

**Math 522 Exam 12: 12/6/7**

Please read the exam instructions.

Please write your answers on **separate paper**, indicate clearly what work goes with which problem, and put your name on every sheet. Notes, calculators, and the textbook are all permitted. Cross out work you do not wish graded; incorrect work can lower your grade, even compared with no work at all. Keep this list of problems for your records. Show all necessary work in your solutions; if you are unsure, show it. You will earn between 25 and 50 points on each problem. You have 30 minutes.

You may earn extra credit by submitting a revised answer to one of the following problems, by the final (12/13/7). Your score on that problem will be the average of the original score, and the revised score (rounded down).

1. Using EITHER Legendre symbols or Jacobi symbols, determine whether  $x^2 \equiv 667 \pmod{919}$  has solutions. Be sure to specify which you use. HINT: 919 is prime BONUS: Do it both ways.
2. For all odd  $m \geq 3$ , prove that if the Jacobi symbol  $\left(\frac{n}{m}\right) = -1$ , then  $x^2 \equiv n \pmod{m}$  has no solutions.