CITA HATI MATH CLUB

CITA HATI STUDENT MATH OLYMPIADS

CHΣMΩ

1st Edition

END OF YEAR CONTEST

Senior Paper

November 28th - December 6th 2025

Instructions

- This test has 10 short answer questions each are worth 1 point.
- Answer all questions truthfully.
- No Calculator is permitted.
- All Answers are from 0 till 99999.
- Submit your answers in the google form on the website.

Questions

(+1 For Correct Answers, +0 For Wrong/Empty Answers)

1. Let there be integer numbers m, n, such that $m^2 n = 2025m - mn - m^2$. If m, n are both prime, find the value of $m + n$.

2. In a square $ABCD$, the midpoint of AC and the midpoint of AD is denoted as M and N. Let the length of $AC = 2\sqrt{2}$ and let the intersection of MA and BN is denoted as point X. Hence if the value of $[ANX] + [MBX]$ can be expressed as $\frac{a}{b}$, find $20a + 10b$. Note : $[ABC]$ denotes the area of triangle ABC.

3. In CHMC street, all houses are identified by a specific 2 digit sequence, made from 1 letter and 1 number (0-9). One day, the Winario Bros will deliver a pizza to each house, given that there are 4 houses that they deliver to, and that all of the houses have unique numbers, with completely different numbers and letters, the probability that the Winario Bros deliver to houses with 2 digit sequences in alphabetical and numerical order is $\frac{m}{n}$, find $m + n$.

4. Let there be an arithmetic sequence (a, b, c, d, e, f), such that all of them don't exceed 2025, and $a < b < c < d < e < f$ with $a, b, c, d, e, f \in \mathbb{N}$. Hence if the number of possible sequences is X, find the last 2 digits of X.

5. It is known that in trapezium $ABCD$, that AB is parallel to CD, M and N are midpoints of AB and CD. If $AC = 6$, $BD = 8$, AND $MN = 4$, find the value of $[ABCD]^2$.

6. Let there be two positive integers a, b such that
$$a^2 + 2ab - 3b^2 - 41 = 0$$
Find the value of $a^2 + b^2$.

7. Consider a recursive sequence $\{a_n\}$, such that $a_1 = 1$, and
$$a_{n+1} = \frac{a_n}{1 - na_n}$$
Find the value of $\frac{1}{a_{2025}} - 2001000$.

8. It is given that in a triangle ΔABC, a circle passes through point A, the midpoint of E of AC, the midpoint F of AB, and is tangent to side BC at D. Suppose that
$$\frac{AB}{AC} + \frac{AC}{AB} = 4$$
Hence determine the measure of $\angle EDF$.

9. Determine the least value of n, such that $2^8 + 2^{11} + 2^n$ is a perfect square.

10. Let there be real numbers c, h, s, m, o, such that

$$c + h + s + m + o = 8$$
$$c^2 + h^2 + s^2 + m^2 + o^2 = 16$$

Hence find the maximum value of $\lfloor o \rfloor$.

11. In the triangle ΔABC, $\angle B = 90^\circ$ and $\angle C = 60^\circ$. Points D and E are outside the triangle ABC such that BAD and ACE are equilateral. The segment DE intersects the segment AC at F. Suppose $BC = 10$. Find the length of AF.

12. Consider a function $g(x) = \cos\left(\frac{2\pi x}{3}\right)$, hence determine the maximum value of

$$\left(f(x+1) + f(x+14) + f(x+2023)\right)^2$$

---END OF THE QUESTIONS---