



RAMC 2024

Middle School Invitational Round

- **SCORING:** The questions in this round are all worth 1 point each, for a total of 10 points.
- This round contains 10 questions to be solved in 30 minutes. All answers are integers.
- No computational aids are permitted other than scratch paper, graph paper, and a pen/pencil. No calculators of any kind are allowed.
- Fill out your information, and sign/initial the honor code on the answer sheet provided.
- If you believe there is an error on the test, submit a challenge to the proctors. Please include your name, level (E1/E2/MS/HS), and your solution to the problem with explanation.

Do not flip the page until the proctor begins the round!

1. Given that $a(1) = 3$ and $a(n) = a(n - 1) + 12$, what is $a(5)$?
2. In how many different ways can 10001 be expressed as the sum of two prime numbers?
3. Silas has 10 clean socks in his drawer. He wears a pair of them, then accidentally puts the dirty socks back into the drawer. Quickly, he rummages through the drawer, randomly retrieving 4 socks. The probability that he recovers both dirty socks is $\frac{p}{q}$, a fraction in simplest form. Find $p + q$.
4. What is the area of the region of the Cartesian plane defined by $|x| + |y| \leq 4$?
5. Adeline is flipping coins, while keeping track of her longest streak of heads in a row. After 8 coin flips, the probability that her longest streak of heads is exactly 4 can be expressed as $\frac{m}{n}$, a fraction in simplest form. What is $m + n$?
6. Colin is putting his cookies away into jars. First, he tries to put 12 cookies in each jar. This leaves 3 jars empty, but the rest are filled. He then tries to put 10 cookies in each jar, but he is left with 4 cookies too many. How many cookies does Colin have?
7. Patty the point is standing at $(0, 0)$ on the Cartesian plane. Patty can only move up by 2 units, or to the right by 2 units, along lattice points. If Patty wants to get to $(20, 24)$, but she must pass through the points $(8, 10)$ and $(16, 16)$, how many paths can she take?
8. A gardener takes care of three types of flowers in his garden. The marigolds are watered every third day, the irises are watered every fourth day, and the hyacinths are watered every fifth day. All the plants will be watered on December 31, 2024. On how many days during 2025 (not a leap year) will none of the flowers be watered?
9. How many permutations of "FOLKLORE" contain a palindrome with length at least 2? For example, "FLEROLOK" is one such permutation, since "OLO" is a palindrome of length 3.
10. A circle passes through 2 vertices of a triangle with side lengths 30, 40, and 50. What is the smallest possible distance between the center of this circle and a vertex of the triangle?