1. Solve the system of equations:
\[
\begin{cases}
|x - y| - \frac{|x|}{x} = -1 \\
|2x - y| + |x + y - 1| + |x - y| + y - 1 = 0
\end{cases}
\]

2. The lines containing the sides of triangle $ABC$, inscribed in a circle of center $O$, intersect at $H$. It is known that $AO = AH$. Find the measure of the angle $CAB$.

3. The sequences $(a_n)$, $(b_n)$, $(c_n)$ are given by the conditions: $a_1 = 4$, $a_{n+1} = a_n(a_n - 1)$, $2^{b_n} = a_n$, $2^{a-c_n} = b_n$ for $n = 1, 2, 3, \ldots$. Prove that the sequence $(c_n)$ is bounded.

4. Given a positive number $a$. Determine all real numbers $c$ with the following property: for any pair of positive numbers $x$, $y$ the following inequality holds
\[
(c - 1)x^{a+1} \leq (cy - x)y^a.
\]

5. Given is an integer $n \geq 1$. Solve the equation:
\[
|\tan^n x - \cot^n x| = 2|n| \cot 2x|
\]

6. In triangle $ABC$ with $AB > AC$, $D$ is the midpoint of the side $BC$; $E$ lies on the side $AC$. Points $P$ and $Q$ are the feet of the perpendiculars from $B$ and $E$, respectively to the line $AD$. Prove that $BE = AE + AC$ if and only if $AD = PQ$.

7. Given positive integers $m$, $n$. Set $A = \{1, 2, 3, \ldots, n\}$. Determine the number of functions $f: A \to A$ attaining exactly $m$ values and satisfying the condition
\[
\text{if } k, \ell \in A, k \leq \ell, \text{ then } f(f(k)) = f(k) \leq f(\ell).
\]

8. Determine if there exists a convex polyhedron having exactly $k$ edges and a plane not passing through any of its vertices and cutting $r$ edges with $3r > 2k$.

9. Let $a_k = 0.91 \text{ and } a_k = 0.9999 \ldots 01$ for $k = 1, 2, 3, \ldots$. Compute
\[
\lim_{n \to \infty} (a_0a_1 \ldots a_n).
\]

10. The medians $AD$, $BE$, $CF$ of triangle $ABC$ intersect at $G$. The quadrilaterals $AFGE$ and $BDGF$ are cyclic. Prove that the triangle $ABC$ is equilateral.

11. In a tennis tournament $n$ players take part. Everyone has played against everyone else, there were no draws. Prove that there exists a player $A$ who won with every player $B$ directly or indirectly, i.e. either $A$ won with $B$ or $A$ won with some player $C$, who had won with $B$.

12. Let $g(k)$ be the biggest prime divisor of an integer $k$ if $|k| \geq 2$, and let $g(-1) = g(0) = g(1) = 1$. Determine if there exists a polynomial $W$ of positive degree with integer coefficients for which the set of the numbers of the form $g(W(x))$ ($x$ — an integer) is finite.