development of Magic Squares and Stifel Squares

Tuesday May 28/mardi 28 mai

REGULAR SESSION/SESSION ORDINAIRE 9:00 – 17:30
(Presider, Morning: Fran Abeles)

9:00 *Hardy Grant*
Leibniz – Beyond the Calculus

9:30 *Craig G. Fraser*
The Technique of Variation-of-Constants in Lagrange's Theory of Differential Equations

10:00 *Thomas Archibald*
Potential Theory and the Foundations of Analysis, 1870- 1890

10:30 TEA & COFFEE/THÉ ET CAFÉ

11:00 *Erwin Kreyszig*
On the Concept of Space in Analysis, Geometry and Physics

11:30 *M.A. Malik*
Mathematization of Motion: Calculus vs. Analysis

12:00 LUNCH AND ANNUAL MEETING/DÉJEUNER ET RÉUNION ANNUELLE
(Presider, Afternoon: *Erwin Kreyszig*)

14:00 *Edward G. Belaga*
On the Enhanced Biblical Value of π

14:30 *Francine Abeles*
A Geometric Approach to Arctangent Relations for Pi

15:00 *Alexander Jones*
Recovering Astronomical Tables from Greek Papyri

15:30 TEA & COFFEE/THÉ ET CAFÉ

16:00 *Glen R. Van Brummelen*
The Computation of the Chord Table in Ptolemy's Almagest

16:30 *Abe Shenitzer*
Survey of the Evolution of Algebra and of the Theory of Algebraic Numbers During the Period of 1800-1870

Wednesday May 29/mercredi 29 mai

REGULAR SESSION/SESSION ORDINAIRE 9:00 – 17:30
(Presider, Morning: Thomas Archibald)

9:00 *Louis Charbonneau & Jacques Lefebvre*
L'Introduction à l'art analytique (1591) de François Viète: programme et méthode de l'Algèbre nouvelle

9:30 *Colin R. Fletcher*
The Fermat-Frenicle-Mersenne Correspondence of 1640

10:00 *Emelie Kenney*
"Imaginary Quantities" and Their Role in the Rise of Abstract Algebra in England, 1778-1837

10:30 TEA & COFFEE/THÉ ET CAFÉ

11:00 *Katherine L. Hill*
Early Set Theory: Dedekind's Influence on Cantor

11:30 *Jonathan P. Seldin*
H.B. Curry, Logic, and Computer Science

12:00 LUNCH/DÉJEUNER
(Presider, Afternoon: *Louis Charbonneau*)

14:00 *Jacques Lefebvre & Louis Charbonneau*
Sur quelques moyens d'accroître la diffusion et le rayonnement social de l'histoire des mathématiques

14:30 *Aĺejandro R. Garciadiego*
Bertrand Russel's Mathematical Work and His Personality circa 1901

15:00 *Norbert H. Schlomiuk*
An Undergraduate Course in History of Mathematics – Its Short History at l'Université de Montréal

15:30 TEA & COFFEE/THÉ ET CAFÉ

16:00 *S. Sanatani*
Mathematics as a Means of Communication

16:30 *Peter L. Griffiths*
The Conditions Favouring Mathematical Discoveries up to 1750

17:00 *P. Rajagopal*
Arithmetic and Algebra: al-Kowarezmi and Brahmagupta

ABSTRACT/RÉSUMÉS

Special Session on Women in Mathematics

I. Kleiner (York University). Emmy Noether: Highlights of Her life and work.

Emmy Noether was a towering figure in abstract algebra. In fact, she was the moving spirit behind the abstract, axiomatic approach to algebra. I will describe her intellectual debts, some of her own major contributions, and her legacy. I will also give a brief sketch of her life.

A.H. Koblitz (Hartwick College). Women in Mathematics: Historical and Cross-Cultural Perspectives.

"There have been only two women in the history of mathematics; one of them wasn't a mathematician [Sofia Kovalevskaia], and the other wasn't a woman [Emmy Noether]." Aphorism attributed to various eminent male mathematicians, including Hermann Weyl.

The legacy of women in mathematics is a mixed one. On the other hand, some of the most eminent and respected women scientists from antiquity to the present have been mathematicians. On the other hand, female Fields medallists have been conspicuous by their absence, and I have had the above aphorism quoted to me on more than one occasion. This talk will discuss various aspects of women's involvement in the mathematical enterprise. Among the topics to be emphasized will be historical and cross-cultural variation in women's participation in mathematics, and feminist gender and science theory in relation to the experiences of women mathematicians.

S. Kunoff (Long Island University). Women in Mathematics. Is History Being Rewritten?

Suddenly women are appearing in history of mathematics texts in increasing numbers. Why? Have they just materialized? Is it to sell more books? It is interesting to note that more women appeared in a popular math history written in 1893 than in the most popular texts of the early 1980's. In this talk we examine this phenomenon and offer some theories as to why this may have occurred.

M.A. Pathan (Aligarh Muslim University). Lilavati.

The earliest woman known to have worked in mathematics was the celebrated Hypatia, who was born in Alexandria about the year 370. In the 12th century the Indian mathematician Bhaskara II dedicated his great treatise on mathematics to his daughter Lilavati, but otherwise there is no record of any significant female mathematician between Hypatia and the 18th century. Over the centuries writers in mathematics have borrowed Lilavati's format, its terminology and its classification of the types of problems concerning squares, excavations and content of solids, shadow of a Gnomon and progressions. It was avidly studied in East and West. Numerous copies of the work were made in Arabic, Persian, English, German, Malayalam and several other Indian languages. In this paper the author describes the way in which the Sanskrit text of Lilavati started evoking interest in the 19th and 20th centuries by examining the methodological commentaries and translations of extracts from the leading commentaries.

J.J. Tattersall (Providence College). Women and Mathematics at Cambridge.

Newnham and Girton Colleges were founded at Cambridge in the early 1870's for the education of women. Each school had its own philosophy as well as an outstanding number of scholars adept at solving mathematical problems. The mathematical achievements of Charlotte Angas Scott and Grace Chisholm Young are known to many, but literature on other female scholars at Cambridge is almost nonexistent. I will trace mathematical development at Newnham and Girton and some of the difficulties that their students encountered at Cambridge. I will note the accomplishments of other female analysist at Cambridge, such as Sarah Marks, Phillipa Fawcett and Dame Mary Cartwright, F.R.S.

Contributed Papers

F. Abeles (Kean College). A Geometric Approach to Arctangent Relations for Pi.

Approximating pi and attempting to square the circle have a long and interesting history. In 1875, C.L. Dodgson began work on a computationally simple approximation method for would-be circle squarers that would convince them of the futility of their attempts. Relating the earlier geometric and the newer analytic approaches in a practical way, this method produces an accurate approximation for pi efficiently.

T. Archibald (Acadia University). Potential Theory and the Foundations of Analysis, 1870 – 1890.

By the early 1870s, the Weierstrassian program to "arithmetize" analysis was well under way, and many researchers were devoting part of their efforts to improving the rigour of classical arguments. Not all of these efforts shared the viewpoint of Weierstrass, however; several writers took the position that a more intuitive foundation for mathematics was needed, and that the role of geometry in foundations should not be overlooked.

In this paper I shall discuss some examples of efforts to improve the foundations of potential theory between 1870 and 1890, contrasting the position of Weierstrass's student Otto Hölder with those of Carl Neumann, Axel Harnack, and Henri Poincaré. Hölder used Weierstrassian concepts about the topology of the real line in improving the hypotheses regarding the density functions employed in standard theorems. Neumann, on the other hand, focused on improving standards of rigour in the subject by investigating the role of the geometry of the surfaces bounding the attracting regions, a consideration that is also central in Poincaré's work. Some effort will be made to place these works in the context of the differing "styles" of mathematics associated with the names of Riemann and Weierstrass; and with the *Mathematische Annalen* versus Crelle's *Journal.*

E.B. Belaga (Université de Québec à Montréal). On the enhanced Biblical value of π.

We shall address here a misconception, shared by both active mathematicians and historians of science, that the famous Biblical text *1 King 7:23* proves that "the ancient Hebrew regarded π as being equal to 3". In fact, according to the Rabbinical interpretation (as soon as we know, never published before and, as in many similar cases, remaining an *oral tradition*) of the *Massoretic version* of this text, the King Solomon and his scholars actually knew a better rational approximation to π, namely,

$$\pi_{\text{Hebrew}} = \frac{333}{106} = 3\frac{15}{105} \quad , \quad |\pi_{\text{Hebrew}} - \pi| < 0.000084.$$

It is not only much better than the values known to ancient Babylonian and Egyptian scholars, – as we shall see, π_{Hebrew} is, in a sense, the *second best rational approximation to* π with a denominator under 30 000!

L. Charbonneau & J. Lefebvre (Université du Québec à Montréal). L'Introduction à l'art analytique (1591) de François Viète: programme et méthode de l'Algèbre nouvelle.

L'Introduction à l'art analytique (1591) est avant tout le programme que se fixe Viète pour sa nouvelle algèbre. En un douzaine de pages, l'auteur condense ce qu'il considère être l'essentiel de son approche dont la réalisation effective était reportée à d'autres ouvrages. Une étude comparée du texte latin de l'édition van Schooten (1646), et des traductions et commentaires en français de Vaulézard (1630) et en anglais de Smith (1955) permet de mettre en lumière la logique interne de cette introduction. Nous préciserons d'abord le sens à donner aux trois espèces d'analytique. Nous aborderons les problèmes que soulève cette division de l'analyse et le fait que contrairement aux idées reçues l'analyse ne nous semble pas s'opposer entièrement à la synthèse dans ce texte de Viète. Nous focaliserons notre attention sur le Zététique (qui est la première espèce d'analytique) et sur ses rapports avec la logistique spécifique (calcul symbolique), ce qui permettra de mieux comprendre la nécessité pour Viète de considérer uniquement des équations homogènes.

C.R. Fletcher (The University College of Wales). The Fermat-Frenicle-Mersenne correspondence of 1640.

At the beginning of 1640 Frenicle challenged Fermat to produce a large perfect number. This led to a correspondence between the two men (and Mersenne) in which Fermat disclosed the general statement of what is now known as Fermat's theorem. The extent of this 1640 correspondence was at least eleven letters, of which only six exist in full. Four letters are missing. The correspondence continued with the (false) Fermat conjecture concerning powers of 2, and with the statement of the corollary of Fermat's theorem. The talk will attempt a reconstruction of this correspondence.

C.G. Fraser (University of Toronto). The Technique of Variation-of-Constants in Lagrange's Theory of Differential Equations.

In 1774 Lagrange introduced the concept of a complete solution to a first-order partial differential equation as a solution that contains two arbitrary constants; the study of such solutions in terms of constants rather than arbitrary functions represented a new approach to the subject. In 1776 he showed that singular solutions of ordinary differential equations can be obtained from the general integral through the variation and elimination of the arbitrary constant appearing in the integral. In 1777 he showed how variation of constants can be used to derive a particular solution to a non-homogeneous ordinary linear differential equation from the general solution of the corresponding homogeneous equation.

The paper shows how Lagrange's "variation-of-constants" procedure acted as a unifying link in what were otherwise separate and independent researches. His later development of differential-equation techniques in his treatises of 1797 and 1806 is also examined.

A.R. Garciadiego (UNAM Mexico). Bertrand Russell's Mathematical Work and His Personality circa 1901.

In general, the layman pictures Bertrand Russell as an extroverted, secure, liberal, sarcastic and witty author. This picture is reasonably obtained from such writings as: *Marriage and morals, Portraits from memory, The autobiography of Bertrand Russell*, and so on. I would like to portrait an extremely contrasting image by analyzing Russell's mathematical work and his personality *circa* 1901. Some historians have already argued that 1901 is perhaps the most important year concerning Russell's intellectual development.

R. Godard (Royal Military College of Canada). Condorcet et la mathematique sociale et politique.

Le terme "mathématique politique" ou "arithmétique politique" englobait au XVIII^e siècle les statistiques, le théorie des jeux, lotteries, le calcul des probabilités. Le terme "mathématique sociale" vient de ses applications directes pour le bien-être de la population.

Lorsqu'on enseigne un cours sous-gradué en probabilité ou statistiques, il est agréable de suivre le raisonnement de nos ancêtres et d'introduire d'abord, de façon intuitive, la notion de fréquence, la définition d'une probabilité selon Laplace et ensuite les axiomes de Kolgomorov sur lequels toute la théorie de probabilité est fondée. On a parfois tendance à oublier que le théorème de Bayes date du XVIII^e siècle.

Condorcet (1743-94) est connu en France comme mathématicien, secrétaire de l'Académie des Sciences, et philosophe. De part sa passion pour l'humanisme, il est l'annonciateur d'un révolution scientifique: faire du fait humain un objet de connaissance, adapter les méthodes des sciences exactes à ce nouveau sujet.

Nous essayons ici de replacer la rôle de Condorcet dans l'évolution de la théorie des probabilités et des statistiques et nous soulignons l'intérêt de l'approche historique dans l'enseignement des deux disciplines.

H. Grant (York University). Leibniz – Beyond the Calculus.

Leibniz figures in the standard histories of mathematics mainly or wholly for his role in the early development of the calculus. But mathematics, regarded by him as a collection of necessary and eternal truths, entered and shaped many other aspects of his thought, in surprisingly detailed and significant ways. This talk will try to sketch this broader perspective by pointing to examples of such mathematical influence on Leibniz' physics and metaphysics.

P.L. Griffiths. The Conditions Favouring Mathematical Discoveries up to 1750.

The historical process of mathematical discovery can be said to follow certain rules.

1. Mathematical discoveries arise from detailed study of the works of one's contemporaries and predecessors.
2. In the course of this study certain contradictions or inconsistencies may appear.
3. If the mathematician sets out to explain and succeeds in explaining these contradictions and inconsistencies then he has contributed a new discovery.

Conditions favouring the detailed study of the works of one's contemporaries and predecessors include knowledge of the language of one's contemporaries and predecessors and the availability of good libraries. It goes without saying that the libraries should be not only accessible to the scholar but also should accept mathematical works which are offered. The process is one of discovery, communication, new discovery, communication etc. Long may this process continue; there have been periods in history when it has come to a halt.

If this process is allowed to continue then all problems will be expressed as mathematical problems, and all mathematical problems will be solvable.

K.L. Hill (University of Toronto). Early Set Theory: Dedekind's Influence on Cantor.

This paper examines two of Georg Cantor's early set theoretic papers partially through their development as shown in the Cantor/Dedekind correspondence. In 1874 Cantor published "Über eine Eigenschaft des Inbegriffs aller reellen algebraischen Zahlen," followed by the 1874 paper titled "Ein Beitrag zur Mannigfaltigkeitslehre." The first paper deals with the denumerability of the algebraic numbers, as well as the nondenumerability of the real numbers. These two facts together were used to show nonconstructively the correctness of Liouville's proof that infinitely many transcendental numbers lie in any interval $(\alpha,\ \beta)$. The second paper shows a unique one-to-one correspondence could be given between continuous domains of one and two dimensions. The development of these mathematical ideas may be traced not only through the papers themselves, but also through an examination of the correspondence between Cantor and Richard Dedekind in this period. The correspondence is pivotal to the understanding of the development of these ideas, as it contains the original formulation of several questions as well as the path taken toward their final statements. Dedekind's influence was substantial in Cantor's early work. The final form taken by both papers was partially shaped by Dedekind's influence.

Dedekind's influence on Cantor's early set theory has often been overlooked. This paper shows the details of Dedekind's contributions to Cantor's work.

A. Jones (University of Toronto). Recovering Astronomical Tables from Greek Papyri.

Greek and Demotic papyri from Egypt are proving to be the most promising of our meagre resources for the history of Greek mathematical astronomy during the three centuries between Hipparchus and Ptolemy, and again for the subsequent period during which Ptolemy's works competed with earlier methods. About fifty fragmentary texts have been published to date, most of them dating from the first to fourth centuries of our era. Perhaps twice as many remain unpublished among the Oxyrhynchus papyri alone. The reason why we have significant numbers of astronomical documents (in contrast, for example, to the very few known geometrical papyri) is undoubtedly the vogue for astrology in provincial Egypt during the Roman period; hence tables, and the instructions for making or using tables, account for the great majority of the texts.

An astronomical papyrus typically consists of small scraps and fragments, so that one cannot count on titles and headings to clarify the purpose of the handful of rows and columns of numerals that may have survived. Analysing a tabular papyrus may therefore involve several stages: transcription, determining the mathematical structure of the data, identifying their astronomical significance, reconstructing the arrangement of the lost whole, and deducing the theory and numerical parameters underlying the table. I will illustrate this process with some unpublished Oxyrhynchus papyri on which I have recently been working.

E. Kenney (Siena College). "Imaginary Quantities" and Their Role in the Rise of Abstract Algebra in England, 1778-1837.

Questions about the foundations of algebra were not popular in England until the mid-nineteenth century; in fact, the primacy of geometry over algebra was assumed, particularly in the universities, prior to the insistence on the importance of abstraction of Peacock, De Morgan, and others. British mathematical education played a significant role in determining how much and what kind of mathematics was done in England in the late eighteenth and early nineteenth centuries, and the dons favored geometry over algebra for what was believed to be its greater importance in a liberal education. Nonetheless, abstraction became a desirable goal of British algebraists, and the complex numbers figured prominently in its rise and in the discussion of algebra versus geometry. The debates involved whether what we now call complex numbers are legitimate mathematical objects and whether questions about what they really are are relevant. This paper examines these developments in light of the questions: To what extent can a mathematical discovery be prefigured? and How does dealing with a "monster" (in Lakatos's sense) contribute to the advancement of mathematical knowledge?

E. Kreyszig (Carleton University). On the Concept of Space in Analysis, Geometry and Physics.

The concept of space developed in mathematics and physics in a complicated fashion under the influence of various rather heterogeneous factors. In this talk we concentrate on a crucial period of that development, mainly related to (nontechnical) ideas of Gauss and their effect on Riemann's famous Vortrag "*Ueber die Hypothesen, welche der Geometrie zu Grunde liegen*" (1854) and his *Commentatio* of 1861.

J. Lefebvre & L. Charbonneau (Université du Québec à Montréal). Sur quelques moyens d'accroître la diffusion et le rayonnement social de l'histoire des mathématiques.

Le rayonnement de l'histoires des mathématiques en-dehors du cercle des historiens des mathématiques ne semble pas encore correspondre à l'ampleur et au niveau de qualité atteints par cette discipline. Les conférenciers feront part de leur expérience quant à trois moyens de diffusion: chroniques dans des revues lues par des mathématiciens ou des enseignants de la mathématique; travail de recherche avec une équipe de didacticiens; lectures de textes mathématiques classiques en compagnie de collègues mathématiciens. Ils aborderont ensuite d'autres formes d'intervention envisagées: ateliers d'historie des mathématiques lors de congrès de mathématiciens ou d'enseignants de la mathématique; interventions structurées lors de journées pédagogiques dans les commissions scolaires; travail auprès de rédacteurs de manuels scolaries; textes ou chroniques dans des journaux à grand tirage. Les participants seront invités à faire leurs commentaires, à décrire leurs propres expériences et à émettre des suggestions, oralement et par écrit.

M.A. Malik (Concordia University). Mathematization of Motion: Calculus vs Analysis.

There is a misconception among students that Calculus and Analysis represent the same subject with a difference only on emphasis. Calculus consists of rules and techniques whereas a careful study of these rules laced with theorem and proof becomes Analysis. Most of the text books on Calculus include a great deal of topics which are in fact a part of Analysis and difficult to teach at that level within the frame of a Calculus course. This part is either skipped or zipped through in a classroom presentation. In either case, the students are unable to grasp the spirit of either of the disciplines Calculus or Analysis.

A review of the history of mathematics suggests that the introduction of motion in mathematics during the renaissance period lead to the creation of Calculus. The mathematization of motion is a landmark in the development of human civilization. It has greatly influenced the human thinking and set the objective of science. The beginning of analysis is with the realisation that motion should not be a part of mathematics and various phenomena could be better explained if mathematical objects are not constraint to the perspective of motion and to the geometrical perception.

In view of these remarks, we present a discussion on the relation between pedagogical and historical aspects of Calculus and that of Analysis.

A. Shenitzer (York University). Survey of the Evolution of Algebra and of the Theory of Algebraic Numbers During the Period of 1800-1870.

The 19th century was an age of deep qualitative transformations and, at the same time, of great discoveries in all areas of mathematics, including algebra. The transformation of algebra was fundamental in nature. Between the beginning and the end of last century, or rather between the beginning of the last century and the twenties of this century, the subject matter and methods of algebra and its place in mathematics changed beyond recognition.

It is difficult to describe precisely what algebra was at the end of the 18th century. Of course, it was no longer the art of computing with numbers, letters, and mysterious magnitudes, or an art involving a handful of rules and formulas and the skill of their correct interpretation. Complex numbers were virtually accepted by all, there existed something like a theory of linear equations, some principles were being outlines and so were the beginnings of a theory of equations of one variable of arbitrary degree. But next to the majestic edifice of analysis all this paled into insignificance. Algebra was on the periphery of mathematics. By the beginning of the 20th century all this had radically changed. Algebra has grown prodigiously in context, has been enriched by remarkable concepts and theories and, moreover, its new concepts and spirit began to penetrate virtually the whole of mathematics. There was a manifest tendency of algebraization of mathematics. Remarkable new disciplines, such as algebraic number theory, algebraic geometry, the theory of Lie groups, combining algebra with number theory, geometry and analysis, respectively, came into being and flourished. Much like the fundamentals of analysis, the fundamentals of such new algebraic theories as those of groups, fields, and vector spaces became indispensable components of general mathematical education not only in the universities but also in engineering and technical schools.

S.M. Svitak (City University of New York). The Contributions of the Spearman-Thomson Debates to the Mathematical Theories Underlying Factor Analysis.

Experts often deplore the misuse of factor analysis, a method of investigation arising from problems in psychology. This paper argues that misuse is largely due to the neglect of the underlying mathematics and related questions in the modern literature and in textbooks in particular. The historical development of the mathematical theory underlying factor analysis will be traced and special attention will be given to the origins of factor analysis and the early controversies which led to the mathematical developments in the 1920's and 1930's.

Specifically, controversies, mathematical and philosophical, immediately ensured the publication by Charles Spearman of his two-factor theory of intelligence in a 1904 paper that is generally considered to be the original source of factor analysis. Godfrey Thomson joined the debates and in 1916 published a seminal paper which led to a more mathematically explicit model, the Sampling Theory of Intelligence. In the following years, the Two-Factor Theory and the Sampling Theory were testily argued in scores of papers by both men as well as by supporters on both sides and by critics of both theories. These debates led directly to a number of attempts to lay down the mathematical foundations of factor analysis.

P. Rajagopal (York University). Arithmetic and Algebra: al-Kowarezmi and Brahmagupta.

al-Kowarezmi's Algebra and Arithmetic, written in the years around 830, arose out of a milieu in which Zij al-Arkand and Zij al-Sindhind were well known. These works, translated in the years about 770, are supposed to be based on (if not translations of) Brahmagupta's Khandakhaadhyaka (665) and Brahma Sphuta Siddhanta (628).

Chapters 12 and 18 of the B.S.S. are titled Ganita (= Arithmetic) and Kuttaka (= Algebra). In these chapters Brahmagupta provides an encyclopedic summary spanning all of Mathematics known in his time in India. al-Khowarezmi on the other hand writes an introduction to a new science, by selecting topics and presenting them through method, example and geometrical validation.

In this talk I will discuss al-Khowarezmi's work and contrast it with that of Brahmagupta. The times, the traditions and the influences on and of the authors will be discussed.

S. Sanatani (Laurentian University). Mathematics as a means of communication.

Mathematics has been frequently characterised as a 'language' – i.e., as means of communication (among humans). As a language then, what would mathematics communicate? For example, would mathematics be used to communicate 'sensations' (like one that is associated to a bee sting)? Perhaps not. I am in possession of a faculty that enables me to distinguish sensations (if I did not have this faculty I would know only one unending sensation without beginning). I also have a faculty that enables me to 'identify' distinct sensations. The outcome of the applications of these two inner faculties to my sensations is constantly augmenting my knowledge. Mathematics, as I see it, tries to communicate the elaborate process of these applications. Like all other means of communication, mathematics too is dependent on the construction of 'structures' to convey its messages (or results). Such constructed representations – even when they are built with the finest tools of logic – are susceptible to ambiguities. The certainty and the necessity one associates with mathematics is buried deep under its formalism and may belong to the realm of beliefs where all tangible means of communication are uncertain.

N.H. Schlomiuk (Université de Montréal). An Undergraduate Course in History of Mathematics – Its Short History at l'Université de Montréal.

The paper will discuss the contents, impact or lack of, and comments as for courses in history of mathematics the author taught in the Department of Mathematics of the Université de Montréal and its prospects for the future.

J.P. Seldin (Concordia University). H.B. Curry, Logic, and Computer Science.

Haskell B. Curry is in some ways an unusual figure in the history of mathematical logic. In the second half of his career, he was regarded as very eminent, but most logicians professed not to understand what he was doing. Indeed, for the first decade after the end of the Second World War, he was (except for F.B. Fitch) almost the only logocian in the world interested in combinatory logic and lambda calculus. In the later '50's and '60's, when he started to have graduate students, most logicians thought he was spending his time on fussy details that were too trivial to be worth the time. (This applies especially to his paper "On the definition of substitution, replacement and allied notions in an abstract formal system", Revue Philosophique de Louvain 50 (1952) 251-269.) Today, one the other hand, many computer scientists regard him as one of the most important pioneers of the theoretical part of their subject, and papers on combinatory logic and lambda calculus make up a large part of the programs of some of their meetings. The purpose of this paper is to try to explain this phenomenon by looking at some of Curry's main ideas and their origin. In doing this, I will quote from some of Curry's earliest notes. I will also revue some of the early history of combinatory logic and lambda calculus.

S. Thomeier (Memorial University). Some Mathematical Questions in the Development of Magic Squares and Stifel Squares.

Magic squares have a long history, and a detailed bibliography of the subject contains many hundred items (including works by Fermat, Euler, Gauss, Lucas, D.N. Lehmer, Bachmann, Fitting, Veblan, etc). However, the largest part of the literature consists of numerous ad hoc construction methods for various cases, invented by laymen and hobbyists, with very little essential progress towards basic mathematical questions, such as the following:

- What connections do exist between various types of magic squares and other mathematical areas (e.g. Latin squares, Euler squares, groups, finite geometries, Diophantine equations, etc.)?
- For which n do there exists magic $(n \times n)$-squares, satisfying various conditions?
- How many (essentially different) such squares are there?

This paper deals with the evolution of progress on these questions. It also includes some open problems and an extensive bibliography.

G.R. Van Brummelen (Simon Fraser University). The Computation of the Chord Table in Ptolemy's Almagest.

The table of chords in Ptolemy's almagest, the earliest extant table of a trigonometric function, has enjoyed an illustrious history as an astronomical tool, but its construction has not been studied extensively. Ptolemy provides a method of computation in the text which employs a number of fundamental trigonometric identities, but it is clear from the small magnitude of errors in the table that this method requires excessive precision. I present results of a numerical and statistical study of the peculiar patterns of error in the tabular entries, and propose a method of computation suggested by the results of the analysis. I conclude that the author did not use some of the techniques given in the text, and employed additional numerical manipulations to increase accuracy in the use of the table.