IV Congreso de Jóvenes Investigadores

Real Sociedad Matemática Española

Valencia, 4-8 de septiembre de 2017

Constructing rational points on elliptic curves

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One of the central problems in number theory is that of describing the set of rational solutions to a system of polynomial equations. Plane curves, the simplest instance of this problem, are still very mysterious from this point of view; elliptic curves are a certain type of cubic curves, which possess a richer structure that allows for even more intriguing questions.

In the 1960s, the British mathematicians Bryan Birch and Sir Peter Swinnerton-Dyer proposed a striking conjecture (known as the BSD conjecture) which is one of the seven Millennium Problems chosen by the Clay Mathematics Institue at the turn of the century. To date, the only successful attempts at proving cases of the BSD conjecture have used a systematic construction of special points on these elliptic curves, known as Heegner points.

In this talk I will review the history of this problem and explain new conjectural constructions of analogues of Heegner points in different situtations.

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