Solutions may of course be presented in Swedish! The sheets of the department should be used. Write your initials and at most one solution on each sheet handed in. Give careful motivations to your solutions!

1. Show that if \( \gcd(a, 32760) = 1 \), then
   \[
a^{12} \equiv 1 \pmod{32760}
   \]

2. Evaluate the infinite simple continued fraction
   
   \[
   [2; 2, 1, 1, 3]
   \]

3. Let \( n \) be a positive integer which is not the sum of squares of two integers. Show that \( n \) cannot be represented as the sum of two squares of rational numbers.

4. Let \( p \) be an odd prime. Show that
   \[
x^4 \equiv -1 \pmod{p}
   \]
   has a solution if and only if \( p \equiv 1 \pmod{8} \).

5. Give a classification into residue classes of the odd primes \( p \) for which
   \[
   (6/p) = 1
   \]
   (Legendre symbol).

6. Define for \( n \geq 1 \)
   \[
   \Phi_n(x) = \prod_{1 \leq k \leq n \atop \gcd(k,n)=1} (x - e^{\frac{2\pi ik}{n}}).
   \]
   (a) Show that \( \prod_{d|n} \Phi_d(x) = x^n - 1 \). (1p)
   (b) Show that
   \[
   \Phi_n(x) = \prod_{d|n} (x^{n/d} - 1)^\mu(d)
   \]
   (where \( \mu \) denotes the Möbius function,) and that \( \Phi_n(x) \) has integer coefficients. (4p)