



★ REGIONAL LEVEL ★

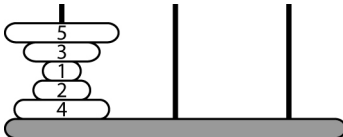
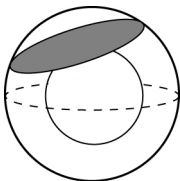
February 2011

The Mandelbrot Competition

Round Four Test

Name: _____

Time Limit:
40 minutes

1. Faraz notices a bowl of cherries and eats half of them, plus three more. Next Meena discovers the bowl and does the same. Finally Yanson finds the bowl of cherries and also eats half of what is left, plus three more, at which point the bowl is empty. How many cherries were originally in the bowl?		①
2. It is possible to arrange five rectangles of sizes 1×10 , 2×3 , 4×5 , 6×7 , and 8×9 without overlap to completely fill out a single larger rectangle. What are the dimensions of the larger rectangle?		①
3. Find a quadratic having the form $x^2 + bx + c$, where b and c are positive integers from 1 to 9, such that increasing b by 1 yields a quadratic that can be factored, while increasing c by 1 also yields a quadratic that can be factored.		②
4. The goal of the puzzle shown is to transfer all the discs onto a single peg so they are arranged from the largest (disc 5) on the bottom to the smallest (disc 1) on top. On each move you may move the top disc from any stack, but you may not place a larger disc on top of a smaller one. What is the least number of moves to solve the puzzle?		②
5. Let s and t each represent a digit from 1 to 9 such that 1) If s is odd then t is spelled with four letters, 2) If t is spelled with an 'f' then s is even, and 3) If s^2 ends with 4 or 6 then t^2 ends with 3 or 7. Deduce the value of t .		②
6. A random pizza is made by flipping a fair coin to decide whether to include pepperoni, then doing the same for sausage, mushrooms, and onions. What is the probability that two random pizzas have at least one topping in common?		③
7. The large outer sphere in the diagram has a surface area of 2011, while the circular disc whose boundary lies on this sphere has area 76. A smaller concentric sphere is tangent to the circular disc. Find the surface area of the small sphere.		③

SCORE: