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English summaries

Joana Cirici

Contributions of Maryam Mirzakhani in geometry and dynamics

We will explore the world of Riemann surfaces, hyperbolic metrics, and geodesic curves to explore some of Maryam Mirzakhani's work that surprisingly combines concepts of dynamics and geometry. We will see how to count geodesics on surfaces using moduli spaces and how to address problems in billiard dynamics by studying geodesic curves on surfaces. We will also review some of Mirzakhani's latest discoveries, such as the Magic Wand Theorem, considered by some the theorem of the decade.

Keywords: Maryam Mirzakhani, Riemann surfaces, moduli spaces, hyperbolic metrics, geodesic curves, billiard dynamics.

MSC2010 Subject Classification: 01A70, 32G15.

Josep Pla i Carrera

Methodological and historical reading of the work Ḥibbur ha-mĕšiḥá wĕ-ha-tišboret *(Treatise on geometry and measurement) by Abraham Bar Ḥiyya (Savasorda)*

On the occasion of the centenary of the birth of Josep Millàs Vallicrosa, I thought that, as a mathematician, it would be good to perform an analysis of the *Treatise on Geometry and Measurement* (1116) by Abraham Bar Ḥiyya (Savasorda) that the famous Arabist-Hebrewist had translated into Catalan. This work shows that in the West, before Fibonacci's *Liber Abaci* (1202), written in

Latin, a booklet had been published in Hebrew in which the quadratic equation and its solving algorithms were introduced, based on the relations in Book II of Euclid's *Elements*. In addition, this booklet had a second part dedicated to the division of figures, using, however, geometric methods. Fibonacci, aware of the methodological difference between these two parts, addressed the question of the division of figures inherited from Greek mathematics in a separate treatise, *The Practica Geometriæ* (1220).

Keywords: second degree equations in the West, history of medieval Jewish mathematics, Savasorda and Fibonacci.

MSC2010 Subject Classification: 01-01, 01A35, 01A99.

Xavier Ros-Oton and Joaquim Serra

Regularity and singularities in free boundary problems

Free boundary problems are those described by PDEs that exhibit a priori unknown (free) interfaces or boundaries. The most classical example is the melting of ice to water (the Stefan problem). In this case, the free boundary is the liquid-solid interface between ice and water.

A central mathematical challenge in this context is to understand the regularity and singularities of free boundaries. In this paper we provide an introduction to this topic by presenting some recent results by Alessio Figalli and the authors.

Keywords: free boundary problem, singularities, Stefan problem.

MSC2010 Subject Classification: 35R35.
