CITA HATI MATH CLUB

CITA HATI STUDENT MATH OLYMPIADS

CHΣMΩ

1st Edition

Cita Hati S.E.A.M.O Try Out

(Paper E)

September 27th 2025

Instructions

- Parts A through C are multiple choice questions.
- No discussion of the questions and answers until after the test.
- There are 20 multiple choice questions and 5 short-answer questions in total.
- Each question in part A is worth 3 points.
- Each question in part B is worth 4 points.
- Each question in part C is worth 5 points.
- Each participant will get their score and rating after a period of time after the test.
- Note that this test may be harder than the actual SEAMO test.
- Nice Try – 3 Pts
- Honorable Mention Cutoff – 11 Pts
- Bronze Cutoff – 22 Pts
- Silver Cutoff – 38 Pts
- Gold Cutoff – 48 Pts

PART A

(+3 For Correct Answers, +0 For Wrong/Empty Answers)

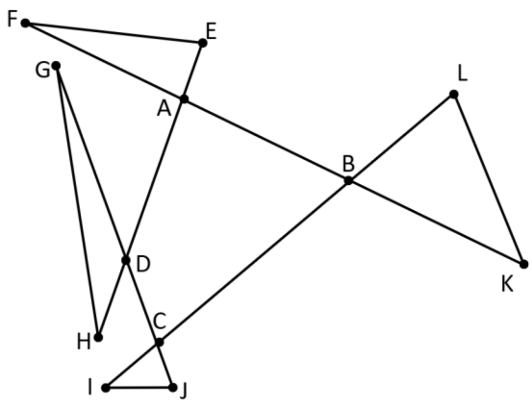
1. It is known that there are prime numbers p, q, such that they fulfill

$$2025q + 7p = 6089$$
$$2025p + 7q = 4071$$

Find the value of $(p+q)^p$

(A) 25 (B) 36 (C) 49 (D) 16 (E) 9

2. Evaluate the value of $\angle AFE + \angle AEF + \angle DGH + \angle DHG + \angle CJI + \angle CIJ + \angle BLK + \angle BKL$, given the following figure below.



(A) 180 (B) 90 (C) 270 (D) 360 (E) 450

3. Determine the value of the digits of $p+q$, if

$$\frac{q! - p}{q!} = \frac{1}{2!} + \frac{2}{3!} + \cdots + \frac{2024}{2025!}$$

(A) 11 (B) 10 (C) 9 (D) 14 (E) 7

4. It is given that $\log^2 a \neq \log^2 b$, and that $a, b \in \mathbb{Z}$. Find the value of $(a+b)(ab)$.

$$(\log_b a^a + \log_\mathrm{a} b^b)(\log a \log b) = 2\log^2 a + 3\log^2 b$$

(A) 32 (B) 35 (C) 30 (D) 36 (E) 42

5. Let the sum of $n+1$ consecutive integers be equal to $10m$ and be denoted as S_{n+1}, and the sum of the first n consecutive integers be equal to $4m$. Hence if the value of the first consecutive integer in S_{n+1} is 21, find the value of n

(A) 25 (B) 27 (C) 28 (D) 35 (E) 29

6. It is known that in the country of $CHMC$, all license plates are in the form of $ABC123$, where ABC is any word made of 3 letters, and 123 are the numbers from 100 to 999. The president of the country of $CHMC$, Kenzo, has a car license plate with the word in ABC and the number in 123 being palindromes. Hence if the number of possible license plates that Kenzo can have can be expressed as $a^p b^q(c)$, find $a+b+c$.
Note : A palindrome is a sequence of letters or words that are read the same backwards and forwards, examples : 121, 222, ABA, ZZZ.

(A) 70 (B) 74 (C) 75 (D) 78 (E) 76

7. Find the sum of all integer bases $b > 9$, for which 17_b is a divisor of 97_b.

(A) 70 (B) 72 (C) 73 (D) 65 (E) 68

8. Let $f(x) = x^2(1-x)^2$, find the value of

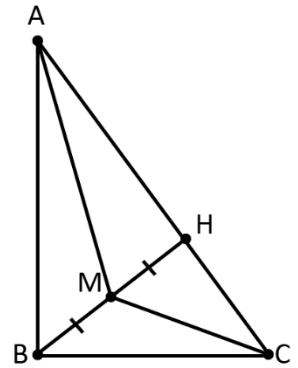
$$f\left(\frac{1}{2019}\right) - f\left(\frac{2}{2019}\right) + f\left(\frac{3}{2019}\right) - \cdots + f\left(\frac{2017}{2019}\right) - f\left(\frac{2018}{2019}\right) + f\left(\frac{2019}{2019}\right)$$

(A) 0 (B) 1 (C) -1 (D) 0.5 (E) -0.5

9. Determine the remainder when $2025^{(2030^{2025}+3)} + 2025$ is divided by 11.

(A) 1 (B) 2 (C) 4 (D) 5 (E) 6

10. In a triangle ΔABC, $\angle ABC = 90°$. Let BH be the altitude of B to AB. Draw line BH and midpoint M, then draw AM and MC. It is also known that $\angle ACB = 60°$, and $AB = \sqrt{3}$. Hence find $\left(\frac{AM}{MC}\right)^2$.



(A) $\frac{37}{7}$ (B) $\frac{38}{7}$ (C) $\frac{39}{7}$ (D) $\frac{40}{7}$ (E) 6

PART B

(+4 For Correct Answers, +0 For Wrong/Empty Answers)

11. Determine the simplified value of the following expression.

$$(3+2)(3^2+2^2)(3^4+2^4)\cdots(3^{2048}+2^{2048})$$

(A) $3^{4080}-2^{4080}$ (B) $3^{4096}+2^{4096}$ (C) $3^{4096}-2^{4096}$ (D) $3^{2096}+2^{2096}$ (E) 5^{4096}

12. It is known that $a-\frac{1}{b}=1$, $b-\frac{1}{c}=1$, and $c-\frac{1}{a}=1$. Find the value of $a+b$, when

$$(2b-2)(a-2)+2=2(2a-2)(2-b)$$

(A) 2 (B) 4 (C) 3 (D) 1 (E) 2

13. For a function $f_q(x)$, it is defined that $f_q(250)=f_{q-1}(250-q)$. Hence find the sum of digits of $f_{20}(x)$, given that $f_0(x)=2x^2+3x+1$.

(A) 8 (B) 10 (C) 6 (D) 2 (E) 9

14. Given that $x+\frac{1}{x}=1$, find the number of trailing zeroes from the given sum.

$$\left|\sum_{k=1}^{2025} x^{2^k}+\frac{1}{x^{2^k}}\right|!$$

Note : $n! = 1\times 2\times \ldots \times n$, and $|x|$ is the absolute value of x.

(A) 504 (B) 500 (C) 405 (D) 410 (E) 505

15. It is known that 99900009 is a product of 4 consecutive odd numbers. Hence find the sum of squares of these odd numbers.

(A) 40000 (B) 40020 (C) 40010 (D) 50000 (E) 40,030

16. For a triangle ΔDEF, it is known that $DE=4$, $EF=5$, and $DF=7$. Hence if $2\sin F : 3\sin E : 4\sin D = m:n:p$, find $m+n+2p$.

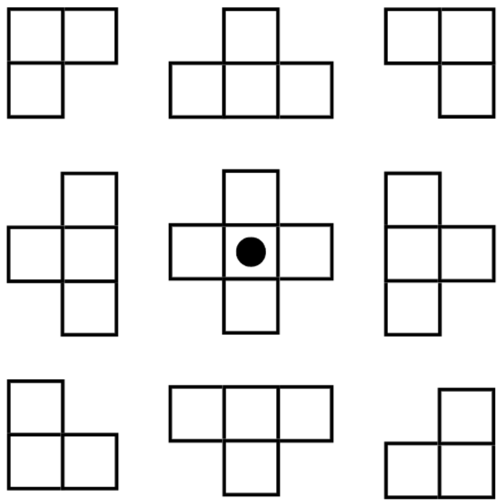
(A) 67 (B) 68 (C) 79 (D) 69 (E) 65

17. If the value of $xyz=1$, find the value of the given expression

$$\left(\frac{1}{1+x+\frac{1}{y}}+\frac{1}{1+y+\frac{1}{z}}+\frac{1}{1+z+\frac{1}{x}}\right)^2$$

(A) 4 (B) 9 (C) 1 (D) 2 (E) 64

18. It is known that the given arrangement of domino's will be rotated $90°$ 4 times about the central point (black circle). Kenzo decides to color 9 of the domino squares as purple, Kenzo then denotes a specific coloring as $sigma$ when that coloring is the same across all rotations of the domino arrangement. Evaluate the last two digits of the positive difference between the amount of $non - sigma$ colorings and $sigma$ colorings.



(A) 68 (B) 88 (C) 21 (D) 22 (E) 24

19. Find the value of $ax^5 + by^5$ if the real numbers a, b, x, y satisfy the following system of equations

$$ax + by = 3$$
$$ax^2 + by^2 = 7$$
$$ax^3 + by^3 = 16$$
$$ax^4 + by^4 = 42$$

(A) 20 (B) 42 (C) 44 (D) 46 (E) 48

20. In a acute angled triangle ΔABC, $AB = \sqrt{30}$, $BC = \sqrt{15}$, and $AC = \sqrt{6}$. There exists a point D for which AD bisects BC and $\angle ADB$ is a right angle. Evaluate $M + N$.

$$\frac{Area(\Delta\mathrm{ADB})}{Area(\Delta ABC)} = \frac{M}{N}$$

(A) 55 (B) 75 (C) 65 (D) 45 (E) 35

PART C

(+5 For Correct Answers, +0 For Wrong/Empty Answers) (All answers are integers)

21. What are the two last digits from $1! + 2! + \cdots + 2025!$

22. Let x, y be non-negative integers such that $2^6 + 2^x + 2^{3y}$ is a perfect square that is less than $10{,}000$. Hence find the value of $2(x + y)$.

23. There exists a triangle ABC, with $\angle ABC = 60°$. O is the circumcenter and H
Is the orthocenter of the triangle. D is a point on BC such that $BD = BH$. E is a point on AB is a point $BE = BO$. If $BO = 1$, and the area of $BDE = \frac{\sqrt{a}}{b}$, find $a^b + b$. -

24. Find the sum of the ordered pairs of (x, y) of positive integers which satisfy the following equation : $x^3 + y^3 = x^2 + 18xy + y^2$

25. Determine the value of $a + b + c$, with $S = a\frac{b}{c}$, given that

$$S = \sqrt{1 + \frac{1}{1^2} + \frac{1}{2^2}} + \sqrt{1 + \frac{1}{2^2} + \frac{1}{3^2}} + \cdots + \sqrt{1 + \frac{1}{2024^2} + \frac{1}{2025^2}}$$

-This is the end, hold your breath and count to 10…-