

**MATH 312: ASSIGNMENT 2**  
**DUE DATE: SEPTEMBER 28, 2012**

- 1) Prove that the integer  $Q_n = n! + 1$ , where  $n$  is a positive integer, has a prime divisor greater than  $n$ . Use this to show that there are infinitely many primes.
- 2) Show that there are no prime triplets of the form  $p, p + 2$  and  $p + 4$  other than 3, 5 and 7.
- 3) Show that there are infinitely many primes that are not one of the primes in a pair of twin primes. (Hint: Use Dirichlet's theorem.)
- 4) Use the Prime Enumeration Sieve to list all prime numbers between 50 and 100,
- 5) Show that the greatest common divisor of an even number and an odd number is odd.
- 6) What is  $(a^2 + b^2, a + b)$ , where  $a$  and  $b$  are relatively prime integers that are not both 0.
- 7) How many digits is the  $n$ -th prime where  $n = 598709$  likely to have?