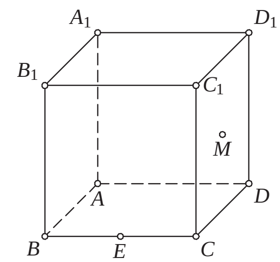
Flanders Mathematical Olympiad 1998

Final Round

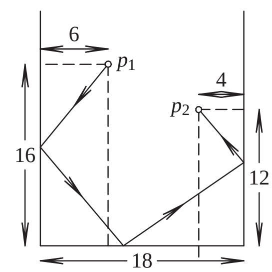
1. Show that there exists a triple of integers (a,b,c) with $0 < a < b \leq c < 2a$ and $a+b+c = 1998$ for which $\gcd(a,b,c)$ is maximal, and determine one such triple. Is the solution unique?

2. Given a unit cube, let E be the midpoint of edge BC and M be the midpoint of the face CDD_1C_1 (see the figure). Compute the area of the intersection of the cube with the plane AEM.



3. A magic $n \times n$ square is an $n \times n$ matrix containing all the numbers 1 through n^2 such that the sums of the entries in each row, column, and diagonal are equal. Determine all 3×3 magic squares.

4. The figure represents three sides of a billiard table. A white ball is positioned at p_1 and the red ball at p_2. The white ball is shot towards the red ball, hiting the three sides of table first (see the figure). Determine the minimum length of the path of the white ball.



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