



★ REGIONAL LEVEL ★

November 2012

The Mandelbrot Competition

Round One Test

Name: _____

Time Limit:
40 minutes

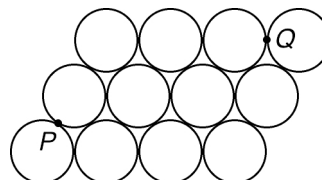
1. It is possible to place a single digit from 0 to 9 in each of the four boxes so that the two-digit numbers reading across have a greatest common divisor of 14, while the two-digit numbers reading down have a greatest common divisor of 3. When this is done, what is the sum of all four digits?

1

2. Clara, Simran, and Maya are each thinking of a number. Clara's number is 1 less than twice Simran's number, which is 1 less than twice Maya's number, which is 1 *more* than twice Clara's number. What is Maya's number?

1

3. The twelve tangent circles shown all have radius equal to 1. What is the length of the shortest path from point P to point Q that does not pass through the interior of any of the circles?



2

4. There is a real number x in the interval $0 < x < 1$ satisfying the equation $\sqrt{1-x} + \sqrt{1+x} = \sqrt{2.012}$. Determine the value of x^2 as a decimal.

2

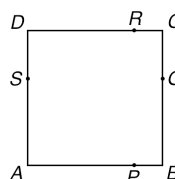
5. Suppose that in quadrilateral $ABCD$ we have $m\angle ABC = m\angle ACD = 90^\circ$ and $m\angle CBD = m\angle CDB$. Label $m\angle DAC = \alpha$ and $m\angle ACB = \beta$. It follows that one of $\sin \alpha$, $\cos \alpha$, or $\tan \alpha$ must always be equal to one of $\sin \beta$, $\cos \beta$, or $\tan \beta$. Which two values are necessarily the same?

2

6. Light red paint is made by mixing white paint and red paint in a 1:4 ratio, while pink is obtained by using a 4:3 ratio. What ratio of light red to pink paint, in that order, will yield a 5:6 ratio of white to red paint? (Write your answer as $m:n$, where m and n are relatively prime positive integers.)

3

7. Let $ABCD$ be a square of side length 6, and let P , Q , R and S be points on the sides of this square as shown so that $\overline{PR} \parallel \overline{BC}$ and $\overline{QS} \parallel \overline{CD}$. If $\text{area}(\text{ARQ}) = 13$, then determine $\text{area}(\text{ASP})$.



3

SCORE: