USEMO Rules and Procedures

United States Ersatz Math Olympiad

Last updated May 20, 2020

Ersatz math olympiad
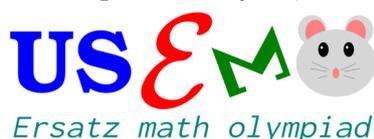
§I General

- The homepage for the USEMO is web.evanchen.cc/usemo.html.

- The registration and submission are hosted through a portal on the Art of Problem Solving website, available at aops.com/contests/usemo.

- The main contact is usemo@evanchen.cc and all inquiries should be directed there.

§II Eligibility and registration

1. In order to be eligible, you must satisfy the following conditions:
   a. You must be either a citizen of USA or go to school in the United States.
   b. You must be enrolled in middle/high school or other K-12 school and not have graduated high school.
   c. You need to be at most 20 years of age on the second day of the exam.
   d. You cannot be a Top Scorer (i.e. top three scores) of a previous instance of USEMO (see item 18 for more details).

2. Registration is done through Art of Problem Solving at aops.com/contests/usemo. You need to register in advance by the deadline stated on the webpage. The portal will acknowledge a successful registration and **assign you an ID number**.

§III Format and content

3. Each day of the exam is **4.5 hours**, and carries three problems worth 7 points. You are expected to write **complete proofs** for each problem.

4. There are **two days**; you can participate in either or both. The time of the exam is fixed (and the same everywhere), and announced on the website ahead of time.

5. The difficulty of the exam is intended to be similar to the International Math Olympiad. The easier questions would follow the IMO syllabus. On the other hand, more difficult questions could be more technical. For example, knowledge of results like inversion, quadratic reciprocity, or Turán's Theorem could be expected for some of the hardest problems.

6. The USEMO is an individual contest (collaboration is not permitted).

7. **The only aids allowed are writing utensils (pencils, pens, and eraser, including colored pencils and pens), ruler, compass, and paper.** In particular, protractors, calculators, electronic devices of any kind, textbooks, notes, music players, magic crystal balls, etc. are NOT permitted.

§IV Taking and submitting (the most important part!)

8. The problems will become available at 12:30pm ET at `aops.com/contests/usemo`. You should print the problems and then work until time expires (5:00pm ET).

9. For each problem, you should submit one or more pages consisting of a proof (or attempt at a proof) at the problem.

    a. You should submit only pages that you wish to have graded.

    b. The submission should be written in English sentences and read as natural proofs following usual mathematical conventions. Avoid submitting equations with no accompanying explanation, two-column proofs, etc., and write clearly. The graders may deduct points for sufficiently poorly written explanations.

    c. Passages which should not be graded must be crossed or struck out. This can increase your score as graders may deduct points for false statements.

    d. Leave a 1-inch margin on all pages.

    e. Separate problems should be on separate pages.

    f. There is a suggested limit of 15 pages per problem. (We expect that most solutions will not be anywhere near this limit.) Solutions exceeding this page limit will still be accepted, but they may not be read in entirety.

10. At the end of the exam, you should **label the top of every page you wish to submit as follows**:

    <div align="center">

    ID A. Page X of Y of Problem N.

    </div>

    Here A is your ID, and $1 \leq X \leq Y$ are integers, and $N \in \{1, 2, 3, 4, 5, 6\}$. The page counter should reset per problem.

    A template is provided on the USEMO webpage which you are welcome to use, but do not have to; writing this heading on unmarked paper is okay too. (If you use the template, you should print several out ahead of time.)

    Do not write your name or other identifying information.

11. Immediately after the exam ends, you should scan your submission and produce **one PDF file for each problem**. Try to compress the PDF to ensure the file is at most 10MB; larger files could cause technical issues.

12. You should upload your work at `aops.com/contests/usemo`. In addition to the 4.5 hours for the exam, you are given a **one-hour grace period for printing the exams and uploading your work**. In other words, the website will accept submissions up until **6:00pm ET**.

    Students are encouraged to practice scanning before the contest to avoid issues on the day-of. Many smartphones support this. On Android, the Google Drive App has a scanning feature. For an Apple device, the Notes App can scan as well. Other options include "Tiny Scanner" on iPhone or "Cam Scanner".

§V Aftermath

13. Discussion of the exam with others is permitted after 7:00pm ET on the day of each exam, two hours after the end of the exam.

    Each day a **live discussion at 7:00pm ET** will be held at `twitch.tv/vEnhance`. Attendance at the live discussion is optional.

14. When the initial scoring is complete, your **score will be displayed** along with your submission at `aops.com/contests/usemo`, together with **comments and feedback**, if any, from the graders. The rubric for each problem will also be posted.

15. You may appeal your score on any problem by emailing the USEMO directors within 48 hours of receiving your score. In your appeal, you should state what score you think you deserve and an explanation of why.

    a. Disagreement with the rubric is not a valid reason to appeal.

    b. Any problem may be appealed at most once. After this, the score can be adjusted (either up or down) and that decision cannot be further appealed.

    c. In some cases, the graders may request additional clarification in response to the appeal. If this occurs, it is the contestant's responsibility to reply within 24 hours, otherwise the appeal may be discarded.

    d. Unsurprisingly, the graders have final discretion in all cases.

§VI Prizes

16. We award prizes for each of the following:

    a. **Top Scorers** (x3): The three highest scores.

    b. **Youth Prize**: The highest score in 10th grade or below not already recognized.

    c. **Top Female**: The highest female score not already recognized.

    d. **Highest Day 1**: The highest score on the first day not already recognized.

    e. **Highest Day 2**: The highest score on the second day not already recognized.

    Any ties are broken by elegance and clarity of solution, as determined by the graders. This procedure always generates seven distinct students, without repetition.

17. Each of the seven students in the previous category earns:

    a. A gift card or check of $20.20, and

    b. Optionally, a donation of up to $20.20 to a charity or nonprofit organization of their choice and made in their name.

18. Top Scorers (i.e. the top three scores of each year) become ineligible for competing in future years. (However, they become eligible for submitting problem proposals.) This helps ensure a rotation of winners.

19. On the webpage, we will also recognize

    a. An **Honorable Mention** to the next 5-7 highest scores after the Top Scorers.

    b. A **Distinction** for any student who earns at least 14 points.

    c. In some years the graders may also award a **Brilliancy Award**, for an unusually elegant solution.

§A   Mathematical conventions

The USEMO will use the following conventions and terminology in problems and solutions documents.

A.1. Problems on the USEMO always require a full proof even when asking for a quantity, regardless of which imperative words are used. For example, "what is x?", "find x", and "determine, with proof, all possible values of x" all have the same meaning.

A.2. The sets $\mathbb{Z}$, $\mathbb{R}$, $\mathbb{Q}$, $\mathbb{C}$ have their usual meanings.

A.3. We let $\mathbb{N} = \mathbb{Z}_{>0} = \{1, 2, \dots\}$ denotes the set of *positive* integers (i.e. 0 is not a natural number). We use the notation $\mathbb{Z}_{\geq 0}$ for nonnegative integers.

A.4. The graph-theoretic terms "graph", "vertex", "edge", "connected", "degree", "directed graph", and "tournament" will be used freely (rather than referring to cities and airlines, etc.).

A.5. Graphs are *simple graphs* unless otherwise specified, meaning that every edge has two distinct endpoints, and every pair of vertices has at most one edge.

A.6. The functions $\lfloor \bullet \rfloor$ and $\lceil \bullet \rceil$ denote the floor and ceiling functions.

A.7. We say 0 divides itself, but not any other integer.

A.8. Polygons are assumed to be non-self-intersecting unless stated otherwise.

A.9. A lattice point is a point all of whose coordinates are integers.

A.10. If D is a positive integer, and a and b are rational numbers whose denominators (in simplest form) are relatively prime to D, then $a \equiv b \pmod{D}$ means that the numerator of $b - a$ is divisible by D when written in simplest form.

A.11. An empty sum is equal to 0, while an empty product is equal to 1.

A.12. We accept the Axiom of Choice.