MOAA 2025: Accuracy Round

October 11th, 2025

Rules

- You have 45 minutes to complete 10 problems. Each answer is a nonnegative integer no greater than 1,000,000.
- If m and n are relatively prime, then the greatest common divisor of m and n is 1.
- No mathematical texts, notes, or online resources of any kind are permitted. Rely on your brain!
- Compasses, protractors, rulers, straightedges, graph paper, blank scratch paper, and writing implements are generally permitted, so long as they are not designed to give an unfair advantage.
- No computational aids (including but not limited to calculators, phones, calculator watches, and computer programs) are permitted on any portion of the MOAA.
- No individual may receive help from any other person, including members of their team. Consulting any other individual is grounds for disqualification.

How to Compete

- **In Person:** After completing the test, write your answers down in the provided Accuracy Round answer sheet. The proctors will collect your answer sheets immediately after the test ends.
- **Online:** Log into the Classtime session to access the test. Input all answers directly into the provided form. Select for the test to be handed in once you are ready.

Special Thanks to Our Sponsors!

Accuracy Round Problems

A1. [**3**] Find the remainder when

$$1! + 2! + 3! + \cdots + 2025!$$

is divided by 45.

A2. [**3**] Niki is baking cookies for X-Camp's bake sale at a rate of n cookies per minute, where n is a positive integer. After 20 minutes, the total number of cookies she has is a multiple of 12. She bakes for 5 more minutes, then accidentally drops 26 cookies on the way to the sale. If she arrives at the sale with a prime number of cookies, what is the smallest possible number of cookies she could have?

A3. [**4**] A positive integer with n digits is formed using only the digits 1, 2, and 3. The integer is called *even-friendly* if the sum of every pair of adjacent digits is even. Find the number of even-friendly 10-digit integers.

A4. [**4**] How many ways are there to permute the 8 letters in "MATHDASH" such that the letters in the odd positions appear in alphabetical order from left to right, and the letters in the even positions also appear in alphabetical order from left to right?

A5. [**5**] Two circles ω_1 and ω_2 with radius 4 are centered at A and B, respectively, so that B lies on ω_1 and A lies on ω_2. Let points C and D be the intersections of ω_1 and ω_2. Point P is on ω_1 such that $\angle APC = 45^\circ$, and Q is the intersection of PC and ω_2 not at C. If lines PA and QB intersect at E, the value of DE^2 can be expressed as $\frac{m}{n}$ where m and n are relatively prime positive integers. Find $m + n$.

A6. [**6**] The 2025 MOAA board consists of 5 directors and 5 associates. Two directors and one associate have names beginning with E. In how many ways can all 10 members be seated around a circular table so that no two directors are adjacent, no two associates are adjacent, and no two people whose names begin with E are adjacent?

A7. [**8**] Find the smallest positive integer value of k for which the sum of the values of n such that $n^2 + k$ is divisible by $kn + 1$ is greater than 20252025.

A8. [**8**] Let ABC be a triangle with $AB = 7$, $AC = 3\sqrt{14}$, and $BC = 14$. Let D be a point on BC such that $CD = 4$, and E be a point on ray $\overrightarrow{AD}$ such that $DE = 5$. Define points O, P, and Q as the circumcenters of triangles ABC, ABD, and CDE, respectively. Given that $\sqrt{OD^2 + PQ^2}$ can be written as $\frac{m\sqrt{n}}{p}$ where m and p are relatively prime integers, and n is not divisible by the square of any prime, find $m + n + p$.

A9. [**9**] Mr. DoBa is using a strange calculator from Citadel that can only display the last two digits of any number. For example, the number 2025 would appear as 25. There are three buttons: button A multiplies the displayed number by 2, button B multiplies the displayed number by 3, and button C multiplies the displayed number by 7. If the calculator currently displays 32, how many ways can Mr. DoBa press 9 buttons so that the screen displays 24 at the end?

A10. [**10**] Let N be the number of ways to fill a 3×3 grid with non-negative integers such that the sum of the numbers in each row and each column is equal to 18. Find the greatest prime divisor of N.