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Solving S-unit equations in Sage and Applications to Algebraic Curves.

Many finiteness and enumerative problems in number theory rely on the finiteness/enumeration of the set of solutions to the equation x+y=1 over the group of S-units in a number field, where S is a finite set of primes. In 1995, Nigel Smart solved certain S-unit equations to enumerate all genus 2 curves defined over the rationals with good reduction away from p=2. Smart's work build on that of of Baker, de Weger, Evertse, Yu, and many others. In 2016, following Smart's methods, Malmskog and Rasmussen found all Picard curves over Q with good reduction away from p=3, and Angelos Koutsianas described methods for enumerating, and in some cases explicitly describes, all elliptic curves defined over a number field with good reduction outside S. Both projects required Sage implementation of special cases of Smart's general method. In January 2017, Alejandra Alvarado, Angelos Koutsianas, Beth Malmskog, Christopher Rasmussen, Christelle Vincent, and Mckenzie West combined these implementations and created new functions to solve the equation x+y=1 over the S-units of a general number field K for any finite set S of primes in K. The code is available on SageTrac and is under review for inclusion in future releases of Sage. This talk will give an overview of motivating problems and applications, the methods involved, and the current state of the implementation.