

Canadian Society  
for History and Philosophy  
of Mathematics

Société canadienne  
d'histoire et de philosophie  
des mathématiques

**PROGRAMME  
and  
ABSTRACTS**

21st Annual Meeting / Congrès annuel

**June 3-5, 1995 / 3-5 juin, 1995**

P3825, Pavillon Dupuis, 800 Maisonneuve E.  
Université du Québec à Montréal  
Montréal

## CSHPM Special Session: Mathematics Circa 1900

Program/Programme

Saturday, June 3 / samedi 3 juin 1995

- 8:30 *Erwin Kreyszig, Carleton University*  
From Classical to Modern Analysis
- 9:25 *Craig Fraser, University of Toronto*  
Mathematical Existence And The Calculus Of Variations 1900-1910
- 9:50 TEA & COFFEE/THÉ ET CAFÉ
- Invited Speaker:**
- 10:10 *J. Dauben, CUNY Graduate Center*  
Cantor and the Epistemology of Set Theory.
- 11:05 *Jim Tattersall, Providence College*  
Women and the Cambridge Mathematical Tripos 1880 - 1910
- 11:35 *Christopher Baltus, SUNY College at Oswego*  
Asymptotic Series after Stieltjes: What Happened to the Continued Fractions?
- 12:00 LUNCH/DÉJEUNER
- 1:00 *Louis Charbonneau, Département de mathématiques, UQAM*  
Les mathématiques au service de l'ingénierie et du commerce dans les institutions d'enseignement supérieure de Montréal et du Québec entre 1878 et 1945.
- 1:30 *Israel Kleiner, York University*  
The genesis of the abstract ring concept.
- 2:20 *Rebecca Adams, McMaster University*  
The Beginnings of General Topology
- 2:45 TEA & COFFEE/THÉ ET CAFÉ
- 3:30 *Abe Shenitzer, York University*  
Remarks on Mathematical Criticism
- 4:30 *Irving Anellis, Modern Logic Publishing.*  
Peirce Rustled, Russell Pierced: How Charles Peirce and Bertrand Russell Viewed Each Other's Work in Logic, and the Debunking of Russell's School of Falsification of the History of Logic
- 5:00 *Alejandro Garciadiego (UNAM)*  
The History of Mathematics in Mexico

## Program/Programme

*Sunday, June 4/dimanche 4 juin 1995*

- 8:15 *Alexander A. Antropov, University of Minnesota*  
On History of One Method of Study of Rational and Integral Binary Quadratic Forms
- 8:45 *Samuel S. Kutler, St. John's College*  
How Ancient Greeks and Moderns View the Menelaus Theorem
- 9:15 *John Anderson, Trinity College*  
The Short Happy Life of the Cassini Ovals
- 9:45 *Richard O'Lander, St. John's University*  
Trigonometry from a Historical Perspective
- 10:15 TEA & COFFEE/THÉ ET CAFÉ
- 10:30 *James A. Ralston (Wartburg College)*  
The Three and Four Line Locus Problem or The Problem of Pappus
- 11:00 *Francine Abeles, Kean College, SCNJ*  
A Closed Form of the Euclidean Parallel Postulate
- 11:30 *Ronald Sklar, St. John's University*  
Automated Theorem Proving in Euclidean Plane Geometry: An Historical Sketch
- 12:00 LUNCH AND COUNCIL MEETING/DÉJEUNER ET RÉUNION DU CONSEIL
- 2:00 *John A. Synowiec, Indiana University Northwest*  
A Confluence of Theories: Partial Differential Equations, Harmonic Analysis and Generalized Functions
- 2:30 *R. Godard, Royal Military College*  
A Story of Vector Calculus
- 3:00 TEA & COFFEE/THÉ ET CAFÉ
- 3:30 *Tom Archibald, Acadia University*  
Why do Existence Theorems Exist?
- 4:00 *Barnabas Hughes, California State University*  
 $\int \frac{1}{x} dx = \ln X + C$ . Why it is defined. How it was discovered. Who were responsible?
- 4:30 *A. Ackerberg, Iowa State University*  
Leonhard Euler: Essential Figure in Eighteenth-Century Mathematical Physics.

**Program/Programme**  
*Monday, June 5/ lundi juin 1995*

- 8:15 *Elaine Landry, University of Western Ontario*  
"Pi in the Category" Realism
- 8:45 *Sunoy Sanatani, Laurentian University*  
Some Aspects of Intuitionism in Mathematics
- 9:15 *Robert Thomas, University of Manitoba*  
From Ethnomathematics to Real Mathematics
- 9:45 *Paul Rusnock, University of Waterloo*  
Kant on Incongruent Counterparts
- 10:15 TEA & COFFEE/THÉ ET CAFÉ
- 10:30 *Ronald Fechter, St. John's University*  
Gödel's Theorem, Platonism, and the Philosophy of Mind
- 11:00 *W. S. Anglin, McGill University*  
Egyptian Fractions in the Twentieth Century
- 11:30 *Colin R. Burnett, Department of Foreign Affairs and International Trade*  
The Canadian Sieve for Prime Pythagorean Numbers
- 12:00 LUNCH AND ANNUAL MEETING/DÉJEUNER ET REUNION ANNUELLE
- 1:30 *Glen Van Brummelen, The King's University College*  
Kushyar ibn Labban's Planetary Astronomy
- 2:00 *P. Rajagopal, Atkinson College*  
Proofs in Indian Mathematics
- 2:30 *Jacques Lefebvre, Université du Québec à Montréal*  
Vigny on Mathematics, Mathematics in Vigny
- 3:00 TEA & COFFEE/THÉ ET CAFÉ
- 3:30 *B. Rosenthal, Ursinus College*  
A Pan-Cultured Approach to Mathematical Epistemology
- 4:00 *Luis Radford, Laurentian University*  
Linking Psychology and Epistemology: how can history of mathematics be a useful tool for the comprehension of students' learning processes?
- 4:30 *Edward L. Cohen, University of Ottawa*  
Calculation of Weekday from Date in the Gregorian Calendar

## ABSTRACTS

### **F. Abeles (Kean College, SCNJ). A Closed Form of the Euclidean Parallel Postulate.**

For every circle, the inscribed equilateral hexagon is greater than any one of the segments which lie outside it. This clever alternative to the Euclidean parallel postulate first appeared in *Curiosa Mathematica, Part I: A New Theory of Parallels*, published in 1888 by Charles L. Dodgson (Lewis Carroll).

In this paper we approach the postulate from a foundational point of view, noting its lack of appeal to infinity and to infinitesimals, and considering its probable origin in the simple method for approximating  $\pi$  that Dodgson had developed four years earlier.

### **A. Ackerberg (Iowa State University). Leonhard Euler: Essential Figure in Eighteenth-Century Mathematical Physics.**

Throughout all of the activities and controversies that characterized eighteenth-century mathematical physics, the prolific Swiss mathematician Leonhard Euler (1707-1783) looms large. Yet, even though some historians have called him the central figure of Enlightenment physics, English-language writers have, for the most part, left him lurking in the background and failed to detail his influence in this area. This paper is an attempt to focus in on this aspect of Euler's broad and varied career and to shed some light on his contributions to physics. It will accomplish these goals by synthesizing some examples most well-known individually, such as the three-body problem, the formulation of Newtonianism, the vibrating string problem, and the continuity debate. The discussion will also place Euler in his relationships with contemporaries including the Bernoullis, D'Alembert, and Lagrange, along the way to a conclusion that clarifies and provides an accounting of Euler's role in mathematical physics in the eighteenth century.

### **Rebecca Adams (McMaster University) The Beginnings of General Topology.**

While mathematicians worked with curves, planes and continuous functions, for efficiency Frechet introduced spaces of arbitrary elements (1904). However, a commonly accepted means of determining structure in an abstract space was not immediate. A comparative analysis of such attempts (1904-1918), discussing the work of Chittenden, Frechet, Hahn, Hausdorff, Hedrick, Riesz, and Root, demonstrates the selection process through which general topology emerged as a separate branch of mathematics.

### **J. Anderson (Trinity College). The Short Happy Life of the Cassini Ovals.**

In the last decade of the seventeenth century Giovanni Domenico Cassini proposed a new kind of curve for the true shape of a planetary orbit. He had hoped to reconcile the difficulties resulting from attempts to employ Kepler's second law of equal areas in conjunction with the hypothesis of an equant point at the empty focus of the orbital path. This curve was developed by analogy from a focal property of the ellipse. A Cassini

oval has a constant product of foci distances whereas the ellipse has a constant sum of foci distances. Less than a decade later this hypothesis of a new orbital path was put soundly to rest by both Pierre Varignon and Edmund Halley and it disappeared from both astronomy and mathematics for more than a century.

**W. S. Anglin (McGill University). Egyptian Fractions in the Twentieth Century.**

The ancient Egyptian practice of writing rationals as sums of distinct fractions with unit numerators has given rise to a number of problems which have been very popular in the twentieth century. For example, there is the still unsolved problem posed by Erdős and Straus in 1948, to show that for any integer  $n > 4$ , the rational  $4/n$  can be written as a sum of three distinct fractions with unit numerators. This problem is the subject of a 1994 paper of J. W. Sander which concludes with a list of 24 references to articles related to the Egyptian practice, all written in the twentieth century.

In this paper, we shall report on a result published in 1993 which is so basic and so elementary that it seems incredible it was not proved previously. This is the result that the so-called ‘splitting algorithm’ terminates. We shall explain exactly what this means, but first we review the historical context of the problem.

**Irving Anellis (Modern Logic Publishing) Peirce Rustled, Russell Pierced: How Charles Peirce and Bertrand Russell Viewed Each Other’s Work in Logic, and the Debunking of Russell’s School of Falsification of the History of Logic.**

I claim that Russell deliberately distorted the history of logic for the purpose of self glorification, and examine in detail the evidence behind that claim, within the context of a survey of the views which Russell and Peirce held of each other’s work in the first few years of the twentieth century.

**A. Antropov (University of Minnesota). On History of One Method of Study of Rational and Integral Binary Quadratic Forms.**

From ancient times the deriving rational (integral) solutions of equation  $XX - dYY = m$  from a given one is based (in modern terms) on constructing rational (integral) automorphisms of binary quadratic form  $F(X, Y) = XX - dYY$  with the help of integral solutions of Pell’s equation  $tt - duu = 1$  where  $d$  is squarefree integer. The way of obtaining integral ones was deduced from the rule of receiving rational automorphisms.

**T. Archibald (Acadia University). Why do Existence Theorems Exist?**

Discussions of the origin of existence theory for ordinary and partial differential equations customarily start with Cauchy. The paper will begin with an overview, based on a recent study by Bottazzini, of why the existence problem was important to Cauchy, and

why competing methods weren't adequate in his view. The paper will then consider some highlights in the evolution of existence theory up to approximately 1880.

**Christopher Baltus, (SUNY College at Oswego) Asymptotic Series after Stieltjes: what happened to the continued fractions?**

Euler, the first to treat divergent series (*De seriebus divergentibus*, 1755), felt that a corresponding continued fraction offered the most secure method of summing a divergent series. Laguerre, the first to prove (1879) that a series was the asymptotic expansion of a function, did so by a continued fraction representation of the function. With the appearance of Stieltjes' *Recherches sur les fractions continues* (1894-95) linking an asymptotic series with a continued fraction and an integral representation of a function, the place of continue fractions in the quickly growing study of asymptotic series seemed assured. Poincaré, in his introduction to the works of Laguerre (1898), characterized the continued fraction approach as "destiné à un grand avenir." . The predicted future never arrived. Continued fractions quietly disappeared from treatments of asymptotic series. The disappearance reflects both limitations of continued fractions and changing interests in the field of analysis.

**C. R. Burnett (Department of Foreign Affairs and International Trade). The Canadian Sieve for Prime Pythagorean Numbers.**

In this talk I shall use the classical concept of prime numbers as a starting point to illustrate several techniques in introducing conceptual change in mathematical systems. By clarifying the pre-systematic meaning - the Greek conception - of primes and introducing an alternative geometric representation - a Gestalt change - we generalize the concept of primes so that it applies equally to similar families of Pythagorean numbers. This in turn leads to the problem of modifying certain classical concepts to allow us to investigate whether other Pythagorean number families are blest with their primes in a similar fashion to primes for the family of square and rectangular numbers. The solution to the problem is modeled on the Sieve of Eratosthenes but I call this generalized sieve the Canadian sieve. We will show how its application to triangular numbers turns up some interesting information which is relevant to an outstanding problem for classical prime numbers.

**Louis Charbonneau (Departement de mathématiques, UQAM) Les mathématiques au service de l'ingénierie et du commerce dans les institutions d'enseignement superieure de Montréal et du Québec entre 1878 et 1945.**

Alors que la Faculté de génie de l'université McGill connaît un développement remarquable dans le troisième tiers du XIX<sup>e</sup> siècle, l'Ecole polytechnique de Montréal, fondée en 1873, démarre lentement. Ce n'est qu'à partir des années 1920 qu'un groupe de professeurs sentira le besoin de travailler à la formation d'une véritable communauté mathématique francophone. Dans notre communication, nous étudierons l'évolution pour la période touchée des contenus de l'enseignement des mathématiques donné dans les écoles supérieures à vocation professionnelle de Montréal, en génie ou en études commerciales.

Nous situerons cet enseignement dans le contexte de l'époque entre autres en tentant de cerner la formation mathématique acquise par les étudiants avant leur entrée dans ces écoles et en décrivant les activités des professeurs visant à promouvoir les mathématiques en dehors des murs de leurs institutions.

**E. L. Cohen (University of Ottawa). Calculation of Weekday from Date in the Gregorian Calendar.**

Gauss (1798), Rev. Zeller (1887) and others around the 1900s and beyond were fascinated by this calculation. We state how the calculations were determined and give a history of the topic.

**J. W. Dauben (CUNY Graduate Centre) Georg Cantor and the Foundations of Set Theory: Competing Ideologies and the Foundations of Modern Mathematics.**

Georg Cantor (1845-1918) is well-known as the founder of transfinite set theory. But even Cantor, at first, resisted the idea of introducing the actual infinite into his mathematics. Eventually, he found that it was indispensable for his analysis of continuity and applications he was making in the theory of functions, especially to trigonometric series. He also believed he could develop transfinite arithmetic/set theory in such a way that its foundations were secure, and justifiable mathematically, philosophically and even theologically. From the beginning, however, the theory faced strong opposition from such authorities as Leopold Kronecker and Henri Poincaré, and ever since the paradoxes of set theory and both the infinite and infinitesimals have concerned mathematicians and philosophers of mathematics alike.

This paper will explore these concerns, then and now, to assess where Cantor's ideas stand with respect to the foundations he thought were adequate, and those advanced more recently in light of the results of Kurt Gödel, Paul Cohen and Abraham Robinson. Above all, what can history of mathematics, and of Cantor's transfinite set theory, contribute to appreciating the foundations of mathematics and the on-going debate over the consistency of mathematical knowledge, and whether Cantor's transfinite world should be regarded as plague or paradise?

**R. Fechter (St. John's University). Gödel's Theorem, Platonism, and the Philosophy of Mind.**

Taking Penrose's recent interpretation of Gödel's Theorem as a point of departure, we consider the influence of Platonism on current views of the mind, and consider what an unravelling of Platonist assumptions about mathematics would entail for our definitions of reality. We relate the philosophic views of Heidegger and Wittgenstein to the foundational standpoint of Skolem in pursuit of an alternative view of mathematics and the mind.

**Craig Fraser (University of Toronto) Mathematical Existence And The Calculus Of Variations 1900-1910.**



Hilbert's work around 1900 on the existence of solutions to variational problems is well known. The present paper looks at the subject of existence and embedding questions in the context of research in the theory of constrained extrema. We examine writings of Kneser, Hahn, Bolza and Hadamard, beginning with Kneser's *Lehrbuch der Variationsrechnung* of 1900 and ending with Hadamard's *Leçons sur le calcul des variations* of 1910.

### **Alejandro Garcadiago (UNAM) The history of mathematics in Mexico.**

Although the history of exact sciences has a rich tradition in Mexican culture, the first serious attempt to promote a professional study of modern mathematics in Mexico did not take place until the late 1930s and early 1940s. In this talk, I will present an overview of the antecedents of such first professional attempt.

### **R. Godard (Royal Military College). A Story of Vector Calculus.**

“Tout le monde doit savoir ce que c'est qu'un point, et c'est même parce que nous le savons trop bien que nous croyons n'avoir pas besoin de le définir. Certes, on ne peut pas exiger de nous que nous sachions le définir, car en remontant de définition en définition, il faut bien qu'il arrive un moment qu'on s'arrête . . .” (Poincaré, *La valeur de la science*, p. 65) . . . “Maxwell était habitué à [penser en vecteurs] et pourtant si les vecteurs se sont introduits dans l'analyse, c'est par la théorie des imaginaires. Et ceux qui ont inventé les imaginaires ne se doutaient guère du parti qu'on tirerait pour l'étude du monde réel; le nom qu'on leur a donné le prouve suffisamment”. (Poincaré, *La valeur de la science*, p.107) By using some simple examples, we try to comment on the History of Vector Calculus up to Maxwell and Poincaré. We also discuss the technique of chronology in the History of Mathematics and the “Harmony” expressed by mathematical laws.

### **B. Hughes (California State University). $\int \frac{1}{x} dx = \ln x + C$ . Why it is defined. How it was discovered. Who were responsible.**

Despite the emphasis on proof of theorems in elementary calculus textbooks, the well-known proposition  $\int \frac{1}{x} dx = \ln x + C$  is usually defined rather than proved. Felix Kelin (1849-1925) is responsible for this. Antonio Alfonso de Sarasa, S. J. (1618-1667), discovered the relationship between hyperbolic areas and logarithms. He recognized it in a proof equating certain hyperbolic areas, that had been written by his mentor, Gregory of St. Vincent, S.J. (1584-1667). The parts played by all three scholars will be discussed together with excerpts from their works.

### **Israel Kleiner (York University) The genesis of the abstract ring concept.**

The notion of ring emerged as a central concept of algebra in the early decades of the 20th century, but its origin dates back to the first half of the 19th century. I will describe highlights of this evolutionary process.

## **Erwin Kreyszig (Carleton University) From Classical to Modern Analysis.**

The analysis of our century looks distinctly different from that of the last century. Landmarks around 1900 were Fredholm's theory of integral equations (1900, 1903), Lebesgue's Thesis on integration (1902), Fréchet's Thesis on functional analysis (1906), and Hilbert's earliest functional-analytic treatment of integral equations and spectral theory (1906), to name just the most essential highlights.

If we add to this the impression caused by Hilbert's famous Paris talk of 1900 on problems of the 19th century left for solution to the 20th century, we might perhaps gain the impression of some discontinuity in the development of analysis around 1900.

In this talk we shall correct that impression to some extent by investigating classical roots of the novel theories by Fredholm etc. mentioned before.

## **S.S.Kutler (St. John's College). How Ancient Greeks and Moderns View the Menelaus Theorem.**

I first consider one of the most beautiful theorems of Mathematics: The Desargues theorem. I present it in its projective form, and then I will show how it was first proved; namely, through four applications of the Menelaus theorem. The Menelaus theorem will have been presented in its modern form. I will complete the talk by exhibiting the Menelaus theorem as the ancient Greeks did - through compound ratios which I will then explain.

## **E. Landry (University of Western Ontario). "Pi in the Category" Realism.**

This paper will investigate the role of category-theory in philosophical issues of mathematics. Specifically, it will consider whether a realist, though non-Platonist, position in mathematics is tenable. This realist position will be taken as that which results by shifting the domain of mathematical discourse from an absolute, Platonic, realm to a local category. The justification of such a shift will be shown to hinge on taking all mathematical entities as "ideal" (in the Hilbertian sense of the term). To say that a mathematical entity exists will be to say no more than it is necessary for the construction of a specific category. Likewise, to say that a mathematical statement is true will be to say no more than it accurately represents how things are in a specific category. Thus it will be shown that we get all the ontology and semantics we need from within a specific category. As realists we no longer have to accept the "Pi in the sky" attitude and its associated reliance on Platonic realms and mysterious graspings. All we need to accept, in order to maintain a realist position in mathematics, is a "Pi in the category" attitude.

## **J. Lefebvre (Université du Québec à Montréal). Vigny on Mathematics. Mathematics in Vigny.**

Alfred de Vigny (1797-1863) was a well-known French poet, novelist and playwright. Readers and critics do not usually associate such a romantic figure with mathematics. However, his work contains information about the role of mathematics in the training of

military officers of his time as well as the positive or negative values Vigny and some of his characters accorded to mathematics. Moreover, he used some mathematical expressions. Above all, we observe frequent uses of the circle, the center of which represents the individual in general, or Vigny himself in particular, according to the context. Various emotions are related to these images and to their transformations. They reveal a type of relation between the writer and the world and also a conscious mode of structuring his own works. The circle, as the word is used in the talk, includes related figures; spheres, rings. . . .

Means will be taken to accommodate listeners more at ease with either the French or English language.

### **R. O'Lander (St. John's University). Trigonometry from a Historical Perspective.**

Trigonometry is an area of mathematics which most students study in college. Traditionally students are not exposed to the origins of trigonometry and how the trigonometric values of angles were derived. This paper will describe how Hipparchus and Ptolemy calculated the table of sine values for angles and in the process derived some of the trigonometric formulas that are in use today. The reasons why these astronomers performed this work will be discussed as well as the rationale for including a discussion of the work of Hipparchus and Ptolemy into a lesson on trigonometry.

### **L. Radford (Laurentian University). Linking Psychology and Epistemology: how can history of mathematics be a useful tool for the comprehension of students' learning processes?**

Suite à l'émergence de la psychologie expérimentale et des travaux de Piaget, les relations peuvent exister entre l'épistémologie (considérée celle-ci comme partie de la philosophie) et la psychologie de la connaissance ont donné lieu à des débats importants.

Une des questions soulevées du côté de l'épistémologie concerne celle des possibilités ou impossibilités des méthodes expérimentales utilisées en psychologie de rendre compte de la connaissance. Or, tant dans les exposés épistémologiques comme dans les psychologues, le problème de la connaissance est sous-tendu par un cadre théorique (empiriste, réaliste, intuitionniste ou autre). Dans le cas de la psychologie des mathématiques, c'est la cadre constructiviste qui est à la base d'un nombre important de travaux récents. Outre les études de type purement psychologique sur le savoir mathématique, ce domaine de recherche tente d'obtenir des informations et des renseignements à travers l'histoire des mathématiques. Une des questions qui se pose au sein de la psychologie constructiviste est celle de se donner les moyens conceptuels et méthodologiques lui permettant d'analyser et d'interpréter de façon appropriée l'histoire du savoir mathématique. Cette communication a pour objet d'aborder cette question. Plus spécifiquement, nous nous proposons de montrer que la recherche des mécanismes pouvant aboutir à la formulation d'hypothèses au sujet de la construction des connaissances mathématiques par le sujet exige une 'lecture' spécifique - et jusqu' à un certain point *neuve*- de l'histoire des mathématiques. Il s'agit d'une 'lecture'

qui passe par l'élaboration d'un nouveau niveau descriptif des phénomènes en étude et qui aboutit à ce que nous suggérons d'appeler *l'épistémologie didactique*. À la fin de notre communication, nous discuterons - en prenant comme exemple certains épisodes de l'histoire des mathématiques - les possibilités que peut offrir l'épistémologie didactique pour aller *revoir* l'histoire des mathématiques.

### **P. Rajagopal (Atkinson College). Proofs in Indian Mathematics.**

Commentaries provide a general exposition of many basic aspects of Indian Mathematics. Their main emphasis is in presenting what they refer to as *upapatti* (roughly translatable as demonstration, proof) for every result in the *mula* (roughly translatable as root text) of the originals. The commentaries provide a general exposition of many basic aspects of Indian mathematics.

In the Indian tradition mathematical knowledge is not viewed to be in any fundamental sense distinct from that in the natural sciences. As a result the purpose of *upapatti* is to clarify, and to convince fellow mathematicians of the validity of the result, rather than to perform formal deductions from some fixed set of axioms.

Examples from the Bakshali Manuscript (7th century), the *Ganitasarasangraha* of Mahavira (850), and the commentaries by Ganesa Daivajna (1545) on the *Lilavati* and by Jyeshthadeva (1675) on the *Tantrasangraha* of Nilakanta will be used as illustrations.

### **J.A. Ralston (Wartburg College). The Three and Four Line Locus Problem or The Problem of Pappus.**

I will discuss the importance of locus problems in the development of Greek and sixteenth century mathematics. Some background on the structure of the proofs and a discussion of sources will be given. The main body of my talk will be a detailed presentation of the analytic half of the four line locus proof. This theorem states: there exists a curve such that, if it exhibits the four line locus property then it is a conic section.

### **B. Rosenthal (Ursinus College). A Pan-Cultured Approach to Mathematical Epistemology.**

The focus of this presentation will be the ideas that inspired and arose from a seminar in education called "Exploring Mathematical Ways of Knowing" that I taught during Fall 1994. Instead of taking Western epistemological perspectives on mathematics as foundational, non-negotiable givens and asking, "What does it mean to know mathematics" , "What is to count as mathematical knowledge, and why?" , and "What is mathematics?" , from the standpoints of conventional mathematical philosophies, we approached epistemology and ontology by beginning with Alan J. Bishop's credo, "Mathematics is a pan-cultural phenomenon", and refusing to reduce our analyses to the terms of what Bishop calls (big-M) mathematics. We attempted to take an anthropological perspective through which a culture's mathematical ways of knowing, doing, and being were understood on its own terms - not our own.

**P. Rusnock (University of Waterloo). Remarks on Bolzano's Philosophy of Mathematics.**

Few problems in Kant interpretation have occasioned as much difficulty as that posed by his remarks concerning incongruent counterparts. Generations of commentators have had their say on his reflections without reaching any agreement which might be regarded as final. The difficulty of this interpretive problem can be traced to a variety of sources historical, mathematical, philological. The mathematical problem which occasioned Kant's reflections, by contrast, is relatively straightforward. In this paper, I discuss the mathematical problem in its historical context, and several solutions. I aim, further, to present a plausible account of Kant's thoughts on these matters, and to explain, in light of this account, some of the unusual aspects of his approach to the problem.

**S. Sanatani (Laurentian University) Some Aspects of Intuitionism in Mathematics.**

In 'Critique of Pure Reason' KANT introduced time as a 'form' of inner intuition and natural numbers were constructed from time. Many consider this idea of KANT as the course of what intuitionism, in general, represented in the later periods. Refinements of intuitionism permeated in logic and in foundational problems of mathematics. If 'construction' is the essence of any intuitionism, then the nature of that what holds or defines the construction must be critically examined. In my presentation I try to assess intuitionism in mathematics from the point of view of 'communicability' and 'applicability to experience'.

**Abe Shenitzer (York University) Remarks on Mathematical Criticism.**

The critic is a salesman of ideas. In this talk I propose to give a few examples of salesmanship of mathematical ideas.

**R. Sklar (St. John's University). Automated Theorem Proving in Euclidean Plane Geometry: An Historical Sketch.**

This talk will focus on the effort to automate the proving of theorems in Euclidean plane geometry. From the analytic geometry of Descartes, which he believed would allow the deduction of all the results of classical Greek geometry in a relatively mechanical way, to the work of Herbert Gelernter and Nathaniel Rochester in the late 1950's, through the fascinating and surprising work of Wu and Chou in the late 1970's and early 1980's, his effort has finally achieved a substantial degree of success, with over 500 theorems proved mechanically including Simson's Theorem, Pappus's theorem, Euler's Theorem, Desargue's Theorem, the Butterfly Theorem, etc.

The use of the relatively new tool of Grober bases in this undertaking will also be discussed.

**J. A. Synowiec (Indiana University Northwest). A Confluence of Theories: Partial Differential Equations, Harmonic Analysis and Generalized Functions.**

Partial differential equations is one of the broadest and deepest subjects in all of mathematics. Here the concern is one aspect, which is basic for linear partial differential equations, namely, the continued interaction between partial differential equations, harmonic analysis, and generalized functions. Although connections between the first two, and the first and last can be traced to the very beginnings of partial differential equations, it was not until the introduction of the theory of distributions by Laurent Schwartz that the three subjects were brought together, and used with great success. Some of the highlights of these developments will be traced.

### **Jim Tattersall (Providence College) Women and the Cambridge Mathematical Tripos 1880 - 1910.**

Up to 1910, the person with the best performance on the Mathematical Tripos Examination was designated the Senior Wrangler. A "pass" on the examination was necessary to receive an honours degree from Cambridge. In the late Nineteenth century the exam lasted 50 hours spread over a five-day period. between 1880 and 1910 a number of women at Girton and Newnham College excelled on the Tripos examination. After a brief history of the Mathematical Tripos Examination we discuss the accomplishments of Charlotte Scott, Phillipa Fawcett, and Eva Smith. Sample questions from the Tripos will be provided to indicate the material that students were expected to master to be successful on the exam.

### **R. Thomas (University of Manitoba). From Ethnomathematics to Real Mathematics.**

The June 1994 issue of 'For the learning of mathematics' is devoted to the variety of views of what ethnomathematics is, including historical from Victor Katz and philosophical from Rik Pinxten, who distinguishes 'mathematics' and 'Mathematics'. Pinxten advocates using mathematics as a bridge into Mathematics, which is certainly preferable to a concentration on mathematics to the exclusion of Mathematics, a danger that has already been noted in the popular press and is already being combatted. To hide Mathematics from schoolchildren is dangerous in a variety of ways. I contend that since the nineteenth century there has been - side by side with a variety of persisting ethnomathematical subcultures - a world-wide Mathematics to which professionals from all countries in the world contribute in a common symbolic language fleshed out in natural languages. It does not trouble me to admit that European mathematics as long as it considered itself based on Euclid was ethnomathematics. But that ended with non-euclidean geometries. The present world-wide Mathematics is not just a continuation of the Hellenistic ethnomathematics. How did the nineteenth century make a difference? It marked the invention of pure mathematics and so of applied mathematics.

### **G. Van Brummelen (The King's University College). Kushyar ibn Labban's Planetary Astronomy.**

Islamic science grew considerably in the tenth century, as the Greek revival began to give way to new ideas. Kushyar ibn Labban was, intellectually, on the threshold of

this “Renaissance” . In astronomy his methods were essentially Ptolemaic and he varied only occasionally from this tradition. In his planetary theory, however, he developed a new mathematical technique that directly contradicted Ptolemy’s advice. It was an experiment that ultimately failed, but an ingenious attempt that exemplifies one of the first halting step toward innovation.

**In addition to the CSHPM Programme, members may wish to attend the following session of CSHPS on Monday, June 5 beginning at 9:00 a.m.**

**Logic and philosophy of mathematics:**

DeVidi, David (Philosophy, Waterloo) & Solomon, Graham (Philosophy, Wilfrid Laurier University): Tarski on “Essentially Richer” Metalanguages.

Kirchoff, Evan (Philosophy, Univ of Manitoba): Philosophical Problems in Chaos Theory

Gauthier Yvon (Universite de Montreal): Forme normale de Cantor et polynomes de Kronecker.