

# The Mandelbrot Competition

## Round Three Test

Time Limit:  
40 minutes

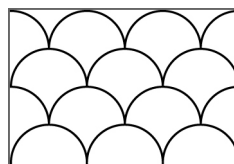
Name: \_\_\_\_\_

1. Which of the following is not an integer? (Write A, B or C as your answer.)

- A.  $\sqrt{20} + \sqrt{5}$       B.  $(5 + \frac{1}{4})(1 + \frac{1}{7})$       C.  $(4 - \pi) - (7 - \pi)$

1

2. The rectangle here measures 3 cm by 2 cm. Compute the total length, in cm, of all the circular arcs inside the rectangle. (Don't include the perimeter of the rectangle.)

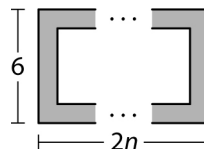


1

3. Simplify  $\left(\frac{2^{(2^{10})}}{(2^2)^{10}}\right)^2$  to the form  $2^n$ , where  $n$  is a positive integer.

2

4. How many  $1 \times 2$  dominoes are required to construct the rectangular track of width 1 at right? The dominoes should completely cover the track without overlapping. Write your answer in terms of  $n$ .



2

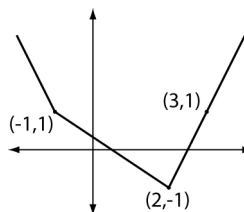
5. Evan has a large triangular sheet of paper. He cuts from the midpoint of one edge straight to the midpoint of another edge. He then selects one of the resulting pieces and again cuts from the midpoint of one edge to the midpoint of another edge. He repeats this process until there are a total of 2011 edges among all the pieces. How many cuts did he make?

2

6. Consider the unit square with vertices at  $(0,0)$ ,  $(1,0)$ ,  $(1,1)$ , and  $(0,1)$ . Suppose that we choose two points  $A$  and  $B$  independently and randomly around the perimeter of this square. What is the probability that point  $A$  is higher than point  $B$ ; i.e. has a larger  $y$ -coordinate?

3

7. Let  $f(x)$  have the form  $f(x) = |ax + b| + |cx + d| + e$ , where  $a$ ,  $b$ ,  $c$ ,  $d$  and  $e$  are real numbers. The graph of  $f(x)$  has "corners" at  $(-1, 1)$  and  $(2, -1)$  as shown, and also passes through the point  $(3, 1)$ . Find the value of  $e$ .



3

SCORE: