1106-11-427  David Mehrle* (dmehrle@cmu.edu), Tomer Reiter (treiter@andrew.cmu.edu), Joseph Stahl (josephmichaelstahl@gmail.com), Dylan Yott (dtyott@gmail.com) and Steven Miller (sjm1@williams.edu). A Family of Rank 6 Elliptic Curves over Number Fields.

We construct a family of elliptic curves over a number field $K$, and prove that when $K/Q$ is Galois, each curve has rank six. Unlike most constructions, which only bound the rank, we find the rank exactly. By evaluating Legendre sums, we determine equations for curves $E$ with $A_p(E) = -6$. Applying a theorem of Rosen and Silverman, we show that the rank is $-A_p(E)$. We obtain in this manner not only infinitely many elliptic curves over $K$, but also infinitely many elliptic surfaces, i.e., elliptic curves over the function field $K(T)$. Additionally, we hypothesize that curves defined analogously over non-Galois extensions $L/Q$ also have rank six, which we prove in several cases, and determine bounds for all other cases. Moreover, we prove that when $K = Q$, if there are any points of finite order in $E(Q)$, they must have order three. However, we are able to modify our construction to find a family of curves with group $E(Q) = \mathbb{Z}^2 \oplus \mathbb{Z}/2\mathbb{Z}$. This generalizes work of Arms, Lozano-Robledo, and Miller, which only dealt with families over $Q$. (Received August 27, 2014)