



★ REGIONAL LEVEL ★

February 2019

The Mandelbrot Competition

Round Five Test

Name: _____

Time Limit:
40 minutes

1. Place the digits 1 to 6 in the grid, then find the largest product of two digits that are next to one another either horizontally or vertically. (Here the largest product is $6 \cdot 4$.) What is the minimum largest product that can occur?

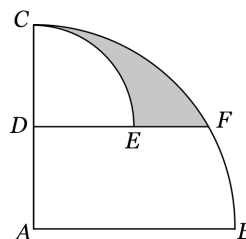
1	4	5
3	6	2

1

2. Ten grams of salt are stirred into a cup of water to produce a cup of salt water with a total weight of 250 grams. After some of the water evaporates the concentration of salt (ratio of salt to water) is three times larger, while the combined weight is now only 200 grams. What is the weight of the cup?

1

3. In the diagram, CAB is a quarter circle with center A and radius $AB = 12$. Plot the midpoint D of \overline{AC} , then draw \overline{DF} perpendicular to \overline{AC} with point F on arc BC . Finally, draw another quarter circle CDE with center D . What is the exact area of the shaded region?



2

4. Find the number of ways to write $3^6 5^8$ in the form $a^b c^d$, where a, b, c, d are positive integers each greater than 1, and $a < c$.

2

5. The graph of $\sin x + \cos y = 0$, where x and y are real numbers in radian measure, is an infinite grid of squares. What is the exact area of one square?

2

6. A box contains distinct blocks of four different colors; one of the colors is blue. There are 157 ways to pick two blocks of different colors. However, there are only 119 ways to pick two blocks of different colors, neither of which are blue. Determine the number of blocks in the box.

3

7. Consider the set of points (x, y) for which x and y are integers satisfying $x^2 + y^2 \leq 100$. What is the area of the smallest convex polygon that contains all 317 of these points in its interior or along its boundary?

3

SCORE: