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Counting points on curves over finite fields

A curve is a one dimensional space cut out by polynomial equations, such as $y^2 = x^3 + x$. In particular, one can consider curves over finite fields, which means the polynomial equations should have coefficients in some finite field and that points on the curve are given by values of the variables (x and y in the example) in the finite field that satisfy the given polynomials. A basic question is how many points such a curve has, and for a family of curves one can study the distribution of this statistic. We will give concrete examples of families in which this distribution is known or predicted, and give a sense of the different kinds of mathematics that are used to study different families.