Canadian Society for History
and Philosophy of Mathematics

Société canadienne d'histoire et
de philosophie des mathématiques

ANNUAL MEETING - CONGRES ANNUEL

University of Manitoba, Winnipeg
May 26 - 28 mai
1986

Monday, May 26 mai, lundi : Room/local 384, University College.

10:00	Victor J. KATZ	Trigonometric functions and the caculus.
11:00	M.A. MALIK	A history of the proofs of Bernstein's theorem.
12:00	OOOOOOOOO	OOO LUNCH - REPAS OOO
13:30	Irving H. ANELLIS	The Heritage of S.A. Janovskaja.
14:30	Israel KLEINER	Evolution of (noncommutative) ring theory.
15:30	Alejandro GARCIADIEGO	On the need to rewrite the history of the fondations of mathematics.
16:00	OOOOOOOOO	OOO TEA -THE OOO
16:20	N.S. MENDELSOHN (Inv. Speaker)	The unusual teaching methods of Samuel Beatty.
17:30-19:00		OOO RECEPTION OOO

Tuesday, May 27 mai, mardi : Room/local 384, University College.

9:30	Len BERGGREN	The early history of the science of spherics.
10:30	A.K. RAY	Some reminiscences of post-war Göttingen in mathematics and its applications.
11:20	Mark REIMERS	An experimental course for first-year

		Arts students.
12:00	OOOOOOOOO	O LUNCH and BUSINUS MEETING O REPAS ET ASSEMBLEE GENERALE
14:00	Erwin KREYSZIG	On the development of the concept of function and its influence on contemporary mathematics.
15:00	Edward BARBEAU	Lagrange multipliers: then and now.
16:00	OOOOOOOOO	OOO TEA - THE OOO
16:20	Gregory H. MOORE (Inv. Speaker)	From Frege to Skolem: the rise of first-order logic.

Wednesday, May 28 mai, mercredi : Room/local 382, University College.

9:30	Louis CHARBONNEAU	Fonction et tangente: réflexions historico-didactiques.
10:00	Roger HERZ-FISCHLER	Theorem XIV, ** of the <u>Elements</u> - the case of the missing theorem; or, when should we prove "obvious" theorems.

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ABSTRACTS - RESUMES

1- Trigonometric function and the calculus
Victor J. KATZ, University of the District of Columbia.

Trigonometric functions only became part of the calculus when they were found necessary in the solution of differential equations coming from physical considerations. Newton and Leibniz both developed the power series expansions for the sine and cosine form geometrical considerations. But for both, the sine (and cosine) were lenghts determined by a particular radius. They were not thought of as "functions" and did not appear explicitly in any calculus text before that of Euler. Euler himself only introduced them into the calculus when they forced their way into his consciousness as solutions of various linear differential equations with constant coefficients.

2- A history of proofs of Bernstein's theorem
M.A. MALIK, Concordia University.

In 1912, S. Bernstein studied the estimate of the derivative of a trigonometric polynomial and obtained an interesting inequality though it was not precise. The sharp inequality concerning the derivative of trigonometric polynomials was first proved by M. Riesz in 1914. The result is now known as Bernstein's Theorem: If $t(\theta)$ is a trigonometric polynomial of degree n and max $|t(\theta)| \leq 1$, then $|t'(\theta)| \leq n$. Later, F. Riesz and de la Vallée Poussin gave different proofs of this famous inequality. A proof relying on geometrical considerations is described by R.P. Boas in a recent article on polynomials. This field of study (extremal properties of polynomials) begins with the work of A. Markoff in 1889. In this talk, we present a survey of these proofs and also describe the method of Bernstein in deriving the inequality. We also present the subsequent development in his subject.

3- The heritage of S.A. Janovskaja
I.H. ANELLIS, Philosophia Mathematica.

On the ninetieth anniversary of the birth of Sof'ja Aleksandrovna Janovskaja (31 January 1896 - 24 October 1966), we survey her scholarship in history and philosophy of mathematics and logic, and trace her contribution to the development of mathemaitcal logic in the Soviet Union.

Throught the early Soviet period of Russian history, formal logic was held in thorough disrepute, and was seen by practicioners of dialectical materialism to be philosophically dangerous to dialectical logic. This attitude persisted until Stalin's "Letters on Linguistics" changed the atmosphere in the mid-1950's. Until that time, Janovskaja carried on a solitairy battle to defend the integrity of mathematical logic, and virtually single-handedly she introduced the classics of modern Western mathematical logic to Soviet mathematicians, through her program of translating and editing. She did no original work of her own in mathematical logic, but made important contributions to the history of mathematics in general, and to the history of logic in particular. Morever, she trained several generations of logicians and mathematics historians. Her high level of scholarship and teaching excellence was responsible for producing some of the best mathtematical logicians in the world today.

4- Evolution of (noncommutative) ring theory

Israel KLEINER, York University.

The topic will be discussed under the following heading:

I. Sources

a) Symbolical algebra (Peacock, De Morgan et al.); quaternions (Hamilton); 1830-1843.

b) Lie groups and Lie algebras (Lie, Scheffers, Killing, Poincaré, E. Cartan); 1880's-1890's.

II. Exploratory stage

Cayley numbers, exterior algebras (Grassmann), group algebras (Cayley), matrices (Cayley), Clifford algebras, nonions (Sylvester); 1840's-early 1880's.

III. Classification begins

a) Low dimensional algebras (B. Pierce, Study, Scheffers); 1870's.

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b) Division algebras (Frobinius, C.S. Peirce); 1878, 1881.

c) Commutative algebras (Weierstrass, Dedekind); 1884.

IV. Structure theory of algebras

a) Over the complex and real numbers (Molien, E. Cartan, Frobenius); 1890's-1903.

b) Over any field (Wedderburn); 1907.

V. Interlude

a) Division algebras (Wedderburn, Dickson); 1905-1926.

b) Definitions of abstract algebras and abstract rings (Dickson, Fraenkel); 1903, 1914.

VI. Structure of rings with minimum condition

The Artin-Wedderburn structure theorems (Artin); 1927.

VII. Some subsequent developments

a) Deep study of division rings (algebras) (Albert, Brauer, Hasse, Noether); late 1920's-early 1930's.

b) Nilpotent rings; 1930's- .

c) Quasi-Frobenius rings (Nakayama); 1939-1941.

d) Primitive rings (Jacobson); 1945.

e) Prime rings (Goldie); 1958-1960.

f) Homological methods (H. Cartan, Eilenberg, Maclane et al.); 1940's-1950's.

5- On the need to rewrite the history of the foundations of mathematics.
Alejandro R. GARCIADIEGO, Universidad Nacional Autonoma de México.

Some of the best-known textbooks on the history of mathematics share what I call a "standard interpretation" of the origin and development of the set-theoretic paradoxes. One might describe the basic premises of this standard interpretation in the following way. Most scholars claim that Cesare Burali-Forti discovered the contradiction of the greatest ordinal number in 1897. Immediately after its publication, dozens of papers appeared dealing with the paradox and,as a consequence, more paradoxes were encountered. It has been said that Georg Cantor came upon similar paradoxes connected with the greatest cardinal and ordinal numbers in 1899. According to standard interpretation, Bertrand Russell presented another paradox in The Principles of Mathematics [1903]. Three main points should certainly be stressed in connection with this "standard" interpretation. First, it claims that paradoxes were originally encountered as the result of criticism of the theory of transfinite numbers. Second, that discovery of the paradoxes made clear the need for a reexamination of the foundations of mathematics and, as a direct result, the paradoxes stimulated three major philosophical schools in mathematics. Finally, historians may generally assume that the semantic paradoxes were a direct product of the logical ones.

It was not unil 1978, more than 80 years after its publication, that the fact that there was no paradox in any of Burali-Forti's papers of 1897, or in Cantor's letters to Richard Dedekind of 1899, was pointed out. The question arises: if Burali-Forti did not discover the paradox of the greatest ordinal number, then who did ?

6- The unasual teaching methods of Samuel Beatty
Nathan S. MENDELSHON, Invited Speaker, University of Manitoba.

7- The Early history of the science of spherics
Len BERGGREN, Simon Fraser University.

Texts relevant to the science of spherics constitute part of our evidence for the earliest phases of the Greek mathematical sciences, and the content and organization of this science continued to be a subject for lively scientific research until the end of the medieval period. In my talk, which will focus on

the beginning of theory, I shall survey the problems that gave rise to this science and outline its development up to the time of Ptolemy.

8- Some reminiscences of post-war Göttingen in mathematics and its applications.
A.K. RAY, Fundamental Research Institute.

Post-war Göttingen witnessed a dialogue of understanding amongst mathematicians (abstract and concrete), physicists etc. in streamlining mathematics into the mainstream of science. This stimulated a perception and influenced an outlook to solve physical problems of complex situations by mathematical model building assisted by observations etc. In the present exposition, the author's intention is to enumerate classical functional analysis within domains of applied mathematics, to realize historically some descriptions and dimensions of physical problems.

9- An experimental course for first-year Arts students.
Mark REIMERS, University of British Columbia.

A course for first year Arts sutdents was developed whose goals were to promote an appreciation of mathematics as a human intellectual discipline, and to equip students with some technical facility with the deeper aspects of mathematics, such as calculus. The first term was spent on the origins and development of significant ideas within the mathematical tradition, up to and including the discovery of calculus. One month in the second term was devoted to some elementary but significant contemporary uses of calculus, and the remaining two months to a less technical overview of some areas within modern mathematics, including some statistics.

Except for the last section of this level, a high level of technical proficiency was demanded from the students, and attained. I think this was made possible in a course for Arts students because of the care taken to elucidate the development of the concepts in question.

10- **On the development of the concept of function and its influence on contemporary mathematics.**
Erwin KREYSZIG, Carleton University.

Whereas traces of the idea of function date back to antiquity (to Appollonius, in particular), the concept of function began to play its crucial role only around 1700 (Leibniz 1694, Jakob Bernoulli 1698). Beginning with Euler's "Introductio in analysin infinitorum" (1748), ideas related to the concept of function have at various times influenced the development of mathematics up to the present time. Such effects often extended over long periods of time, for instance, in the case of orthogonal functions from Fourier's "Théorie analytique de la chaleur" (1822) to the classical theoritical physics of the late 19^{th} century and Hilbert space theory of the 1930sa, in the case of functions arising as solutions of partial differential equations from Daniel Bernouli's and d'Alembert's work to generalized functions (Sobolev 1936, L. Schwartz 1945, Gelfand 1958), in approximation problems from Chebyshev's and Weierstrass's work to splines and interval functions (R.E Moore 1966).

This paper charactirizes the main stages of this evolution and their principal contributors and contributions, essentially beginning with Euler and contemporaries, proceeding to the critical period of greater rigor (Gauss, Cauchy) that followed the 18^{th} century period of rapid expansion and then concentrating on the transition period from "classical" to functional analysis, roughly the time from 1880 to 1910, which followed the time of the completion of the basic theory on complex analytic functions (by Weierstrass and others) and included the development of the theory of measurable fucntions (Borel 1894, Lebesgue 1902). Some of the ideas fundamental to this development around 1900 and beyond had considerable impact on accomplishments during the subsequent decades, as wil be exemplified by some critical case studies.

11- **Lagrange multipliers: then and now.**
Edward J. BARBEAU, University of Toronto.

The method of multipliers was devised by Lagrange as a way of determining the extrema of multivariate functions in a symmetric way when some of the variables are dependant on others. In part as a response to the need of economic theory, the theory of optimization under constraints (or nonlinear programming) developed enormously in the 1950s beginning with an important paper of Khun and Tucker. In this paper will be traced the main

ideas as they came to be worked out in convex analysis, functional analysis of partially ordered sapces and duality theory.

12- **From Frege to Skolem: the rise of first-order logic.**
Gregory H. MOORE (Invited Speaker), Mount Allison University.

13- **Fonction et tangente: réflexions historico-didactiques.**
Louis CHARBONNEAU, Université du Québec à Montréal.

L'analyse du concept de fonction révèle les multiples facettes de cette notion. Les historiens des mathématiques portent naturellement leur attention sur l'évolution du concept après son explicitation dans le cadre des premiers travaux sur le calcul différentiel et intégral de Leibniz à Euler. Le didacticien des mathématiques doit par ailleurs s'intéresser davantage aux manifestations de l'idée de fonction qui sont antérieures à son explicitation. Nous tenterons dans cette communication de préciser le lien historique existant entre l'évolution de l'idée de fonction et l'évolution de l'idée de nombre jusqu'au début du XVIII^{e} siècle. Nous en tirerons quelques conséquences didactiques et parlerons d'une courte expérimentation dont les résultats tendent à confirmer nos conclusions théoriques.

14- **Theorem XIV,** of the Elements - the case of the missing theorem; or, when should we prove "obvious" theorems.**
Roger HERZ-FISCHLER, Carleton University.

From an examination of the evidence provided by Pappus, and the Arabic, Arabic-Latin, Greek(?)-Latin and Greek(?)-Hebrew traditions it seems very certain that the result: "If the side of the hexagon is divided in extreme and mean ratio then th larger segment is the side of the decagon" which appears implicitly in existing manuscripts of the so-called XIVth Book of the Elements, was once an explicit result - stated and proved - in that book. The critical edition of the Elements would therefore appear to be incomplete. Since the result in question might be considered as obvious once XIII,9 is known, the talk will also deal with the subjet of the subtitle.