



★ REGIONAL LEVEL ★

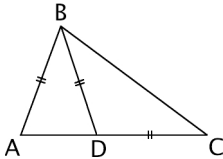
March 2012

The Mandelbrot Competition

Round Five Test

Name: _____

Time Limit:
40 minutes

1. How many ways are there to split a group of eight people labeled A, B, C, D, E, F, G , and H into two groups of four people each if A and B must be in the same group but C and D must be in opposite groups?		1
2. Find the real number x satisfying the equation $\frac{6}{5 + \frac{4}{3+x}} = 2$.		1
3. Let us call a number “arithmetic” if its digits form an arithmetic progression when arranged in increasing order. Thus 804 and 741 are both arithmetic numbers. Find the largest three-digit arithmetic number N such that $2N$ is also a three-digit arithmetic number.		2
4. Point D is situated on side \overline{AC} of triangle ABC so that $AB = BD = DC$. If $m\angle ABC = 69^\circ$, then determine the measure of $\angle BAC$.		2
5. A jar contains between 7 and 70 marbles, some of which are orange. The probability of choosing a pair of marbles at random from the jar and obtaining two orange marbles is exactly $1/5$. How many marbles are there in the jar?		2
6. For how many complex numbers z does $x^2 + xz^5 + 2x + z^5 - 5$ have a pair of repeated roots for x ? For instance, when $z = -1$ we obtain $x^2 - x - 6$. This quadratic has roots $x = -2$ and $x = 3$, which are distinct roots, so $z = -1$ is not one of the desired values.		3
7. Let A and B be points on the lines $y = 3$ and $y = 12$, respectively. There are two circles passing through A and B that are also tangent to the x -axis, say at points P and Q . Suppose that $PQ = 2012$. Determine distance AB .		3

SCORE: