

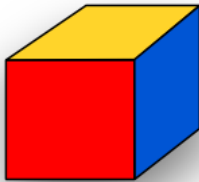
# Order of Battle

UW Math Circle

Session  $\omega + 10$  (4 December 2014)

1. Prove or disprove: from any triangle you can cut out three congruent shapes each having area at least  $\frac{1}{4}$  of the area of the triangle.
2. 100 spotlights of various shapes and sizes illuminate a square field with side length 1. The sum of the areas of these spotlights is greater than 99. Prove that there is a point in the field that is illuminated by all 100 spotlights.
3. Determine the fewest number of points that can be marked inside a convex  $n$ -gon so that any triangle with vertices in the vertices of the  $n$ -gon contains at least one of the marked points in its interior.
4. A  $20 \times 20 \times 20$  cube is built out of 2000  $2 \times 2 \times 1$  bricks. Prove that you can stick a long needle somewhere through the cube (so that it comes out of the opposite side).
5. Find all pairs of integers  $x, y$  ( $x \neq y$ ) such that  $x^y = y^x$ .

**1 x 1 x 1 Rubik's Cube** spikedmath.com  
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Difficulty Level: **Trivial**

Every position can be solved in 20 moves or less.

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