



# The Mandelbrot Competition

## Round Three Test

*Time Limit:*  
40 minutes

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

<p>1. Each morning Phoenix walks to his lab at 4 feet per second, leaving his home at 7:42 and arriving at precisely 8:00. One minute into his walk last Thursday he realized that he had forgotten to lock his door, so he immediately turned around, returned home at 4 ft/sec, and locked the door. In ft/sec, how fast did he have to walk to work after that to still arrive on time at 8:00?</p>		1
<p>2. The value of <math>\frac{n}{2} + \frac{18}{n}</math> is smallest for which positive integer <math>n</math>?</p>		1
<p>3. Find the decimal number between 1 and 10 with the property that moving the decimal point one digit to the left and writing a 3 in front yields a number that is half its original value. (For instance, 4.7 would become 3.47.)</p>		2
<p>4. It is possible to place the digits 0, 1, 2, ..., 9 into the squares at right so that there is one digit per square, each horizontal number is divisible by 7, each vertical number is divisible by 9, no number begins with a 0, and the 9 is placed as shown. Which digit must appear in the circle?</p>		2
<p>5. Consider a cube on a table with each of the faces painted a different color. Suppose one were to pick up the cube, turn it around, then return it to its original location with the colors permuted. Of the 23 ways to reposition the cube, in how many cases does no color occupy its original position?</p>		2
<p>6. Given concentric circles with center <math>O</math> and a point <math>P</math> outside the circles, draw segment <math>\overline{PO}</math> and also draw lines through <math>P</math> tangent to the circles at <math>S</math> and <math>T</math>, as shown. If <math>OS = 10</math>, <math>\overline{PT}</math> bisects angle <math>\angle OPS</math>, and <math>area(\triangle TOP) = 35</math>, then determine distance <math>OP</math>.</p>		3
<p>7. Determine the smallest positive integer <math>m</math> such that <math>m^2 + 7m + 89</math> is a multiple of 77.</p>		3

SCORE: