History and Philosophy of Mathematics
Histoire et philosophie des mathématiques

(Org: **Maritza Branker** (Niagara University), **Nicolas Fillion** (Simon Fraser University) and/et **Glen Van Brummelen** (Quest University))

LEN BERGGREN, Simon Fraser University
Some Mathematics of the "Mountain Man"

One of the outstanding geometers of medieval Islam is Abu Sahl al-Kuhi, who hailed from the mountainous region in Iran south of the Caspian Sea. ("Kuh" means "mountain" in Farsi.) In our talk we will discuss some of al-Kuhi's mathematics – including works on a number of problems in the Archimedean tradition, mathematical problems arising from the astrolabe, and calculating the distance from the earth to the shooting stars. We will end the talk with some thoughts about what, if anything, was particularly "Islamic" about al-Kuhi's work.

JIM BROWN, Philosophy, U of Toronto
Plato vs Aristotle

The two great philosophers of antiquity are both mathematical realists, but otherwise had different outlooks. Plato took mathematics to be transcendental while Aristotle believed that mathematics is part of the natural world. I will compare the views of the leading contemporary platonist, Kurt Gödel, and the Aristotelian, James Franklin, author of the recent book, An Aristotelian Realist Philosophy of Mathematics. A number of topics will be discussed, from the nature of intuition to the pure-applied distinction.

BRENDA DAVISON, Simon Fraser University
Divergent series leading up to the turn of the 20th century

While Euler and others of the mid-18th century had methods for assigning a value to some divergent series, the broad adoption of the Cauchy definition for the sum of a series made such objects problematic. However, by the mid-19th century, renewed interest in these series, as a result of their usefulness in physics, appeared at the hands of Stokes and Poincaré. In this talk I will look at some of the objections to divergent series as well as the reasons why they continued to appear and were clearly useful in some applications. Associating a divergent series with a convergent integral, finding a divergent series solution to a differential equation, or using a divergent series for asymptotic approximations made clear that these series were useful but also that a more coherent mathematical theory was needed. The consideration of these issues led to the development of new techniques near the turn of the 20th century.

TOM DONALDSON, Simon Fraser University
Language, Truthmaking, and Logic

Logicists claim that there are certain basic arithmetical statements (or inference rules) which are true (or truth-preserving) by stipulation or convention. These stipulations, they say, are partly constitutive of the meanings of our basic arithmetical words – words like 'plus' and 'zero.' They argue that many, or perhaps all, the truths of pure arithmetic are consequences of these basic stipulations or conventions. Many of those who favour logicism do so for epistemological reasons. Having discussed the epistemology of logicism elsewhere, in this talk I will consider metaphysics. To put it crudely for now, my proposal will be this. If a purely arithmetical sentence is true, its truth is wholly metaphysically explained by the relevant linguistic conventions or stipulations. That is, arithmetical truths are 'analytic' in a particular, metaphysical sense of that difficult term. This claim should appeal to physicalists. For suppose it is correct that the relevant linguistic conventions and stipulations are on their own sufficient to metaphysically explain the truths of pure arithmetic. Then it would follow that there is no need to look to a non-physical 'third realm' to find truthmakers or grounds for pure arithmetic. We could thus reconcile our acceptance of arithmetic with a commitment to physicalism, construed as the claim that all truths have physical truthmakers, or that every fact has a physical ground.

NICOLAS FILLION, Simon Fraser University
A philosophical take on variational crimes in the finite element method

Despite being one of the most dependable methods used by applied mathematicians and engineers in handling complex systems, the finite element method commits variational crimes. This paper contextualizes the concept of variational crime within a broader account of mathematical practice by explaining the tradeoff between complexity and accuracy involved in the construction of numerical methods. We articulate two standards of accuracy used to determine whether inexact solutions are good enough and show that, despite violating the justificatory principles of one, the finite element nevertheless succeeds in obtaining its legitimacy from the other.

VICTOR KATZ, University of the District of Columbia
Modern Mathematical Ideas from Medieval Times

In looking at mathematics in the Middle Ages, we find some mathematical ideas being developed that are usually thought of as having been developed much later. Why is it that these ideas "died out" without any consequences – as far as we know – for several hundred years? Is it that there was too small a mathematics community to support and continue to develop these ideas? Reviel Netz gave an approximation to the size of the mathematics community in ancient Greece – surprisingly small and scattered geographically. Still, there was a community in which members learned ideas from others and developed them over the years. What about medieval Europe or the medieval Middle East? Were the communities large enough to support mathematical ideas – or are there just "geniuses" who worked on their own, discovered interesting mathematics, and then sent these ideas out into a world where no one could understand them? We will consider several examples of modern mathematical ideas that were originally developed in the Middle Ages and speculate on the possibilities that, in fact, these ideas were somehow preserved and made their way, though paths currently unknown, to the western Europeans who eventually "rediscovered" them and propagated them after the invention of printing.

CONOR MAYO-WILSON, University of Washington
Potential Infinity and the Aristotelian Plane

Aristotle famously distinguished between $potentially$ and $actually$ infinite objects. For instance, he claimed that line segments are $potentially$ infinitely divisible, in the sense that an idealized geometer can divide them indefinitely. Yet he denied that a segment contains an infinite number of points at any given time. Cantor denied the importance of Aristotle's distinction, arguing that all potentially infinite quantities presuppose the existence of actually infinite ones. In this talk, I investigate whether Aristotle's distinction is (i) mathematically cogent and (ii) useful. After briefly introducing a few ways of formalizing the notion of potential infinity in contemporary set theory (thereby showing Aristotle's distinction is perfectly intelligible by contemporary standards), I argue that Aristotle's distinction helps us to better Euclidean geometry and number theory.

JOHN MUMMA, California State University San Bernardino
The effectiveness of geometric diagrams in geometric proofs

Mathematical proofs are often presented with notation designed to express information about concepts the proofs are about. How is such mathematical notation to be understood, philosophically, in relation to the proofs they are used in? In my talk I approach this question by examining the distinctive effectiveness of geometric diagrams in the proofs of elementary geometry. First, I explain how geometric diagrams can be fruitfully understood as a kind of mathematical notation. Second, to show what exactly the effectiveness of geometric diagrams consists in, I contrast the presentations of proofs using a diagrammatic notation with presentations using a purely sentential formalism. Finally, I consider the philosophical implications of the contrast by relating it to some observations on the surveyablility of proof from Wittgentsein's *Remarks on the Foundations of Mathematics*.

DEREK POSTNIKOFF, University of Saskatchewan
Mathematics as a Liberating Art

In contemporary society, "liberal arts" is widely understood as synonymous with "humanities" and distinguished from STEM and professional disciplines. A growing faction views liberal arts education as partisan and detrimentally impractical, and, thus, diametrically opposed to the practical disciplines and vocational training they champion. However, until relatively recently, mathematics was considered to be a crucial component of a liberal arts education rather than a rival alternative. I argue that conceiving of mathematics as a liberating art is an important first step in overcoming this troubling divisiveness in education.

GLEN VAN BRUMMELEN, Quest University