Second Round 2026

MATHEMATICAL. OLYMPIAD.CH
MATHEMATIK-OLYMPIADE
OLYMPIADES DE MATHÉMATIQUES
OLIMPIADI DELLA MATEMATICA

Duration: 3 hours

Difficulty: The problems of each topic are ordered by difficulty.

Points: Each problem is worth 7 points.

Zürich, Lausanne, Lugano

December 13, 2025

Geometry

G1) Let Γ_1 and Γ_2 be two circles intersecting at the points X and Y. Let ℓ be a line intersecting Γ_1 at points A and C, and intersecting Γ_2 at points B and D, such that A, B, C, D lie on ℓ in this order. Let P be the intersection of XA and YB, and Q be the intersection of XD and YC.

Prove that PQ is parallel to ℓ.

G2) Let A, B, C, D, E be five points lying on a circle in this order, such that AE is a diameter and $BC > CD$. Let F be the intersection of AD and BE. Let O be the circumcenter of the triangle BFD. Let the reflection of the line BD across BC and the reflection of the line BD across DC intersect at Y.

Prove that $\angle OYC = 90°$.

Combinatorics

C1) Let $k \leq a \leq b$ be positive integers. Ruhi has a sequence of $a + b$ letters that contains a copies of the letter M, and b copies of the letter O. She wants the sequence to have exactly k pairs of consecutive letters that form the word MO. In how many ways can she arrange the letters?

C2) Mark has 20 bookshelves of heights $1, 1, 2, 2, \ldots, 10, 10$, where two bookshelves of the same height are indistinguishable. He wants to place them in a line in such a way that his cat can jump from one bookshelf to the next, starting on the leftmost bookshelf and ending on the rightmost bookshelf. His cat is lazy and has two conditions:

- Exactly one of the cat's nineteen jumps is from a bookshelf to a strictly taller bookshelf.
- Between two bookshelves of the same height, no strictly taller bookshelf can be placed.

In how many ways can Mark place his bookshelves satisfying both conditions?

Number Theory

N1) Determine all triples (p,q,n) of positive integers where p and q are prime numbers, and

$$20p + 26q = n^2 + 48.$$

N2) Determine all positive integers n such that

$$n^3 \mid (n + 1)(n + 2)(n + 3)(n + 4)(n + 5)(n + 6).$$

Good luck!