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Girls in Math 2026

Guts Round - 1

1.

2.

3.

1. [4] Compute $\frac{(2!+0!+2^6)+\frac{201}{5}}{(2!+0!+2^6)-\frac{201}{5}}$.

2. [4] Square $ABCD$ has side length 6, and point P is such that $AP = BP = 5$. If the greatest possible length of segment $\overline{CP}$ can be expressed as $\sqrt{a}$, what is the value of a?

3. [4] What is the minimum number of chess pieces (rooks or bishops) that must be placed on an 8×8 chessboard so that each rook attacks exactly one bishop and each bishop attacks exactly one rook? Rooks can attack along a row or column, and bishops can attack along a diagonal.

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4.

5.

6.

4. [6] The answer to this problem can be expressed as $2025 \cdot \frac{p}{q}$ where p and q are positive, relatively prime integers. Given that $p + q = 67$, what is pq?

5. [6] Brianna has nine solid cubes with side lengths $1, 2, \ldots, 9$. She paints each large cube only on its outer surface, then cuts each into $1 \times 1 \times 1$ cubes. Brianna selects a single unit cube uniformly at random. Let the probability that the chosen unit cube has all six faces unpainted be $\frac{m}{n}$, where m and n are relatively prime positive integers. Find $m + n$.

6. [6] Traffic in Queen Beatrice's beehive is controlled by stop signs. The regular octagon-shaped signs are painted yellow along the borders. 50 stop signs need to be painted. If the side length of the stop sign is 1.5 mm, and the side length of the inner edge of the border is 1.2 mm, and each bucket of paint can cover 50 mm^2, how many full buckets of paint are required?

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7.

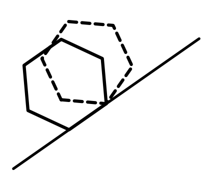
8.

9.

7. [7] $ABCDEF$ is a regular hexagon, with center O. A bee starts at A, and every second it moves to an adjacent vertex or O (or if it is at O, it can go to any other vertex). How many ways are there for it to be at D in exactly 4 seconds?

8. [7] We call a month `perfect` if the month starts on a Sunday and ends on a Saturday. How many perfect months are there from January 1st, 2026 up until December 31st, 2126? A year that is divisible by 400, or divisible by 4 but not 100 is a leap year. Today is Saturday, February 28th, 2026.

9. [7] Sisyphus the Bee, has been sentenced to an eternity of punishment, where he must roll a honeycomb (which is a regular hexagon of side length 1) up a slope. The area that the hexagon sweeps after one roll can be written in the form $\frac{a\sqrt{b}+c\pi}{d}$, where a, c, and d are relatively prime and b is square free. Find $1000a + 100b + 10c + d$. Note: Rolling the hexagon involves rotating the hexagon into the air while keeping one pivot vertex fixed on the ground at all times.



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Guts Round - 4

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10.

11.

12.

10. [9] Bonnie the Bee starts on a hexagonal cell in the middle of an infinite honeycomb. Each second, Bonnie moves to the middle of a neighboring hexagonal cell. How many different cells could Bonnie be on after following this procedure for one minute?

11. [9] Bridget the queen bee orders Sleepy the worker bee to review n problems and write m problems, where n, m are non-negative integers and $n + m = 100$. The ith problem reviewed takes $2i$ energy and the jth problem written takes $3j$ energy. What is the minimum energy Sleepy can use?

12. [9] Point P is inside square $ABCD$. Given that $\angle DAP = \angle ADP = 15°$, find $\angle CPD$, in degrees.

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13.

14.

15.

13. [11] We say that two points $(a, b), (c, d)$ are `equivalent` when both $a - c$ and $b - d$ are integers. What is the minimum number of points $P = \{p_1, p_2, \ldots, p_n\}$ in the plane needed such that any point (x, y) is at most a distance $\frac{1}{2}$ away from a point equivalent to some p_i in P?

14. [11] A deck of cards labeled 1 through 100 is dealt. What is the length of the largest set of cards such that no card is directly divisible by any other in the set, unless that quotient is a power of 2 or a power of 5? For example, 9 and 6 can both be dealt in the same sequence, as well as 36 and 9, but not 9 and 3.

15. [11] Consider a sequence that alternates between being arithmetic and geometric. Let $a_1 = 1$. Define for $n \geq 2$, $a_n = a_{n-1} + 2$ if n even and $a_n = 3a_{n-1}$ if n odd. If $a_{2027} - a_{2026} = a \cdot 3^b - 2$, with a and b positive integers and a not divisible by 3, what is $a + b$?

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Guts Round - 6

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16.

17.

18.

16. [14] How many functions from $\{1, 2, \ldots, 8\}$ to $\{1, 2, 3\}$ are there such that $f(x)f(x+1)f(x+2)$ is even for all $1 \leq x \leq 6$?

17. [14] How many ways are there to color a 5×5 grid with white or black squares subject to the following conditions:

(1) All squares along the diagonal from the bottom left corner to top right corner are black.

(2) The grid is symmetric about the diagonal from the bottom left corner to top right corner.

(3) If a black square in the ith row and a black square in the jth row appear in the same column, then the square in the ith row and jth column is black. (Rows are indexed from bottom to top, and columns indexed from left to right.)

18. [14] There are 6 distinct lines in a plane, and no three intersect at one point. There are n points where two lines intersect. Find the sum of all possible values of n.

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19.

20.

21.

19. [17] For how many nonnegative integers n does $2^n + 3^n$ divide $4^n + 9^n$?

20. [17] It is possible to create a polygon such that there exists a point in the polygon such that standing at that point one can't see the entirety of any side. (We say a point P cannot `see` the entirety of an edge E if there exists a point $P' \in E$ where P' is not an endpoint of E and the segment $\overline{PP'}$ intersects some edge other than E.) What is the minimum number of edges for such a polygon?

21. [17] Consider triangle $\triangle ABC$ with circumcircle Ω and incenter I. Let M be the arc midpoint of major arc BC and N the midpoint of minor arc AB. Lines MN and AB meet at X, and then line XI and side BC intersect at K. Given that $AB = 7$, $AC = 10$, and $BC = 12$, it can be found that $AK = \frac{\sqrt{m}}{n}$ for positive integers m, n with n minimized. Find m.

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Guts Round - 8

A.

B.

C.

D.

E.

F.

This set contains six problems, which can be grouped into three pairs. The two questions in each pair have the same answer. You will receive $5N^2$ points, where N is the number of pairs in which you give the correct answer for both problems. No other points will be awarded.

Question A: Consider a unfair coin; initially, the probability of flipping heads and tails are both $\frac{1}{2}$. However, for each flip following the first flip, the probability that the result is the same as the previous flip is $\frac{1}{3}$. In expectation, how many flips will we need to perform before we observe a consecutive sequence of HHH or TTT?

Question B: Let a number be `superprime` if the sum of its digits, product of its digits, and all possible permutations of it are prime. The answer to this question is a superprime, and moreover, if you reverse the digits of the answer to this question, you get the largest superprime that exists.

Question C: Beth is a very busy bee, so every day she only has the brain capacity to think of a single number. Today, she is thinking of some number N such that the congruence $x^2 \equiv 1 \pmod{N}$ has exactly 32 solutions modulo N, N is divisible by 9, N has exactly 60 positive divisors, and N is not divisible by 5, 11, or 13. Moreover, since Beth is very busy, N is the smallest positive integer that satisfies these properties. What is N?

Question D: How many ordered triplets of integers (a, b, c) are there such that $-10 \leq a, b, c \leq 10$ and $ab + c^2 = 0$?

Question E: A security hub has 6 identical sensors placed at the vertices of a regular hexagon. Each sensor can be either `Armed` or `Disarmed`. Two configurations are considered the same if one can be transformed into the other by any symmetry of the hexagon (i.e., rotations or reflections). How many different configurations are there?

Question F: Consider 5 points such that no three are collinear. Draw an edge between every pair. How many ways are there to color these edges with red, blue, and yellow such that there is no triangle using the points as vertices with three edges of the same color?

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25.
26.
27.

25. Let p denote the number of individuals who scored above a 5 and a denote the number of teams that scored above a 5 at GIM 2026, and q denote the number of individuals who scored above a 5 and b denote the number of teams that scored above a 5 at last year's (2025) GIM. Compute $ap+qb$. If the correct answer is A and you provide an estimate E, you will recieve

$$\max\left(0, \left\lfloor 20 - \sqrt{\frac{|E-A|}{2}} \right\rfloor\right)$$

points.

26. [20] An antichain of $\{1,2,\ldots,n\}$ is a set of subsets $A_i \subseteq \{1,2,\ldots n\}$, where $A_i \subsetneq A_j$. if $i \neq j$. What is the number of antichains of $\{1,2,3,4,5,6\}$? If the correct answer is A and you give an estimate E, you will recieve

$$\max\left(0, \left\lfloor 20 \cdot \left(1 - \ln\left(\max\left(\left|\frac{A}{E}\right|, \left|\frac{E}{A}\right|\right)\right)\right) + 0.5 \right\rfloor\right)$$

points.

27. [20] $ABCDEF$ is a regular hexagon, with center O. A bee starts at A, and every second it moves to an adjacent vertex or O (or if it is at O, it can go to any other vertex). How many digits are in the total number of ways for the bee to be at D in exactly 2026 seconds? If the correct answer is A, and you give an estimate E, you will receive

$$\max\left(0, \left\lfloor 20 - \frac{|A-E|}{20} \right\rfloor\right)$$

points.