Galois_rep

%timeit  # Took me 1 minute

EllSet= ['40A','56A'];
for Ell in EllSet:
    E = EllipticCurve(Ell);
    rho = E.galois_representation()
    print Ell, E;
    print "\nIs the mod 3 Galois representation surjective? \t", rho.is_surjective(3);

poly = E.torsion_polynomial(9);  # Torsion polynomial for 9-division points of E

for fac in poly.factor():
    if (fac[0].degree() ==36):  # Finding the irreducible factor of degree 36
        break;

f = fac[0];
print "\nWhat is the degree of f:", f.degree();
K.<a> = NumberField(f);  # Number Field of degree 27 over Q

#var('x');
R.<x> = PolynomialRing(K)

poly2 = R(f);
for fac in poly2.factor():
    if (fac[0].degree()==27):
        break;
g = fac[0];
print "\nWhat is the degree of g:", g.degree();

print ""
Is the mod 3 Galois representation surjective? True

What is the degree of f: 36

What is the degree of g: 27

56A Elliptic Curve defined by $y^2 = x^3 + x + 2$ over Rational Field

Is the mod 3 Galois representation surjective? True

What is the degree of f: 36

What is the degree of g: 27

CPU time: 49.02 s, Wall time: 49.65 s