



AMAZING.MATHEMATICAL.REVENGE.CH  
*Incredibile Vendetta Matematica Svizzera*  
Великолепный Швейцарский Математический Реванш  
惊人的瑞士数学复仇

# ASMR 2024

**Time:** 14293 seconds

**Difficulty:** HARD

**Points:** Every complete solution is worth 10.5 points.

Here

Today

Amazing Swiss Mathematical Revenge

1. Let  $ABC$  be a triangle with  $\angle ABC = 120^\circ$ . Let  $A', B', C'$  be the intersections of the internal angle bisectors from  $A, B, C$  with sides  $BC, AC, AB$  respectively. Determine  $\angle A'B'C'$ .

2. Let  $a_1, b_1, a_2, b_2, \dots, a_n, b_n$  be nonnegative real numbers. Prove that

$$\sum_{i,j=1}^n \min\{a_i a_j, b_i b_j\} \leq \sum_{i,j=1}^n \min\{a_i b_j, a_j b_i\}.$$

3. Determine all natural numbers  $n$  such that one can dissect a square into exactly  $n$  acute triangles.

4. Flexi has a secret natural number  $x$  which Rösti is trying to discover. At each stage Rösti may only ask questions of the form “is  $x + n$  a prime number?” for some natural number  $n$  of his choice. Prove that Rösti may discover  $x$  using finitely many questions.

good luck ig