DG7 SEMIOTIC AND SOCIO-CULTURAL EVOLUTION OF MATHEMATICAL CONCEPTS

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The goal of the group will be to discuss epistemological and semiotic aspects of the historical evolution of mathematical concepts to gain insight into the teaching and learning of mathematics. The role of signs in mediating the expression of ideas and the conceptualizations of new ones has been a prevalent force in mathematics and these signs evolved as mathematical concepts went from being empirical and concrete to being general and abstract. The discussion will focus on the pedagogical implications of Greek thought on geometry and the evolving conceptualization of the second-degree equation. To launch the discussion there will be presentations followed by small group discussions.

Revisiting Guided Reinvention

In antiquity, geometry developed in an empirical way through a naïve phase of trial and error; it started from a body of conjectures, followed by mental experiments of control and proving experiments (mainly analysis) without any fixed axiomatic system. This process suggests a didactical approach to proof in the classroom. A kind of guided reinvention (in Freudenthal's style) using dynamic software to help students create a 'local theory' of geometry (few theorems and definitions) to foster an appreciation of the theory. (Fulvia Furinghetti & Domingo Paola, Università di Genova, Italy)

Semiotic Aspects in the Development of the Solution of the Second Degree Equation

The historical development of the solution of the second-degree equation provides an illustration of the evolution of mathematical thinking as a semiotic expression of the rationality of the cultures in which the mathematical activity took place. From the Babylonians, to the Greeks, to the Arabs, to Descartes, to Euler and Carlyle, the solution of the second-degree equation was achieved through different indexical, iconic, and symbolic representations mediating particular ways of thinking influenced by the socio-cultural and economic factors of the time. These representations will be analyzed and their pedagogical implications considered. (Adalira Sáenz-Ludlow, University of North Carolina at Charlotte, USA)

An Analysis of Early History of Geometry in Light of Peirce's "Commens"

Questions like the following will be explored using Peirce's construct, *commens*, which he defined as the mind into which the minds of utterer and interpreter have to fuse for communication to take place. (A)More than 2000 years ago, Archimedes used a method of exhaustion to calculate the area enclosed by a parabola and the segment perpendicular to the axis of symmetry. Why was it only in the 17th century that such methods became widespread with the advent of the calculus? (B) Hipparchus of Crete generated some excitement when he figured out that the area of his "lune" was the same as that of a right triangle whose hypotenuse was the diameter of the lune. Why was this discovery important in the geometry of the time? (Norma Presmeg, Illinois State University, USA)