



★ REGIONAL LEVEL ★

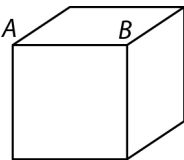
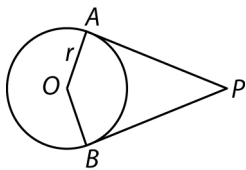
November 2010

The Mandelbrot Competition

Round One Test

Name: _____

Time Limit:
40 minutes

1. Find the value of x satisfying $(x - 7)(17 - 10) = (x - 10)(17 - 7)$.		1
2. A <i>quarter-turn</i> of a cube consists of rotating the cube by 90° in either direction around any line through the centers of opposite faces. What is the minimum number of quarter-turns necessary to swap the two corners labeled A and B ?		1
3. Lars, Molly and Nate are measuring angles outdoors as part of a geometry exercise. Lars finds that the rays from his position to two trees creates a 45° angle. Molly, who is situated directly between Lars and the first tree, finds that the angle from herself to the same two trees is 70° . Nate is standing at the second tree. What angle will he measure from himself to Lars and Molly?		2
4. We say that a positive integer is <i>nimble</i> if it can be written as a perfect cube minus a prime. For instance, 12 is nimble since $12 = 5^3 - 113$. What is the next nimble positive integer after 12?		2
5. Abby sells widgets for \$30 apiece. She plans to discontinue the current model and instead offer two new types of widgets, one of which will cost \$8 more than the other. She does not expect a change in the total number of sales, but anticipates that 75% of the units sold in the future will be the cheaper model. If she wants revenue to increase by 10%, how much should she charge for the less expensive type of widget?		2
6. Find the smallest positive integer m above 2010 such that the difference $\frac{1}{2010} - \frac{1}{m}$ does <i>not</i> reduce to a fraction of the form $\frac{1}{n}$ for some integer n .		3
7. Two points A and B are located on a circle with center O and radius r . The tangents to the circle at A and B intersect at a point P . If $AB = 12$, $OP = 13$, and $r < 10$, then compute r .		3

SCORE: