

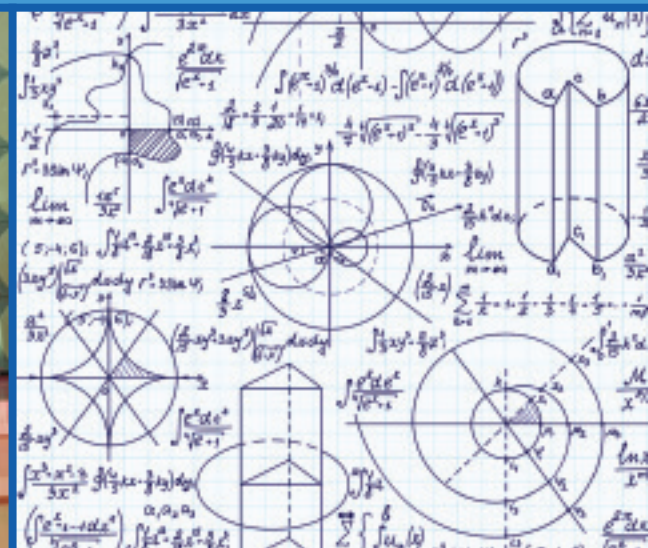
MAA American Mathematics Competitions

2022 INVITATIONAL

COMPETITIONS

TEACHER'S MANUAL

A guide for administering a successful and rewarding AIME, USAMO, and USAJMO



AIME I: TUESDAY, FEBRUARY 8, 2022

AIME II: WEDNESDAY, FEBRUARY 16, 2022

USAMO & USAJMO: TUESDAY, MARCH 22 AND WEDNESDAY, MARCH 23, 2022



MAA AMC
American Mathematics Competitions

Mathematical Association of America
PO Box 471 Annapolis Junction, MD 20701
800-527-3690 • maa.org/amc

WELCOME TO THE 2022 COMPETITION 40TH ANNUAL AMERICAN INVITATIONAL MATHEMATICS EXAM AND THE 51ST ANNUAL USA MATHEMATICAL OLYMPIAD

What is the MAA American Mathematics (AMC) Program?

The Mathematical Association of America's American Mathematics Competitions program leads the nation in strengthening the mathematical capabilities of the next generation of problem solvers. Through classroom resources and friendly competition, the MAA AMC program helps America's educators identify talent and foster a love of mathematics. The MAA AMC program positively impacts the analytical skills needed for future careers in an innovative society. The MAA American Mathematics Competitions are a series of examinations and accompanying curriculum materials that develop problem-solving skills and mathematical knowledge in middle and high school students.

What is the American Invitational Mathematics Examination (AIME)?

The AIME is a challenging competition offered to participants who excelled on the AMC 10 or AMC 12. It is a 15-question, three-hour competition, where each answer is an integer between 000 and 999, inclusive. The questions on the AIME are more difficult than those on the AMC 10 and AMC 12.

What are the USAMO and USAJMO?

The USA Mathematical Olympiad (USAMO) and the USA Junior Mathematical Olympiad (USAJMO) are both six-question, proof-based competitions that take place 4.5 hours each day for two consecutive days. Students will be invited to take the USAMO based on a combination of their AMC 12 and AIME scores. Students will be invited to take the USAJMO based on a combination of their AMC 10 and AIME scores. U.S. citizens and students currently studying in the United States and Canada who meet the age and grade requirements are eligible to qualify for the USAMO and USAJMO.

When is the AIME?

The AIME I is administered on Tuesday, February 8, 2022. The AIME II is administered on Wednesday, February 16, 2022. Students who qualified for the AIME will automatically be registered to take the AIME I. If a competition manager cannot administer the AIME I and needs to administer

the AIME II instead, they must complete the AIME II registration form and pay the associated fees. On competition day, the competition must be given between 1:30 p.m. and 5:30 p.m. Eastern Time.

When are the USAMO and USAJMO?

Day 1 of the USAMO and USAJMO is Tuesday, March 22, from 1:30 PM ET to 7:00 PM ET. Day 2 of the USAMO and USAJMO is Wednesday, March 23 from 1:30 PM ET to 7:00 PM ET. Three questions are given each day and participants are expected to compete on both days.

Invitational Exam Contact Information

For questions regarding AIME administration, please contact:

Email: amcinfo@maa.org

Phone: 800-527-3690

For questions regarding USAMO and USAJMO administration, please contact:

Email: usamoinfo@maa.org

Phone: 202-417-2048

Fax: 202-379-7852

Email contact is preferred.

**THE MATHEMATICAL ASSOCIATION OF AMERICA
AMERICAN MATHEMATICS COMPETITION
PROGRAM LEADS THE NATION
IN STRENGTHENING THE
MATHEMATICAL CAPABILITIES
OF THE NEXT GENERATION
OF PROBLEM-SOLVERS**

Pre-Competition Preparation: AIME

How do students qualify to participate in the AIME?

Qualification parameters for the AIME vary each competition cycle. For the AMC 10, at least the top 2.5% of all scorers on the AMC 10 A and the top 2.5% of scorers on the AMC 10 B are invited to take the AIME. For the AMC 12, at least the top 5% of all scorers on the AMC 12 A and the top 5% of scorers on the AMC 12 B are invited. The cutoff scores for AIME qualification will be announced after each competition (10A, 10B, 12A, and 12B) based on the distribution of scores. There is no predetermined cutoff score for the 2022 AIME and this year's AIME cutoff may differ from last year's.

How do you prepare students for the AIME?

The AIME has a different format than the AMC 10 and AMC 12. The competition is three hours, all answers are three-digit integers, and there are 15 problems. If you have participants who are first-time AIME qualifiers, show them the MAA AMC Invitational Competitions web page so that they can familiarize themselves with the types of problems on the AIME.

AIME Administration Policy:

The AIME I must be administered on February 8, 2022 and the AIME II must be administered on February 16, 2022. The AIME I and AIME II consist of different questions of equal difficulty. Students who qualified may take either the AIME I or AIME II. They may not take both. Any participant who takes both will be disqualified. If you have a student that qualified for the AIME but is unable to take the AIME I, please register for the AIME II. To do this, you can complete an [AIME II Registration Form](#) and email it to amcinfo@maa.org. Please note that there is a processing fee for the AIME II.

AIME Venue Policy:

Participants must take the AIME at the same location where they took the AMC 10 or AMC 12. This is to ensure that their AMC 10 or AMC 12 scores can be accurately matched with their AIME scores for USAMO and USAJMO qualification. In the event that a participant **absolutely cannot** take the AIME at the same location, they are to make arrangements with a different competition manager who already has the materials to proctor the AIME. The new proctor must complete the Change of Venue form that is available on the MAA AMC Invitational Competitions webpage. Participants should use the [Additional Competition Locations](#) tool and reach out to nearby institutions to find an alternative location. **The MAA AMC program will only accommodate change of venue arrangements that have been made between a participant and an approved competition manager.**

Pre-competition checklist for AIME:

- Confirm the time and location of the competition with all of your students who qualified.
- Locate the AIME materials that were mailed to you with your AMC 10/12 materials.
- Participants must use their full legal name, no nicknames or abbreviations. They should pay careful attention to marking their names accurately. **Their name on the AIME answer sheet must match the name they used to complete the AMC 10/12 answer sheet.** Once participant information has been submitted, the MAA AMC program office cannot edit any of the information provided on the answer sheet.
- Reserve a quiet room for at least 3 hours and 30 minutes on the day of the competition to allow for 15 minutes of prep time, the 3 hour competition, and 15 minutes to collect papers and clean up. The AIME must be administered between 1:30 p.m. and 5:30 p.m. ET.
- For time zones located outside of the continental United States (International), the competition must be given at the same time window of 1:30 p.m. to 5:30 p.m. ET on the competition day, to ensure the integrity of the competition.
- Complete the School Identification Form and USAMO/ USAJMO Identification Form using the instructions found on those forms.
- Make arrangements to mail the AIME return envelopes the day after the competition. Use an overnight or 2-day shipping service, with a tracking number, to guarantee timely arrival of these materials. FedEx, UPS, or USPS Overnight **are strongly recommended.**
- Obtain a supply of #2 pencils and unmarked scratch paper. Inform participants that no aids are permitted other than blank scratch paper, rulers, compasses, and erasers. **Calculators and electronic devices of any kind are not allowed.** AIME questions do not require the use of a calculator.

AIME Competition

Competition Delivery

An email will be sent to the inbox of the email address that you used to register for the AMC 10 or AMC 12 on Monday, February 7, 2022 by 1:00 p.m. ET for the AIME I and on Tuesday, February 15, 2022 by 1:00 p.m. for the AIME II. This email will contain a link to a password-protected PDF of the AIME problems. Print out the PDF and make enough copies for each of your AIME participants. To ensure that you are able to receive this email, please add amcinfo@maa.org to your list of approved contacts. The PDF files should be opened using Adobe Acrobat to ensure that the files print correctly.

Before the Competition

- Ensure that you have enough copies of the AIME problems for each of your AIME participants.
- Seat participants so they are separated by an empty space, if possible.
- Hand out the AIME problems and inform participants that they are not to turn to the pages containing the problems until they are instructed.
- Instruct participants to read the entire front cover of the AIME. Allow 5 minutes to review the front cover.
- Read aloud the following instructions:
 - For each problems, use a #2 pencil to write your answer at the top of the problem's answer column. Use 3 digits: each problem has only one correct answer, which is an integer between 000 and 999, inclusive. Then, in each of these columns, bubble in the one circle which is labeled with the digit you have written at the top.
 - DO NOT BUBBLE IN ANSWERS UNTIL YOU ARE CERTAIN OF YOUR FINAL CHOICE. Answer sheets that contain stray marks may not be read correctly by the scanner that scores the answer sheets.
- Ask if there are any questions about competition procedures. Inform participants that talking or asking questions during the competition is not allowed. They must do their own work.

- When it is time to begin, tell participants to open the packet containing the AIME problems and to be careful to match their answers to the corresponding column. Remind participants that there are 15 problems and that they have three hours to complete the competition. Then instruct students to **begin**.

During the Competition

- Provide as quiet an environment as possible.
- Participants should be continuously monitored by the competition manager.
- Be sure that no participant has access to any electronic devices, including calculators, cellphones, and smart watches.
- Warn any participant whose eyes wander, and disqualify any who are clearly copying or collaborating.
- If there is an urgent need to use the bathroom, only one participant may leave at a time. Their answer sheet and the AIME problems packet should remain with the competition manager while the participant is out of the room. If there is a health or medical emergency, a backup competition manager should be available to assist in administering the competition.
- Make an announcement when there are 90 minutes left and again when there are 15 minutes left.
- When time is up after three hours, tell the participants to **stop** and have them sign their name in the space provided in the middle of side 2 of the answer sheet.
- Collect the answer sheets and AIME problems packets immediately following the administration of the competition. Once all answer sheets are received, check that each participant's name is correct and that the answer sheet is bubbled in correctly.
- Inform the participant that the problems and solutions may not be discussed with anyone outside of the room either orally or digitally (e.g. email, online, and social media of any type) until 24 hours have passed from the official competition date. The AIME problems may be returned 24 hours after the competition period is over.

AIME Competition

After the Competition

- **Please do not score the answer sheets.** Send them to the MAA AMC for scoring.
- Check the answer sheets for complete personal information (legal name, date of birth, gender, etc.).
- Arrange the answer sheets so that each sheet faces the same direction with the same side up. Remove all paper clips, rubber bands, and scratch paper attached to the answer sheets. Make sure that no two sheets are stuck together.
- Place the School Identification Form on top of the answer sheets and insert all sheets in the return envelope.
- Complete the [AIME Certification Form](#). Make sure that your principal or person with comparable title signs the certification form where it is indicated and that you complete the rest of the form.
- Place the [AIME Certification Form](#) and School Identification Form in the AIME return envelope with the answer sheets,
- Seal the envelope and indicate the number of answer sheets that you are returning in the space provided on the front of the return envelope.
- Return the return envelope to the MAA AMC office the day after competition administration. Use an overnight or 2-day shipping service, with a tracking number, to guarantee timely arrival of these materials. FedEx, UPS, or USPS Overnight **are strongly recommended**.
- **February 28, 2022** is that last day that AIME I and AIME II answer sheets will be accepted by the MAA AMC office for scoring.
- The AIME answer sheets sent to the MAA AMC office in Annapolis Junction, MD for scoring will not be returned to competition managers.
- After you have mailed all of the answer sheets, you may discuss the problems and solutions with the participants. Remember that there will be institutions taking the competition at different times. It is important that no one discusses the problems and solutions in any online or public forum.

AIME Reports:

AIME scores, PDF certificates of participation, and the AIME solutions guide, will be emailed to competition managers after the answer sheets have been scored. Please retain the score report for future reference. Many students cite their scores on applications to college and other programs. The MAA AMC office cannot look up individual student scores after the competition cycle has ended.

USAMO & USAJMO Qualification Announcements:

- The MAA AMC office makes all possible attempts to contact qualifiers and competition managers about USAMO and USAJMO qualification.
- Competition managers will be emailed a list of students who took the AIME at their institution, which will indicate any students who qualified for the USAMO or the USAJMO.
- Students will find their USAMO or USAJMO IDs when they log in to the student portal on the AoPS website. The MAA will not publish IDs as all names must remain anonymous to the graders. Student solutions must only have IDs and page numbers on them.
- A list of USAMO and USAJMO qualifiers will be posted on the [MAA AMC website](#). This list will provide the first initial, last name, school, and state of each qualifier.
- Cutoff indexes will be announced on the MAA AMC website. If you discover that you have a student with a score above the cutoff who did not receive an ID number for the USAMO or USAJMO, or was not listed as a qualifier, please contact usamoinfo@maa.org to see if there was an error in matching the student's AIME score with their AMC 10 or AMC 12 score.

USAMO and USAJMO Competitions

How do students qualify to the USAMO or USAJMO?

After the AIME I and AIME II are scored, the USAMO committee and MAA AMC program will determine the cutoff indexes that will qualify students for USAMO or USAJMO. Each year the MAA AMC program selects approximately a total of 500 students for the two Olympiads. The USAMO and USAJMO indexes are calculated as follows:

$$\text{USAMO Index} = \text{AMC 12 Score} + 10 \times \text{AIME Score}$$

$$\text{USAJMO Index} = \text{AMC 10 Score} + 10 \times \text{AIME Score}$$

When determining the cutoff index, the USAMO committee considers the difference in difficulty of the AMC 10/12 A and B, as well as the difference in difficulty in the AIME I and AIME II, as determined by score distribution. If this difference is significant, different cutoffs may be announced for the different competitions. If a student's scores qualify them for both the USAMO and the USAJMO, they will be invited to take the USAMO. The USAMO committee may choose to invite additional students to take the USAMO or USAJMO. For example, the committee may invite the top scoring participants from underrepresented states to take the competition. Only students who are U.S. citizens or are currently attending school in the United States or Canada are eligible to participate in the USAMO and USAJMO.

How do you prepare students for the USAMO?

The format of the USAMO and USAJMO is identical to the format of the International Mathematical Olympiad. Both the USAMO and USAJMO consist of six proof-based questions to be solved over two days. Three questions will be given on Wednesday, and three questions will be given on Thursday. Each day, participants will have 4 hours and 30 minutes to solve them. Answers will be graded based on how they approached the problem, clarity of reasoning, evidence of ingenuity, inventiveness, and general insight. Please make sure participants have read the [USAMO/USAJMO Instruction Sheet](#), and have read our [MAA AMC Invitational Competitions webpage](#) to prepare for the competition.

Administering the USAMO & USAJMO

Pre-competition Checklist:

- Reserve a room for March 22, 2022 and March 23, 2022 from 1:30 p.m. ET to 7:00 p.m. ET on both days to allow for pre- and post-competition activities. **The competition must begin between 1:30 p.m. ET and end at 7:00 p.m. ET.**
- If you cannot administer the competition for the entire time on both dates, please find another competition manager to assist you.
- Confirm qualifying students have their ID numbers, the date of the competition, and that they plan on participating in the competition. The competition must begin between 1:30 p.m. ET, and participants cannot be given any additional time after 7:00 p.m. ET.
- Review the competition distribution instructions that were sent to you via email. If you have not received any instructions and will have students taking the competition, email usamoinfo@maa.org as soon as possible.

AMC Policies

Policy for Changes:

The MAA Committee on the American Mathematics Competitions may change the program rules, regulations, awards, and conditions of participation in whole or in part. Whenever possible, competition managers will be notified of these changes ahead of time.

Early Administration:

Early administration is never permitted and will result in the disqualification of all the results at your institution. Early administration jeopardizes the validity of all scores from other institutions.

Official Administration:

The only official days for the AIME are February 8 for the AIME I and February 16 for the AIME II. The only official days for the USAMO and USAJMO are March 22 and March 23. Only official AIME participants are eligible to qualify for the USAMO or USAJMO, and only the answer sheets from official USAMO and USAJMO participants will be scored. If the AIME is administered in a time zone outside of the continental United States, the competition must begin after 9:00 a.m. ET on the official competition day.

Competition Administration:

- The AIME, USAMO, and USAJMO must be administered by a competition manager. This person is a teacher, school administrator or coach, and must be a responsible adult who not related to any of the participants. Under no circumstances may a parent administer any competition.
- The proctoring of the competition must take place in a public building (e.g., schools, universities, or places of worship).
- All participants must take the competition at the same time under the supervision of a competition manager who fully understands the responsibilities.

Inclement Weather and School Cancellation:

If school is canceled on the day of the AIME I, the competition manager must contact AMC customer service immediately (amcinfo@maa.org) so the school can register for the AIME II. If school is cancelled on the day of the AIME II and the competition cannot be administered, students will not be eligible to qualify for the USAMO or USAJMO. In the event of a school closure, the competitions can be offered at a different location. The competition manager must receive approval from the school administration before offering the competition at an alternative location.

Questionable Scores:

If it is clear to the competition manager from personal observation that a participant has cheated, then the competition manager must disqualify that participant. If the competition manager receives an accusation or obtains indirect evidence of cheating, the competition manager must immediately report all the facts of the situation to the MAA AMC Office at amchq@maa.org. The MAA AMC Office will determine what further action to take. **Under no circumstances** may the competition manager decide on their own to accept a questionable score.

Students with Accommodation Plans:

If a student who qualified for the AIME has a physical or learning disability, contact the MAA AMC office at amcinfo@maa.org to discuss accommodations. The time allowance for participants with learning disabilities is 4 hours and 30 minutes. If a student who qualified for the USAMO or USAJMO is visually impaired and/or has a learning disability, contact the USAMO office at usamoinfo@maa.org.

Lost or Delayed Packages:

Answer sheets must be received by the MAA AMC office by February 28, 2022 for the AIME I and AIME II. The MAA AMC is not responsible for lost or delayed answer sheets. Answer sheets received after these deadlines will not be scored. This means that participants will not be eligible to qualify for the USAMO or USAJMO and their scores will not appear on the MAA AMC website.



AIME I: FEB 8, 2022

AIME II: FEB 16, 2022

ONLINE AIME REGISTRATION

• ONLINE STUDENTS:

- All students who took the AMC 10/12 online will automatically be registered for the AIME I on AoPS in their student portal

• PRINT TO ONLINE STUDENTS:

- Students who took the AMC 10/12 on paper can still take the AIME online. If the Competition Manager decides to switch to online administration, students will need their unique IDs, CEEB code, first and last names to register for the AIME on AoPS. The unique IDs will be emailed to Competition Managers who administered the AMC 10/12 on paper. Students can register for online AIME in February by visiting: <https://aops.com/contests/amc>

ONLINE PROCTORING

Participants should be continuously monitored by the competition manager (CM) proctor. Only competition manager proctoring is allowed.

For CM Proctors: Please start video conferencing with students at least 30 minutes ahead of time and begin proctoring as students sign into the competition site. Students will complete a series of competition steps which include sections, such as rules and regulations, the Competition page (featuring a timer), a post-competition integrity form, and final submission page.

The CM proctor must not answer any questions about the competition and should ensure that no participant has the opportunity to communicate by any means to any other person while the competition is in progress. If there is an urgent need to use the bathroom, all materials should remain with the proctor. No other breaks are permitted.

SPECIAL ACCOMODATIONS

The Competition Managers must complete this [form](#) by Feb 5. The time allowance for participants with learning disabilities is 4 hours and 30 minutes.

Access FAQs here: <https://artofproblemsolving.com/contests/amc#faqs>.

CONTEST TIMING

STUDENTS WILL HAVE THREE HOURS DURING THEIR LOCAL FOUR-HOUR WINDOW TO COMPLETE THE AIME. PLEASE FIND YOUR LOCAL AIME TIME WINDOW WITHIN THE FOLLOWING US TIME ZONES:

1:30 PM - 5:30 PM ET

12:30 PM - 4:30 PM CT

11:30 AM - 3:30 PM MT

10:30 AM - 2:30 PM PT

8:30 AM - 11:30 AM HT

COMPETITION DAY

Students can access the AIME I using [this link](#) (aops.com/contests/amc) and logging into their student portal

AIME II REGISTRATION

If for some reason the AIME I cannot be administered on Feb 8, Competition Managers may register students for the AIME II by [completing the form](#) and sending it to amcinfo@maa.org. The deadline to submit the form is Feb 3, 2022.

DAY 1: MARCH 22, 2022

DAY 2: MARCH 23, 2022

ONLINE USA(J)MO REGISTRATION

- **ONLINE STUDENTS:**
 - All students who took the AIME online will automatically be registered for the USA(J)MO on AoPS in their student portal.
- **PRINT TO ONLINE STUDENTS:**
 - Students who took the AIME on paper must take the USA(J)MO online. Students will need a unique IDs, CEEB code, and full name to register for the USA(J)MO on AoPS. The unique IDs are emailed to Competition Managers who administered the AMC 10/12 on paper. Students can register for online USA(J)MO by visiting when the site opens: <https://aops.com/contests/amc>

ONLINE PROCTORING

Participants should be continuously monitored by the competition manager (CM) proctor. Only competition manager proctoring is allowed.

For CM Proctors: Please start video conferencing with students at least 30 minutes ahead of time and begin proctoring as students sign into the competition site. Students will complete a series of competition steps which include sections, such as rules and regulations, the Competition page (featuring a timer), a post-competition integrity form, and final submission page.

The CM proctor must not answer any questions about the competition and should ensure that no participant has the opportunity to communicate by any means to any other person while the competition is in progress. If there is an urgent need to use the bathroom, all materials should remain with the proctor. No other breaks are permitted.

SPECIAL ACCOMODATIONS

The Competition Managers will have to complete this [form](#) by March 18. The time allowance for participants with learning disabilities is 6 hours and 45 minutes.

CONTEST TIMING

STUDENTS WILL HAVE 4.5 HOURS DURING THEIR LOCAL 5.5-HOUR WINDOW TO COMPLETE THE USA(J)MO. PLEASE FIND YOUR LOCAL TIME WINDOW WITHIN THE FOLLOWING US TIME ZONES:

1:30 PM - 7:00 PM ET

12:30 PM - 6:00 PM CT

11:30 AM - 5:00 PM MT

10:30 AM - 4:00 PM PT

8:30 AM - 1:00 PM HT

COMPETITION DAY

Students can access the USA(J)MO using [this link](#) (aops.com/contests/amc) to log-in to their student portal

Access FAQs here: <https://artofproblemsolving.com/contests/amc#faqs>.