The British Society for the History of Mathematics is delighted to welcome the Canadian Society for History and Philosophy of Mathematics to Oxford for this first ever joint meeting between the two societies. It is especially gratifying to see the variety and richness of the contributions with so many talks presented by those who have travelled furthest. We hope that the combination of milieu, programme and people will enable this meeting to be not only a satisfying experience in its own right but also a stimulus for further fruitful co-operation.

La Société Britannique de l'Histoire des Mathématiques est heureuse d'accueillir la Société Canadienne d'Histoire et de Philosophie des Mathématiques pour cette toute première réunion commune à nos deux sociétés ici à Oxford. C'est avec grande satisfaction que nous voyons la variété et la richesse des contributions avec tant de communications présentées par ceux qui viennent des pays les plus eloignés. Nous espérons que cet amalgame de milieu, de programme et de participants permettra à cette réunion de n'être pas seulement une expérience enrichissante en elle-même mais qu'il servira ultérieurement à stimuler une coopération fructueuse.

FRIDAY 18 JULY

2 p.m. to 3 p.m.	**Registration** (in the foyer of the Harris Building Lecture Theatre)
3 p.m.	**Welcome** J V Field (BSHM President) John Earle (Meeting Organiser)
3.15 p.m.	**Mathematicians as Philosophers of Mathematics** Jeremy Gray
4 p.m.	**Tea**
4.30 p.m.	**Mathematical Methods in the Astronomical Tables of Medieval Islam** Glen Van Brummelen
5.15 p.m. (to 6 p.m.)	**Notes on the Relation between the History of Modern Mathematics and Modern Art** Florence Fasanelli
7 p.m.	**Dinner**
8.30 p.m.	**Oxford Mathematics** Robin Wilson

SATURDAY 19 JULY

9 a.m. **The Beginnings of General Topology** Rebecca Adams

9.30 a.m. **M$_{191}$ and the History of Factoring**
Hardy Grant

10 a.m. **British Mathematical Values and Canadian Mathematics**
Tom Archibald

10.40 a.m. **Coffee**

11.10 a.m. **"All the Mistery of Infinites": Thomas Harriot, atomism and mathematical infinitism** Stephen Clucas

11.50 a.m. **From Anaximander to St Augustine: early mathematical,**
(to 12.30 p.m.) **theological and physical conceptions of the infinite**
Gregory H Moore

1 p.m. **Lunch**

2 p.m. **Choice of activities:**
(a) Visit to the Oxford Museum of the History of Science
(led by the Museum Director, Dr Jim Bennett)
(b) Tour of Mathematical Oxford (led by John Fauvel and
Raymond Flood)
(c) Private visits / sightseeing / resting

4.30 p.m. **Tea**

5 p.m. **Contraries and Contradictories: the early history of proof by derivation of an impossibility in Greece**
Janet D Sisson

5.30 p.m. **Proof: a many splendored thing** Israel Kleiner
(to 6.15 p.m.)

7 p.m. **Reception**

7.30 p.m. **Conference Dinner**

followed by **Musical Entertainment**

SUNDAY 20 JULY

9.30 a.m.   **Women and the Educational Times**   Jim Tattersall

10.10 a.m.   **The Rhetoric of Utility: negotiating the role of mathematical practitioners in early modern England**
                                                            Katherine Hill

10.50 a.m.   **Coffee**

11.20 a.m.   **Factoring in the US: the early mathematical history of factor analysis in the United States**   Sylvia Svitak

11.50 a.m.   **Sylvester's Work in Combinatorics**   Robin Wilson

12.20 p.m.   **Conclusion**   Robert Thomas (CSHPM President)

1 p.m.   **Lunch**

NOTE: All talks take place in the Harris Building Lecture Theatre unless otherwise notified.

Throughout the meeting there will also be

- an exhibition celebrating the life and work of James Joseph Sylvester whose centenary we are marking this year

- a mathematics bookstall run by QED Books

- BSHM t-shirts available for purchase

This Joint Meeting has been organised by **JOHN EARLE** on behalf of BSHM and **JIM TATTERSALL** on behalf of CSHPM with the support, assistance and encouragement of the BSHM Council and the CSHPM Committee.

The British Society for the History of Mathematics
and
The Canadian Society for History and Philosophy of Mathematics

JOINT MEETING

ABSTRACTS

Oriel College, Oxford

18 - 20 July 1997

Mathematicians as Philosophers of Mathematics

JEREMY GRAY
Open University

I shall argue, from the standpoint of an historian of mathematics, that hard and fast distinctions between mathematics, the philosophy of mathematics and the history of mathematics might be difficult if not impossible to make and ill-advised on all counts, mathematical, philosophical and historical. The talk comes in three unequal parts. I begin with some discussion of Kant's views and hope to show that they were prevalent among mathematicians attracted to Kronecker's style of algebraic geometry; these mathematicians were active epistemologists. A shorter middle third glimpses the situation a generation or two later: Weil, van der Waerden and Zariski as ontologists. Finally I do the stirring, arguing as an historian of mathematics for a position close, I believe, to that of Maddy and Kitcher as far as the philosophy of mathematics is concerned, although I disagree with her about mathematics.

In particular, I shall argue that there is more to mathematics than set theory and that it would be interesting to see what a philosophy of mathematics might be that was not so restricted in its gaze.

Mathematical Methods in the Astronomical Tables of Medieval Islam

GLEN VAN BRUMMELEN
The King's University College

The interplay between astronomy and mathematics has produced fruit in both fields. In particular, medieval Islamic scientists requiring prodigious amounts of calculations to solve astronomical problems found a variety of solutions that, in several cases, anticipate later mathematical developments. We sample several of these instances of creativity spurred by scientific necessity.

Notes on the Relation between the History of Modern Mathematics and

Modern Art

FLORENCE FASANELLI
MAA/SUMMA , Washington, D.C.

The History of Mathematics and the History of Art are intertwined in such a way that can be shared with students in the classroom or in museums to enrich their visual insights into difficult problems. This talk will highlight some of these connections in the 19th and 20th centuries. Information about the artists and the mathematicians as well as their works will be incorporated into the presentation.

Oxford Mathematics

ROBIN WILSON
Open University

This illustrated talk depicts some of the people and places arising in the history of the mathematical sciences in Oxford over the past 800 years - from the Merton School of the 14th century, via the experimental philosophy group in Wadham to Lewis Carroll and the recent Fields medallists. Some of the places shown will be visited on the tour of mathematical Oxford on Saturday afternoon.

The Beginnings of General Topology

REBECCA ADAMS
Department of Mathematics, Southern California College.

While mathematicians worked with curves, planes and continuous functions, for efficiency Fréchet 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 (1904-1914) demonstrates the significance of the neighborhood concept in the emergence of general topology.

M$_{191}$ and the History of Factoring

HARDY GRANT
York University, Toronto

The history of attempts to factor large numbers cannot (of course) be told in half an hour. However, it happens that the factorization of the Mersenne number M_{191} (i.e. 2^{191}-1) reflects a number of the leading features of that history, since this number's five prime factors were found by four different methods spanning more than two hundred years. I shall therefore structure an overview around the career of M_{191} and then, if time permits, I shall offer some thoughts on what a more comprehensive history of factoring might contain.

British Mathematical Values and Canadian Mathematics

TOM ARCHIBALD
Acadia University

The Canadian universities of the nineteenth century were for the most part established on the basis of Scottish models. Their mathematical curricula likewise adhered strongly to British models as did the career trajectories of mathematics professors. This is in marked distinction to the situation in the US where the German research university was highly influential.

In this paper I will examine the early British influence on Canadian mathematics and aspects of its legacy.

"All the Mistery of Infinites": Thomas Harriot, atomism and mathematical infinitism

STEPHEN CLUCAS
Birkbeck College, University of London

In this paper I shall attempt a census of Thomas Harriot's scattered writings on infinites (some of which have not been previously discussed). My main contention is that Harriot's infinitism and atomism arose out of his mathematical investigations rather than any supposed encounter with the philosophy of Giordano Bruno. In considering the possible sources of his infinitist and atomist ideas, I look at Harriot's reflections on divisibility and infinite progressions which stem from his work on geometrical problems from Francois Viète, the sum of arithmetical progressions, continual

proportions and mediaeval discussions of motion in terms of divisible magnitudes. In particular I shall consider how the early-modern concept of the unit as indivisible (derived from the ancients) contributed to the development of the atomistic hypothesis and the idea of infinite space.

From Anaximander to St. Augustine: early mathematical, theological and physical conceptions of the infinite

GREGORY H MOORE
McMaster University

This talk will deal with changing conceptions of the infinite. The earliest versions (e.g. Homer) used infinite in the sense of "very large finite", the next (e.g. Anaximander) in the sense of "indefinite, undetermined". The atomists (e.g. Democritus) argued for an infinite universe with infinitely many atoms. Then Aristotle distinguished the potential and actual infinite, primarily in the context of physics, and argued for a finite universe. Euclid used only the potential infinite, with an apparent exception, noted by A. Weil. Somewhat later, St. Augustine (c.400) argued for God's knowledge of the infinite, especially number. At about the same time, Proclus used an infinitely long line.

Contraries and Contradictories: the early history of proof by derivation of an impossibility in Greece

JANET D. SISSON
Department of Philosophy, University of Calgary

The earliest surprising European geometrical proof we know of is the discovery that the side and the diagonal of the unit square are incommensurable. This was proved by showing that if they are commensurable then some number is both odd and even or, as Aristotle puts it, "odd numbers become equal to even ones". The proof requires numbers to have contrary characteristics; standardly, each number must be either odd or even, but never both. If the side and diagonal are commensurable, this conception of number is undermined. Such a surprising result, we may hypothesize, led to investigation of the idea of opposites and shed new light on the nature of proof and of proof discovery. In philosophy, Zeno of Elea developed the method of dialectical discussion by means of deriving impossible conclusions which have the form of pairs of contrary predicates

(as, if things are many, they are both like and unlike). In mathematics, the result led to a conceptual revolution; ratios of lines, figures and volumes were studied in separation from the numbers that might be used in measuring some of them.

I am mainly interested in mathematical method as it affected philosophical method and see the historical result of discovery of a contradiction at the heart of a system as provoking the Greeks to look for ontological distinctions within the lines they used to represent numbers. Here I present the mathematics only: in other work I examine the results of this conceptual revolution for philosophy.

Proof: A Many Splendored Thing

ISRAEL KLEINER
Department of Mathematics, York University

In a recent article in the *Bulletin* of the AMS, Jaffe and Quinn expressed concern about what they viewed as diminishing standards of proof in certain areas of mathematics and suggested a framework for dealing with the issue which included attaching labels to "speculative and intuitive" work. The article has engendered a fascinating debate about the nature and function of proof in mathematics. I hope to show, using examples from the history of mathematics, that the current debate is a continuation of a 2000-year-old tradition.

Women and the Educational Times

J. J. TATTERSALL
Providence College

The Educational Times, a monthly periodical devoted to pedagogical interest, contained a section devoted to mathematical problems and their solutions. The British mathematician, W. K. Clifford, claimed that the journal did more to encourage original mathematical research than any other European periodical in the late nineteenth century. Approximately three per cent of the published mathematical problems and solutions were contributed by women. We discuss the accomplishments of several problem solvers including Christine Ladd-Franklin, who received her Ph.D. from Johns Hopkins, Hertha Ayrton, first women to have been nominated a Fellow in

London's Royal Society, and Charlotte Scott, first women to receive first class honors on the Cambridge Mathematical Tripos. Several problems from the mathematical section of the Educational Times solved by these women will be discussed.

The Rhetoric of Utility: negotiating the role of mathematical practitioners in early modern England

KATHERINE HILL
Science Studies Unit, University of Edinburgh

In early modern England mathematical practitioners developed strategies of argumentation to persuade their audience that their profession, a collection of practical arts dependent upon arithmetic and geometry, was necessary for both private individuals and the commonwealth. The common perception of mathematics in this period was that it was a difficult and tedious pursuit and it was also associated with illicit and occult practices. Therefore, mathematical practitioners used the rhetoric of utility, a technique of persuasion that centred upon stressing the practical uses of mathematics, as one of their tactics to publicize their conception of mathematics as well as to diffuse hostility and obtain patrons and students. The practical vernacular mathematics textbooks used their extended titles, epistles to the readers and the problems themselves to portray mathematics as vital to such useful activities as astronomy, navigation, surveying, gunnery, architecture and mensuration. The practitioners attempted to persuade their readers that mathematics could be both profitable and pleasurable. A survey of a selection of early modern English vernacular mathematics literature will show how the rhetoric of utility was used to negotiate a role for mathematical practitioners in early modern England.

Factoring in the US: the early mathematical history of factor analysis in the United States

SYLVIA SVITAK
Queensborough Community College; New York City University

Factorial indeterminacies and invariances were dilemmas faced by American researchers in the mathematical formulation of factor analysis in the 1930s and 1940s. The history of their efforts sheds light on the nature of these inherent difficulties in using factor analysis as a viable method of

investigation. L. L. Thurstone is recognized as the pioneering leader in the development of factor analysis as a scientific method of investigation in the United States. His mathematical observation, that the rank of the correlation matrix and the dimension of the factor space are equal, ushered in the modern formulation of factor analysis in terms of matrix algebra.

C. Eckart, G. Young and A. S. Householder were among the primary explicators of the basic mathematics underlying matrix approximation techniques employed in factor analysis. A 1936 paper by Eckart and Young is considered a classic cornerstone of factor analysis. A. A. Albert contributed a solution for obtaining unique communalities or diagonal entries of a correlation matrix when factoring. Uniqueness, always a cherished mathematical goal, is simply dismissed in this case as a "solution in theory only" by practitioners looking for feasible interpretations of factors.

Sylvester's Work in Combinatorics

ROBIN WILSON
Open University

James Joseph Sylvester died in 1897. In this centenary tribute we outline his work in combinatorial analysis, with particular reference to the following four areas:
* partitions
* chemical trees
* 'tactic' (block designs)
* factorization of graphs

No previous knowledge of combinatorics will be assumed.