1: Find the minimum possible discriminant $\Delta = b^2 - 4ac$ of a quadratic $f(x) = ax^2 + bx + c$ which satisfies the requirement that $f(f(f(0))) = f(0)$.

2: Show that for every integer $a$, there exist infinitely many perfect powers of the form 

$$a + 2010t, \ t \in \mathbb{Z}.$$ 

(A perfect power is an integer of the form $n^k$ for some integers $n \geq 0$ and $k \geq 2$).

3: Let $n$ be a positive integer. Evaluate $\sum_{k=0}^{\infty} \left\lfloor \frac{n + 2k}{2k+1} \right\rfloor$, where $\lfloor x \rfloor$ denotes the largest integer less than or equal to $x$.

4: A point $p = (x, y)$ is chosen at random (with uniform distribution) in the unit square $0 \leq x \leq 1, 0 \leq y \leq 1$. Find the probability that, in the triangle with vertices at $(0,0)$, $(1,0)$ and $p$, the angle at each vertex is at most $\frac{5\pi}{12}$.

5: Let $x$ be an irrational number, and let $M$ be a positive integer. Show that there exist integers $a$ and $b$ with $b > 0$ such that

$$|x - \frac{a}{b}| < \frac{1}{Mb}.$$

6: Let $f$ be continuous on $[0,1]$ and differentiable in $(0,1)$. Suppose there exists $M > 0$ such that for all $x \in (0,1)$ we have $|f(0) - f(x) + xf'(x)| < Mx^2$. Prove that $f$ is differentiable (from the right) at 0.
1: Find the minimum possible discriminant \( \Delta = b^2 - 4ac \) of a quadratic \( f(x) = ax^2 + bx + c \) which satisfies the requirement that \( f(f(f(0))) = f(0) \).

2: Show that for every integer \( a \), there exist infinitely many perfect powers of the form

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a + 2010t, \ t \in \mathbb{Z}.
\]

(A perfect power is an integer of the form \( n^k \) for some integers \( n \geq 0 \) and \( k \geq 2 \)).

3: Evaluate \( \sum_{n=0}^{\infty} \int_{0}^{\pi} (-1)^n \sin^{2n} x \, dx \).

4: Two points \( p \) and \( q \) are chosen at random (with uniform distribution) in the unit ball \( x^2 + y^2 + z^2 \leq 1 \). Find the probability that the triangle with vertices at \( p \), \( q \) and the origin is an acute-angled triangle.

5: Let \( A \) be the \( n \times n \) matrix whose \((i, j)\)th entry is \( A_{i,j} = \frac{1}{i+j} \). Show that \( A \) is invertible.

6: Let \( f \) be continuous on \([0, 1]\) and differentiable in \((0, 1)\). Suppose there exists \( M > 0 \) such that for all \( x \in (0, 1) \) we have \( |f(0) - f(x) + xf'(x)| < Mx^2 \). Prove that \( f \) is differentiable (from the right) at 0.