Plenary Lectures
Conférences plénières

ROBERT GHRIST, University of Pennsylvania
The Evolution of Mathematics Education

After a short survey of the-state-of-things in higher-education, this talk will speculate on the evolutionary forces and potential futures of education in mathematics. Particular focus will be given to the role of MOOCs – Massive Open Online Courses. This subject has of late elicited hope, hype, and hyperbole. This talk will focus on facts and experience as a basis for discussion of how best to imagine and prepare for the future. Included will be an overview what considerations are particular to Mathematics, the pros-and-cons of MOOCs, what their long-term impact in Mathematics may be, and what other innovations may augment or supersede these. The discussion will be based in part on the speaker's experience in building and running the Coursera class "Calculus: Single Variable", available to view at http://www.coursera.org/course/calcsing

NILIMA NIGAM, Simon Fraser University
On numerical analysis and spectral geometry

Spectral geometry is concerned with the relationships between the geometric properties of domains and the spectra of elliptic operators on them. For most domains, there is no exact expression for these spectra, and they must be approximated.

How does one compute the eigenvalue of an elliptic operator on a bounded domain? It is easy to compute such approximations; it requires more effort to compute them well. In this talk I'll provide a high-level survey of the challenges of approximation of spectra. I'll then present a high-accuracy method which is based on integral operators, and another, lower-accuracy technique which is suited to validated numerical computations.

CHRISTIANE ROUSSEAU, Université de Montréal
What can we learn from divergent series?

What can we learn from convergent power series? They provide asymptotics close to the origin, they are useful in numerical computations. Moreover, in the complex domain, a convergent series encodes the complete information on the analytic extension of the function which is the sum of the series, including its singularities. But, what about divergent series? For centuries, they have been successfully used in mathematics until the call for rigor banished them from most of mathematics. In this lecture, I will discuss the rehabilitation of divergent series in the 20th century, and how we can rigorously justify their use. I will then move to highlighting the very rich information they can provide on the functions that are their "sums". The examples presented come from differential equations.

ANDREW TOMS, Purdue University
What is a C-algebra and when is it "good"*

C*-algebras are algebras of bounded operators on Hilbert space. They can be associated to all sorts of mathematical objects, such as groups, dynamical systems, and graphs, and can tell us a great deal about the structure of these objects. As with any collection of mathematical objects, it is interesting to consider their classification. Over the past decade or so, it has become clear that a reasonable classification will only be possible for "good" C*-algebras. I will explain what we think "good" ought to mean, and how it connects some topological and algebraic regularity properties for C*-algebras.

JAMES YORKE, University of Maryland
The many facets of chaos

Chaos is a concept with many facets or aspects. It has several definitions that emphasize different aspects of chaos. No definition is complete. My talk will illustrate how focusing on different aspects of chaos leads us in different directions and results in a fuller understanding of chaos.