



★ REGIONAL LEVEL ★

February 2013

The Mandelbrot Competition

Round Four Test

Name: _____

Time Limit:
40 minutes

1. There are odd positive integers a and b such that the fractions $\frac{a}{7}$ and $\frac{b}{35}$ are both in lowest terms, while the sum $\frac{a}{7} + \frac{b}{35}$ has a 2 in the numerator when reduced to lowest terms. What is the value of b ?		1
2. The diagram at right shows twenty-one evenly spaced points arranged in a square grid. How many lines pass through exactly three of the points?		1
3. Find the unique positive integer N between 250 and 300 with the property that the numbers N , $2N$, and $3N$ together use all the digits from 1 to 9 exactly once among the three of them.		2
4. Three chords of a circle intersect one another as shown. Suppose that each chord is split into three segments, each of length 1, by the other chords. Find the area of the circle.		2
5. A certain positive integer requires four digits when written in base 5, but has only seven digits when written in base 2. Furthermore, this number is not a palindrome when written in either base 2 or base 5. Find this number, writing your answer in base 7.		2
6. In the country of Weirdbillia there are \$1, \$2, and \$5 bills, each of which is printed with either blue or green ink. How many different ways are there for Vaughn to have \$8 in his pocket? (Note that having eight blue \$1 bills is different than having five blue \$1 bills and three green \$1 bills, for instance.)		3
7. Solve the following equations for x , writing your answer in simplest form. $(\log_{21} 48)x + (\log_5 13)y = \log_{21} 56,$ $(\log_{13} 3)x + (\log_5 21)y = \log_{13} 7.$		3

SCORE: