

MAA

MATHEMATICAL ASSOCIATION OF AMERICA

12th/62nd Annual

American Mathematics Competitions

AMC 10/12 A

TEACHERS' MANUAL

Instructions and Reporting Forms
for School Contest Managers

Tuesday, February 8, 2011

Please read this booklet thoroughly upon receipt.

DATES TO REMEMBER

AMC 10/AMC 12 - Tuesday, February 8, 2011 &/or Wednesday, February 23, 2011

AIME - Thursday, March 17, 2011 or Wednesday, March 30, 2011

USAMO & USAJMO - Wednesday & Thursday, April 27 & 28, 2011

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American Mathematics Competitions

Dear Contest Managers:

I am very pleased you will be providing the opportunity for your students to participate in the 62nd annual American Mathematics Contest 12 (AMC 12) or its sister contest, the 12th annual American Mathematics Contest 10 (AMC 10). I believe that you and your students will find these contests to be both interesting and challenging. Again this year the Committee on the American Mathematics Competitions and panelists under the leadership of Committee Chairs LeRoy Wenstrom for the AMC 10 and Bernardo Abrego for the AMC 12 developed a total of 4 contests (two AMC 10 and two AMC 12). I extend special thanks to both of them for the effort involved in developing these excellent contests.

This year, we continue to include in this manual several handouts, included in Section XIV:

- * Worksheets for contest preparation (page 23-31)
- * A handout for parents on why mathematics is important (page 17)
- * A sample Press Release (page 16)
- * A Certificate of Participation (pages 19-20)

You may reproduce these pages for your students.

Sincerely,

Dr. Steven R. Dunbar
Director, MAA American Mathematics Competitions

American Mathematics Competitions

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Important Procedures

Format

There are two official dates for the AMC 10 & AMC 12. Give the AMC 10 and AMC 12 at the same time within each participating school on Tuesday, February 8, 2011 (AMC 10-A & AMC 12-A), or Wednesday, February 23, 2011 (AMC 10-B & AMC 12-B) in a convenient 75-minute interval, preferably in the morning. All four contests consist of 25 questions.

NOTE: Each correct answer scores 6 points, a **blank scores 1.5 points** and an incorrect answer scores 0 points.

The AMC 10 and AMC 12 have several questions in common. The students in grades 10 and below should choose between the AMC 10 and AMC 12. Students in grades 11 and 12 may only take the AMC 12. All rules and awards apply to both contests for all schools and students. Any student who missed the exam may take it unofficially, and we will be happy to grade it. Students may take the contest booklets home with them the day of the contest.

Answer Forms

The AMC 10 and AMC 12 each have their own color coded answer form (AMC 10-orange and AMC 12-red). Contest B answer forms have instructions in black ink. Please be careful to match the correct answer form with the appropriate contest when passing out the papers.

AIME Qualification

Students who score 100 or above or finish in the top 5% on this AMC 12 or students who score 120 or above or finish in the top 2.5% on this AMC 10 will qualify to take the 29th annual American Invitational Mathematics Examination (AIME) on Thursday, March 17 or Wednesday, March 30.

Results

We will send your school's results by email (if available) and first class mail as soon as the answer forms are scored. If you have not received your results from our office within 30 days after the contest, please contact us to verify that your answer forms were in fact received. All student Answer Forms are held for 90 days after the exam date, then they are recycled.

School Flier

We are again providing a flier you can use to promote the contests within your school. It is included on page 18 of this Manual. It has space left for you to add school information, such as the location of the contests, and who to contact locally for more information. If you would like a color version, visit our web page to download a pdf version of the flier you need: amc.maa.org/



I. Preliminary Instructions for Administering the AMC 10/AMC 12

1. Inform students far in advance about the date for the AMC 10/AMC 12 and obtain a supply of No. 2 lead pencils.
2. Hand out the student Answer Forms and have the students complete the non-answer sections on the front and back. **Have students use their full legal name, no nicknames or abbreviations. Have them pay special attention to marking their name and address accurately.** Remind them that student names listed on the AMC website come from this form. The AMC Office will not do any editing of the information.
3. The name of the school, city, state and postal code must be stamped or written on each student answer form. This is very important because there is no other school identification on the answer forms. Please do not use stick-on labels to provide this information.
4. Announce that the students may use scratch paper, graph paper, rulers, compass, protractors, and erasers. **CALCULATORS ARE NOT PERMITTED.** We cannot assure that all participants in the contest have the same access to technology. In addition, it is becoming increasingly difficult to ensure that students will not use calculators as communication devices. For these reasons, the AMC does not allow the use of calculators on its examinations. No problems on the contest will require the use of a calculator.
5. Review past tests and solutions or inform your students how to order copies for themselves. The Publications Order Form can be printed from the AMC Web page at amc.maa.org, (or call, fax or write to the AMC Office for a copy).
6. Encourage participation by students who have not taken the contest before, especially younger students, but make sure students know what to expect. Let them know about typical scores at your school last year at their grade level. Show students the national statistics in our National Summary of Results and Awards from last year. Tell them to set appropriate goals for themselves.
7. Remind students the day before the contest about the time and place of the AMC 10/AMC 12. Also tell them your plan if the school should suddenly close. All students must take the contest at the same time, either in one group or in separate classrooms and be under the supervision of a proctor.
8. Make sure you have arranged to follow all the rules and procedures in this manual. **EARLY ADMINISTRATION OF THE CONTESTS IS NEVER PERMITTED**, and will lead to disqualification. To assure the validity of the results we report, we take our rules very seriously.

II. Instructions For The Day of The AMC 10/AMC 12

If today is not yet Tuesday, February 8, 2011 STOP EVERYTHING. Under no circumstances is the contest to be given to anyone before the official day, nor should the contest package(s) be opened before that date.

1. Sign the Certification Form to certify that the package was opened within an hour before the contest.
2. When the students arrive, seat them so they are separated by an empty space if possible.
3. Hand out the Answer Forms which have been partially completed by the students (AMC 10-orange/AMC 12-red).
4. As you hand out the papers, tell the students not to open the contest booklet. They should then read the entire front cover. Give them 5 minutes to do this.
5. Inform the students to, "Carefully read instructions 3 and 4 on the contest cover." (see pages 21 and 22 of this manual). The AMC 10/AMC 12 has a scoring system which has important consequences for guessing. Unless you are fairly sure of the answer, it is better to leave a question unanswered than to guess. Six points are given for a correct answer, 1.5 points for a blank answer and 0 points for an incorrect answer. If a student can reduce the problem to three possible answers, it is advantageous to guess one of the three possible answers. If a student can only reduce to 4 possible answers by eliminating 1 of the possibilities, then it is not advantageous to guess.
6. Inform the participants they may not talk or ask any questions during the contest, and they must do their own work.
7. Remind students they have 75 minutes, then tell them to BEGIN. (See page 6 for student disabilities policy)
8. Students who finish the contest early may be dismissed provided they will be under the supervision of a teacher during the remainder of the contest period.
9. You (and other teachers, if there are many participants) should proctor continually as you would for any important contest. Students whose eyes wander should be warned; students caught copying answers or collaborating must be disqualified. Try to provide as quiet an environment as possible.
10. Announce when there are 30 minutes remaining and when there are 5 minutes remaining.
11. When time is up, tell the students to STOP and have them sign their name in the space provided on the Student Answer Form. Collect the Answer Forms as quickly as possible.
12. Please do not grade the answer forms. They are to be sent to the AMC office for grading. Students may circle their answers on the contest booklet. However, the official answers will be the ones blackened on the answer form.
13. Fan the forms, making sure none are stuck together, place the School ID Form on top. There is only one ID FORM to be used with all the AMC 10/AMC 12 answer forms.
14. YOUR SCHOOL'S CEEB NUMBER IS THE NUMBER WRITTEN ON THE FRONT OF THE AMC 10/AMC 12 REPORT ENVELOPE.
15. Complete the Certification Form (only one form is needed)

and place it on top of the School ID Form and answer forms and place all in the Report Envelope. Seal and send it by a **trackable mail service** within 24 hours or as soon as possible after all administrations have taken place.

16. Please affix the proper postage before mailing.
17. Please note: After the Answer Forms have been delivered to the school office to be mailed, you may discuss the contest with your students under the following conditions which take into consideration the fact that there will be schools taking the contest in other locations at different times.
 - a. Inform the students that the contest may not be discussed with anyone outside of your school verbally, via email, phone, text, web, social networking site, copier or media of any type until after the contest period.
 - b. Students may keep the contest booklets and take them home.

III. Eligibility

AMC 12 Eligibility — A student in a program leading to a high school diploma, and under 19.5 years of age on the day of the contest.

AMC 10 Eligibility — A student in a program leading to a high school diploma, and under 17.5 years of age on the day of the contest, and not enrolled in grades 11 or 12 or equivalent.

Please note: students in grades 11 & 12 cannot take the AMC 10. However, students in grades 9 & 10 may choose which contest they take.

International Students & Non-Citizens in USA Schools

US and Canadian Citizens and International Students residing in the United States (with qualifying scores) are eligible to take the USAMO.

Students learning "English as a Second Language" (ESL) may use a book nontechnical dictionary between their native language and English. A student may use the dictionary only the first time that he/she takes the AMC 10/AMC 12. The dictionary must be given to the school contest manager to examine and retain for the 24-hour period preceding the contest. The proctor must announce to other students that the student(s) has/have been given special permission to use the dictionary during the contest.

IV. Team Score Identification

TO RECEIVE OFFICIAL TEAM STATUS AND AWARDS, A SCHOOL MUST HAVE AT LEAST THREE PARTICIPANTS ON A CONTEST DATE. The team score for a school is the sum of its three highest student scores and will be determined by the AMC Office. The score of USA and Canadian teams is used to determine National School awards. In addition, the team score is used to select the top 60 schools to identify teachers who are eligible for the Edyth May Sliffe Award for Distinguished High School Teaching.

V. School Results

The AMC office will send results by email (if available) and first class mail as soon as the answer forms are scored. If you have not received your results from our office within 30 days

after the AMC 10/AMC 12 please contact us to verify that your answer forms were in fact received.

If you would like to receive your results by e-Mail, and have not previously sent us your email address, send a message, including your name, school name, address, and CEEB # to:

hstran@amc.unl.edu

Results are not official until you receive the postal mailed paper copy of your report, and that should be no longer than 30 days after the AMC 10/AMC 12.

Please retain this report for future reference, either in your files or with the student counselor's office. Many students cite these scores on college applications.

VI. Policy Statements

Early Administration

Administration on an earlier date is NEVER permitted and will lead to disqualification. Such an administration would jeopardize the validity of all scores from other participating schools.

Official Administration

The AMC 10-A/AMC 12-A will be given officially on Tuesday February 8, 2011. The AMC 10-B/AMC 12-B will be given officially on Wednesday, February 23, 2011. Only official participants, their school and their teacher are eligible for National Awards. In addition, official participants are eligible for all intramural awards and for participation in the AIME.

Unofficial Administration

If you are unable to give Contest A on Tuesday, February 8, 2011 because:

- a. your school is closed,
- b. your school has an academic conflict,
- c. the class periods have been shortened due to an assembly or other reason,

then you may give the second version of the contests (AMC 10-B/AMC 12-B) on the second official day, Wednesday, February 23, 2011 (See Contest B Registration Form on page 14). You may still take either exam unofficially on later dates, but those contests will not be eligible for state and national awards and will not be eligible for participation in the AIME. Unofficial participants are still eligible for intramural awards. It is important to note that the only days eligible for official participation are the two official Contest days: February 8, and February 23, 2011.

Contest Proctoring

The proctoring of the AMC 10 / AMC 12 contest should be by:

- 1st preference, a math teacher at the school
 - 2nd preference, a teacher or administrator at the school
 - 3rd preference, a college or university teacher of mathematics or a responsible adult who is a math club or team coach, and not related to any of the participants
 - 4th preference, a responsible adult not related to any of the participants such as librarian, clergy, etc.
- The proctoring of the contest must take place in a public building, (E.g. school library, college or university, church, etc.).
 - All students must take the contest at the same time, either

in one group or in separate classrooms and be under the supervision of a proctor.

- The proctor should not be related to any of the participants
- If a parent wishes to help, they can arrange room reservations and set-up, help with student sign-up, provide treats, etc.

One Contest per Date

A student may take only one exam on a given day but can participate on both contest dates if the school registers for both contests. The higher score will be used for individual awards.

Students with Visual or Learning Disabilities

The AMC 10/AMC 12 time limit set by the CAMC for students who are visually impaired or learning disabled is 120 minutes. A teacher or a school administrator may read the questions to the student and mark the answers as directed by the student. The cost of a Braille or Large Print exam is \$11.00 shipping and handling for both the AMC 10 and AMC 12. **They are mailed separately and must be ordered no later than three weeks before the test.**

Sickness and Other Special Situations

A student who is sick or on a field trip on the first contest day may register and take the alternate Contest B on Wednesday, February 23. **YOU MUST REGISTER FOR CONTEST B** if you have not already done so. (see page 14 for a Registration Form).

Questionable Scores

If it is clear to the Contest Manager from personal observation that a student has cheated, then the Manager must disqualify the student. If the Contest Manager receives an accusation of cheating, or obtains other indirect evidence of cheating, then the Manager must hold back the student's paper and immediately report all the facts of the situation to the AMC Director, who in conjunction with the Chair of the CAMC, will determine what to do. **UNDER NO CIRCUMSTANCES** may the school decide on its own to accept a questionable score, nor should a school retest the student in question before receiving instructions from the AMC Office.

Follow-up Inquiries and Reexamination

The results of this contest helps to identify students with unusual mathematical ability. To assure that this purpose is served, the CAMC reserves the right to retest students before deciding whether to grant official status to individual or team scores. Reexamination will be requested when, after an inquiry, there is a reasonable basis to disbelieve a score. Official status will not be granted if a student or school does not agree to a requested retesting.

Policy for Changes

The CAMC may, from time to time, change the program rules, regulations, awards and conditions of participation in whole or in part. Whenever possible you will be notified of these changes ahead of time.

Refund/Credit Policy

If your school is unable to take the contests, please use the materials as practice sets for the next year. Do not return them. **WE CAN NOT GIVE REFUNDS OR CREDITS AFTER THE CONTEST MATERIALS ARE SHIPPED.**

Request for Student Names Policy

The following statement appears on the student answer forms for the AMC 10 and AMC 12:

The American Mathematics Competitions (AMC) receives requests from educational institutions and organizations for the names, addresses and grade levels of high scoring AMC 12 (or AMC 10) students. The optional personal data on ethnic origin and gender is used for recruiting and academic purposes..

Blacken this circle if you give the AMC permission to release this information to these organizations. (Your score will not be affected if you do not blacken the circle.)

Receiving information is an “opt-in” decision for each individual student. The AMC handles requests from institutions and organizations on a case-by-case basis and evaluates each individually for appropriateness. We provide legitimate educational institutions of all levels, both secondary and collegiate/university level, with one-time use of selected names and addresses for postal mailings. We also provide professional and scholarly organizations such as those listed as contributors to the AMC with one-time use of names and addresses for postal mailings, generally for professional or career information. The only information we provide is the name, address, city, state, and zip code necessary for a postal mailing. We do not list individual scores or awards.

VII. AIME Instructions

The 29th annual American Invitational Mathematics Examination (AIME) will be held on Thursday, March 17, 2011 with a second alternate exam given on the alternate date of Wednesday, March 30, 2011. These are the only days the exam may be taken officially. You may give the exam for practice (unofficially), after the official dates. We will be pleased to grade it for you but your students will not be eligible to take the USAMO/USAJMO. The contest is provided free of charge to all those taking the exam on the first date, however those taking the exam on the second alternate date will be charged a processing fee to cover expedited delivery.

AIME Rules for AMC 10/AMC 12

In 2011, the qualification parameters will be slightly relaxed for the American Invitational Mathematics Examination (AIME). For students taking the 2011 AMC 10 contests, we will invite students in the top 2.5% of all scorers or scorers with at least 120 points (whichever is more inclusive) to the AIME. This differs from the values of 1% (or 120 points) which have been in effect since 2004. For students taking the 2011 AMC 12, we will invite students in the top 5% of all scorers or scorers with at least 100 points to the AIME. These AMC 12 qualification values remain at the same level they have been since 2000. This policy guards against the possibility of a particularly difficult examination, one on which the scores are uniformly lower than normal, reducing the number of AIME qualifiers. The requirement is set higher for AMC 10 qualifiers for two reasons:

- First, the AIME can be quite intimidating, and we do not want young students to be discouraged by poor performance on this examination.

- Second, we would like to ensure that any student qualifying for the AIME by virtue of placement on the AMC 10 would likely also qualify for the AIME in subsequent years when taking the AMC 12. It could be very disappointing for a student to be an AIME qualifier in grade 10 but not in subsequent high school years.

By restricting the number of AIME qualifiers from the AMC 10 to the top 2.5%, our plan is to not exclude any very good young students for whom the AIME would be an appropriate experience, but also not put students in a situation where they do not have opportunity to succeed.

AIME School Manager

1. The AMC office will include all materials relating to the examination (including instructions for the exam) with your AMC 10/AMC 12 results.
2. All questions or problems concerning the AIME should be directed to the AMC office (800-527-3690).
3. The AIME is a three-hour examination. Each of its 15 questions requires a three digit integer answer and each correct answer will receive one (1) point.
4. Calculators are not allowed.
5. The AIME Answer Forms are sent directly to the AMC office for grading and processing.
6. Each participating school will receive a report of their results, an AIME solution pamphlet, and a list of students who qualify for the USAMO.
7. All AMC 10/AMC 12 procedures for disqualification, follow-up inquiries and reexamination apply to the AIME as appropriate.
8. If you have students who you feel may qualify for the AIME please order prior year AIME exams and solutions for practice now. This way you will have these practice materials on hand when you receive your AMC 10/AMC 12 results.

Second AIME Testing Date

Situations in which a student may take a second version of the AIME to be held on Wednesday, March 30, 2011, keeping their USAMO eligibility open are:

1. School is closed on March 17 (i.e. spring break, weather).
2. Student is out of school the entire day due to attendance at an academic/school related event.
3. Student is ill and can not attend school on March 17.

There will be a processing fee for the second AIME as follows: 1-10 students = \$25, 11+ students = \$50. We will need your payment before the answer forms can be graded. A special envelope and payment form will be included with your AIME material, if you have AIME qualifiers. All AIME answer forms must arrive in the AMC office by April 2, 2011.

Email requests for the second AIME may be sent to:

AIMEQUAL@AMC.UNL.EDU

or, you can call the AMC office at 1-800-527-3690. Please have your school identification number (CEEB) and charge card information available before calling. E-Mail requests should include the school's CEEB number, and complete mailing address. **Under no circumstances can a student take both AIME's.**

VIII. USAMO/USAJMO Participant Selection

The USA Mathematical Olympiad (USAMO) is a two day, nine-hour, six-question, essay-proof examination. In 2011 we will have slightly revised qualification rules for the USA Mathematical Olympiad and USA Junior Mathematical Olympiad. The goal is to select approximately 500 students total for the two Olympiads, split approximately 270 for the USAMO and 230 for the USAJMO respectively. Selection for the 2011 USA Mathematical Olympiad (USAMO) and 2011 USA Junior Mathematical Olympiad (USAJMO) will be made according to the following rules:

1. U.S. citizens and students residing in the United States and Canada (with qualifying scores) are eligible to take the USAMO and USAJMO.
 2. Selection to the USAMO will be based on the USAMO index which is defined as $\text{AMC 12 Score} + 10 * \text{AIME Score}$. Selection to the USAJMO will be based on the USAJMO index which is defined as $\text{AMC 10 Score} + 10 * \text{AIME Score}$.
 3. Only AMC 12 A or AMC 12 B takers who are U.S. citizens and students residing in the United States and Canada will be eligible for the USAMO.
 4. Only AMC 10 A or AMC 10 B takers who are U.S. citizens and students residing in the United States and Canada will be eligible for the USAJMO. This automatically limits Junior Math Olympiad participation to 10th graders and below. Students who take ONLY the AMC 10 test, whether AMC 10 A or AMC 10 B or both, will NOT be eligible for the USAMO regardless of their score on the AMC 10 or the AIME.
 5. The approximately 260-270 individual students with the top AMC 12 based USAMO indices will be invited to take the USAMO. These indices will be selected from the pool of AMC 12 takers with an AIME score.
 6. The approximately 230-240 individual students with the top AMC 10 based USAMO indices will be invited to take the USAJMO. These indices will be selected from the pool of AMC 10 takers with an AIME score after removing students who also took an AMC 12 test and qualified for the USAMO in rule 4. This means young students MUST take the USAMO if they qualify through an AMC 12 index.
 7. We will select the student with the numerically largest index, whether AMC 10 based USAJMO index or AMC 12 based USAMO index, from each US state not already represented in either the USAMO or the USAJMO. The student will be invited to the USAMO if the numerically highest index in the state is AMC 12 based, and invited to the USAJMO if the index is AMC 10 based.
- More information will be provided in the AIME Teachers'

Manual. You can also visit our website at amc.maa.org/e-exams/e8-usamo/usamo.shtml or amc.maa.org/e-exams/e0-usajmo/usajmo.shtml for more information.

Which Contest Should Young Advanced Students Take?

A student in 10th grade or below who wishes to qualify for the USAMO must take either the AMC 12 A or the AMC 12 B contests in order to be considered for USAMO selection. We recommend that such a student take an AMC 10 contest on one date if possible. A student in 10th grade or below wishing to take the AMC 12 and qualify for the USAMO should have a good problem solving knowledge in advanced algebra, analytic geometry, function notation, logarithms, trigonometry, and complex numbers in order to score well on the AMC 12, AIME and USAMO. The student must also be prepared to compete with 11th and 12th grade students on an equal basis since USAMO qualification is based on score only with no consideration for grade in school.

The minimum USAMO qualifying index for the last years have been:

2010.....	208.5....	277 students
2009.....	201.5....	514 students
2008.....	204.0....	503 students
2007.....	197.5....	505 students
2006.....	217.....	432 students

We recommend students aim for an AMC 12 based index of at least 210 in order to qualify for the USAMO.

Based on the single year experience of 2010, we recommend students aim for an AMC 10 based index of at least 200 in order to qualify for the USAJMO.

Exact invitation levels will vary each year depending on the difficulty of the contests and the pool of participating students. The historical minimum qualifying scores here are for planning purposes only and do not necessarily indicate future qualifying scores.

IX. The MOSP Program

The Mathematical Olympiad Summer Program (MOSP) is a 3-week, academic challenge designed to broaden participants' view of mathematics while fostering excitement toward further math study. It is held each year at the University of Nebraska-Lincoln in June-July. Invited students include the top 12 USAMO winners, 12-18 high-scoring USAMO participants, who are current juniors and below, and an additional 25 USAMO/USAJMO participants, grant funding permitting. Watch for further details to be announced in the 2011 AIME/USAMO Teachers' Manual and on the AMC website at amc.maa.org.

X. Regions of the AMC 10/AMC 12

The USA and Canada are partitioned into the following regions. National Awards are given to a minimum of 10 high scoring students and 5 schools (based on the team score) in

each of these regions.

Region

- 0 Connecticut, Maine, Massachusetts, New Hampshire, Pennsylvania, Rhode Island, Vermont
- 1 New Jersey, New York
- 2 Delaware, District of Columbia, Maryland, North Carolina, South Carolina, Virginia, West Virginia
- 3 Alabama, American Embassy and APO/FPO Schools, Florida, Georgia, Puerto Rico, Virgin Islands
- 4 Indiana, Michigan, Ohio
- 5 Arkansas, Iowa, Kansas, Minnesota, Nebraska, North Dakota, Oklahoma, South Dakota, Wisconsin
- 6 Illinois, Kentucky, Missouri, Tennessee
- 7 Louisiana, Mississippi, Texas
- 8 Alaska, Arizona, Colorado, Guam, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming
- 9 California
- 10 Canada

XI. Intramural and National Awards

Intramural Awards for Students

The AMC Office will send you Intramural awards, along with your school results. Your registration fee entitles you to pins, medals, and certificates. An order form for additional intramural awards will be included with your results. Committee and Donor Awards will be sent later.

1. **AMC 10 & AMC 12 School Winner Pin** — For each school making a report on three or more students the Mathematics Award Pin is awarded to the student with the highest score.
2. **AMC 10 & AMC 12 Honor Roll of Distinction Pin** — The Honor Roll of Distinction Pin is awarded to the top 1% of all participating students.
3. **Gold Medal** — The Gold Medal is awarded to participants who place first in their respective school for four consecutive years.
4. **Silver and Bronze Medals** — These medals are awarded to participants who place first in their school for three and two consecutive years, respectively.
5. **AMC 10/12 Certificate of Distinction** — A Certificate of Distinction is awarded to those students who qualify to take the American Invitational Mathematics Examination (AIME).
6. **AMC 12 Certificate of Achievement** — Awarded to students in grade 10 and below who score a 90 or above on the AMC 12 contest.
7. **AMC 10 Certificate of Achievement** — Awarded to students in grade 8 and below who score a 90 or above on the AMC 10 contest.
8. **School Certificate of Honor** — Awarded to schools with a team score of 400 or greater on the AMC 12 only.
9. **School Certificate of Merit** — Awarded to schools with a team score between 300 and 399 on the AMC 12 only.

Committee and Donor Awards for Students

All committee and donor awards are based on the AMC 12 scores.

1. **Large Plaque** — A large plaque, donated by the Committee on the American Mathematics Competitions, is awarded to each student with a perfect score.
2. **Small Plaque** — A small plaque, donated by the Committee on the American Mathematics Competitions, is awarded to the student with the highest score in each region in which there was no perfect score.
3. **Mathematics Magazine*** — A one-year subscription to the *Mathematics Magazine*, donated by the Committee of the American Mathematics Competitions, is awarded to a maximum of four participants with high score in each of the eleven regions.
4. **NCTM Book*** — A book, donated by the National Council of Teachers of Mathematics, is awarded to three high-scoring participants in each of the eleven regions.
5. **Mu Alpha Theta Book*** — A book, donated by Mu Alpha Theta, is awarded to one participant with a high score in each of the eleven regions.
6. **AMATYC Review*** — A one-year subscription to the *American Mathematical Association of Two-Year Colleges Review* is awarded to one student in each of the eleven regions.
7. **CAMC Problem Book** — One *Problem Book* donated by The American Mathematics Competitions, is awarded to the top-scoring student in grade 9 or less in each of the eleven regions.

National School Awards

The AMC divides the United States and Canada into eleven regions. In each of these regions the five schools with the highest team scores (sum of the highest three scores by participants) are recognized by Donor or Committee Awards.

1. **Charles T. Salkind Memorial Silver Cup** — This silver cup, is awarded to the school with the highest team score (in any region).
2. **William H. Fagerstrom Memorial Silver Cup** — This silver cup is awarded to the school with the second highest team score (in any region).
3. **Committee Bronze Cups** — In each of the regions in which a silver cup is not awarded the Committee on the American Mathematics Competitions provides a Bronze Cup to the school with the highest team score.

Awards for Schools not Receiving a Cup

4. **CAMC Mathematics Books*** — In each of the eleven regions, five books are donated by the Committee on the American Mathematics Competitions to one school having a high team score.
5. **W. H. Freeman Books*** — In each of the eleven regions, a set of books, donated by W.H. Freeman and Company, San Francisco is awarded to one school having a high team score.
6. **Mathematics Magazine*** — In each of the eleven regions, a one-year subscription is donated by the Committee on the American Mathematics Competitions to one or more schools having a high team score.

XII. Contest A Certification

The AMC 10 and AMC 12 must be administered by a teacher or an adult not related to any of the participants. The administration of the contest must take place in a public building (e.g. school, library, church). Please send all Answer Forms from your school or group at one time.

The Contest Manager and the Principal, Vice Principal, or Headmaster must sign this form which is to be returned with your student Answer Forms.

Certification by the Contest Manager:

I certify that the following statements are true or that, if there are any exceptions, I have checked the box at the bottom of this page and have listed them on a separate page. I understand that the absence of either signature from this form, and a consideration of the exceptions may result in DISQUALIFICATION of all scores from our school.

1. I certify that the exam package(s) were retained in their sealed condition within an hour of the start of the contest.
2. I accept for our school the rules and procedures described on this page and pages 4-7, and accept that failure to follow these rules and procedures may result in DISQUALIFICATION from official standing of all scores from our school.
3. The contest was held on Tuesday, February 8, 2011.
4. The AMC 10A / AMC 12A were given at the same time.
5. The participants were continually monitored during the contest, and they were separated by an empty space, if possible.
6. No aids were permitted other than scratch paper, graph paper, ruler, compass, and protractor. NO CALCULATORS WERE USED - (see Section I. Item 4).
7. Participants had exactly 75 minutes working time. (See page 6 for Student Disabilities Policy)
8. No students were permitted to proctor or grade the contest.
9. The instructions relating to the opening of the "Complimentary Solutions Envelope" and/or Solution Packets were followed.
10. After the contest, the answer forms were kept secure and no changes were made in the answers.
11. No parent assisted in the administration of the contest.
12. I have followed all the rules as stated in this Teachers' Manual.

Signature _____ E-mail (please print) _____

Day & Date Test was given _____

Name of School _____

City _____ State/Province _____

Telephone (_____) _____ School CEEB Number _____

Certification by the Principal, official or person of comparable title:

I agree that the Contest Manager followed all the rules and procedures listed above.

Signature _____ Date _____

Title _____

PLEASE INDICATE THE EXACT NUMBER OF AMC 10A /AMC 12A ANSWER FORMS RETURNED FOR GRADING. _____

EXCEPTIONS

Questionnaire to Help Us Serve You Better

Thank you in advance for taking the time to answer these questions for us. Answer to the best of your ability, and if you don't know, just give us a "best estimate". Please fill in your answers in the ovals provided on the back of the school ID form. Thank you!

1. **Rate the difficulty of the AMC 10 and AMC 12 problems 1-15 compared to the difficulty of your mathematics curriculum (for 9th & 10th grade curricula for the AMC 10, and 11th & 12th grade curricula for the AMC 12)**
0) much easier 1) easier 2) about the same 3) harder 4) much harder 5) N/A
2. **What are the obstacles in your school to offering the AMC 10 and/or AMC 12? Mark all that apply:**
0) cost 1) paperwork/purchase order 2) scheduling 3) duration of contest 4) finding location 5) other
3. **How do you fund the purchase of the AMC contests?**
0) teacher discretionary fund 1) dept. discretionary fund 2) PTA/PTO funds 3) regular budget item
4) student contributions/fees 5) other
4. **How did you register for the AMC contests?**
0) mailed paper registration 1) faxed paper registration 2) online registration 3) phone
5. **If you did not register online for the AMC contests the reason was, (Mark all that apply):**
0) School/district policies prohibit registering online 1) Don't have access to school purchasing card
2) Don't have access to web during the school day 3) Need approval from school official to register
4) online form is too confusing 5) other
6. **Who or what do you rely on for information about activities or competitions your school can participate in? (mark all that apply)**
0) student/parent 1) administrators 2) my own research 3) emails 4) direct postal mail 5) word of mouth
7. **How did you find out about the American Mathematics Competitions?**
0) Student/Parent 1) Fellow teacher 2) Administrator
3) Direct email 4) Direct postal mail 5) Our school has historically participated
8. **How do you prefer to receive information about the American Mathematics Competitions and its contests? (mark all that apply)**
0) Email 1) Postal mail 2) I prefer to go to the website myself
9. **Do you use any of the following social networking sites to keep updated on topics important to you? (mark all that apply)**
0) Facebook 1) Myspace 2) Twitter 3) Blogs/Wordpress 4) LinkedIn 5) None
10. **How many math contests does your school participate in during the school year?**
0) just the AMC 1) two 2) three 3) four 4) five 5) more than 5

XIII. Additional Forms used - (if the form you need is not here, please see our web site)

Additional Bundles Form

Please fill in the information below and FAX your order. The administrator or authorized person of the school agrees to pay the American Mathematics Competitions for the following materials:

School Name _____ CEEB # _____

Address _____

City _____ State _____ Zip _____

Teacher placing the order _____ Email _____

AMC 10 Contest A Bundles of ten # _____ @ \$16/bundle =\$ _____
 A Solutions Sets of ten (optional) # _____ @ \$ 6/set =\$ _____

AMC 12 Contest A Bundles of ten # _____ @ \$16/bundle =\$ _____
 A Solutions Sets of ten (optional) # _____ @ \$ 6/set =\$ _____

To order either the 2010-2011 AMC 10/12 Math Club Package or the 21st Century CD with pdf's of all contests 2001-2009, download the Publications Order Form from the AMC website at amc.maa.org/

Postage/handling Fee (see chart below)\$ _____

Total..... \$ _____

P.O. Number _____ VISA/MC# : _____

Name (Please Print): _____

Address: _____

Exp. Date: _____

AMC ORDERING -- TERMS

1. VISA & MasterCard accepted.

FAX: 402-472-6087 or PHONE: 800-527-3690

2. Make checks payable to:

AMERICAN MATHEMATICS COMPETITIONS

3. PAYMENT IN U.S. FUNDS ONLY.

Please Send Your Order To:

4. U.S.A.:	<u>Order TOTAL</u>	<u>Shipping Charge*</u>
	\$10.00 -- \$40.00	\$7.00
	\$40.01 -- \$50.00	\$9.00
	\$50.01 -- \$75.00	\$12.00
	\$75.01 -- UP	\$15.00

American Mathematics Competitions

ATTN: AMC 10/12 Additional Bundles

P.O. Box 81606

Lincoln, NE 68501-1606

5. OUTSIDE USA: Add additional \$10 to the above USA shipping costs.

*Orders after February 1st add \$10.00 additional for 1-day Service.

Proof of Intent to Pay

This document is intended to be used in lieu of pre-payment when calling or faxing in an order. Please indicate if you wish to be billed or will be sending a "check in the mail" (to be received within 2 weeks of order or you will be billed). Mail orders not wishing to be billed should include a check when returning this form. The person who signs this form must be authorized to pay the order that is placed by the teacher.

BILLED

Name of Person Authorized to Pay (please print): _____

Signature: _____

Title: _____

Date: _____

Rescoring Request Form

I would like to have the following student's answer form rescored. I understand that there is a \$10.00 charge for each student answer form rescored

\$ 10.00/each

Student Name _____ \$ _____
Circle contest taken: AMC 10-A AMC 10-B AMC12-A AMC12-B AIME I AIME II

Student Name _____ \$ _____
Circle contest taken: AMC 10-A AMC 10-B AMC12-A AMC12-B AIME I AIME II

Grand Total _____ \$ _____

Teacher's Name _____ CEEB # _____

School Name _____

Address _____

City _____ State _____ Zip _____

Email _____ Fax _____

Method of Payment:

Check (US funds only) made payable and mailed with this form to the:

AMERICAN MATHEMATICS COMPETITIONS

University of Nebraska-Lincoln

P.O. Box 81606

Lincoln, NE 68501-1606

Charge to Visa/Mastercard#: _____

Name on card (print): _____

Signed _____

Expiration Date: _____ Telephone: _____

FAX to: 402/472-6087



2011 AMC 10/12 Registration Form

MAA American Mathematics Competitions 10/12 B

February 23, 2011



CEEB#: PLEASE PRINT CLEARLY

Teacher/Contest Manager: _____

School: _____

School street address: _____
Please note: We cannot ship to PO Boxes.

City: _____ State: _____ Zip: _____

School phone #: (____) _____ Email for results: _____

Home School Proctor: _____

Proctor address: _____
Please note: We cannot ship to PO Boxes or residential addresses.

City: _____ State: _____ Zip: _____

Email: _____

Type of school: College/University High School Middle School Home School/Learning Center

Step 1

Pick Registration shipping by current date. If you are in Canada, U.S. non-adjacent, or International, please include additional shipping below. Base fee covers 10B/12B Registration and U.S. contiguous 48 states shipping.

Registration & Express Shipping \$50.00
(Postmarked by February 2, 2011)

Registration & Expedited Shipping \$60.00
(Postmarked Feb. 3–Feb. 16, 2011)

U.S. Registration Subtotal..... \$ _____

Step 2

Add extra shipping if not in U.S. contiguous 48 states. This is in ADDITION to the Registration & Shipping shown above. Must be ordered 2 weeks prior to exam to ensure delivery.

Canada, Alaska, Guam, Hawaii, Puerto Rico
 Add \$10.00

International Schools Additional (\$105.00 max)
 # Exam Bundles _____ x \$7.00/Bundle

Step 3

Indicate your selection of contests (and solutions). There are 10 contests per bundle and each bundle costs \$16.00. To order Braille or large print contests, email us at amcinfo@maa.org before January 17, 2011.

AMC 10B

English 10B contests# of bundles _____
 Spanish 10B contests# of bundles _____
 French 10B contests# of bundles _____

AMC 12B

English 12B contests# of bundles _____
 Spanish 12B contests# of bundles _____
 French 12B contests# of bundles _____

Subtotal (\$16 per bundle of contests)..... \$ _____

Solutions

Solutions 10B (English only).....# of bundles _____
 Solutions 12B (English only).....# of bundles _____

Subtotal (\$6 per set of solutions)..... \$ _____

Subtotal for all contests & solutions\$ _____

PAYMENT OPTIONS

TERMS: Payment is accepted in U.S. FUNDS ONLY. Payments submitted without completed registration form cannot be processed and will be returned.

Check (Make checks payable to: American Mathematics Competitions)

P.O. #: _____

Billing Address: _____
Purchase order billing address, if different from school.

City: _____ State: _____ Zip: _____

VISA or MasterCard (circle one) Expiration date: _____

#:

Print name on card: _____

Signature: _____

Step 4

Order our Math Club Package and help your students prepare for the exam! Includes study guide, CD, web materials, and more. Available in the Fall of 2010.

AMC 10/12 Math Club Package

Add \$25.00 within the contiguous U.S. 48 states \$ _____

Additional shipping required for International/overseas addresses, please contact the AMC office at amcinfo@maa.org for more information.

Step 5

Add sub-totals for steps 1, 2, 3 and 4.

Order GRAND TOTAL \$ _____

Must be paid in U.S. Funds. All orders are **Non-Refundable** once shipped. Mail along with your payment or Purchase Order to:

MAA American Mathematics Competitions
 ATTN: AMC 10/12 Registration
 PO Box 81606
 Lincoln, NE 68501-1606

American Mathematics Competitions

Fax 402-472-6087

Call 1-800-527-3690 • Website amc.maa.org • Email amcinfo@maa.org

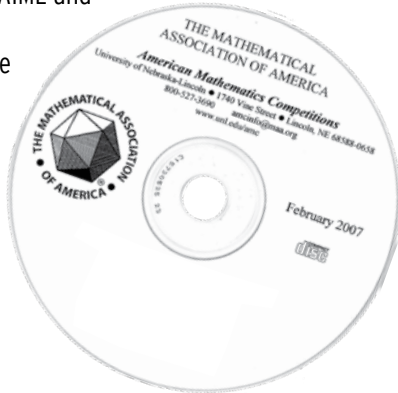
The Mathematical Association of America American Mathematics Competitions

NEW this year CD's with all the Contests – \$20 each

1. AJHSME & AMC 8 (1985-2007) + worksheets (1999-2007)
2. AHSME 1 (1950-1974)
3. AHSME 2 (1975-1999)

OR . . . Buy the Math Club Package! – \$25 each

Tips and ideas for High School - use with your Math Club or Circle, or with students in class. Includes 50 new question worksheets and an appendix on "Elusive Formulas" Contains a CD of the AMC contests for the last 10 years of AMC 8, AMC 10, and AMC 12 and for the AIME and USAMO from 2001. The CD also includes problem worksheets we have developed thus far from the questions, from the AMC 8 and the AMC 10 and AMC 12.



front

back



back of black shirt

NEW!!

MAA AMC T-Shirt – \$15 each

Choose from a black t-shirt with the theme, "6 Decades of the American Mathematics Competitions." Design on back, logo on front left chest; or choose a light blue t-shirt featuring the new MAA logo. Design on front chest and upper back.

Men's sizes available: Small, Medium, Large and X-Large. Quantities are limited in black.

- CD-AJHSME/AMC 8 1985-2007# ___ @ \$20/ea=\$ _____
- CD-AHSME 1, 1950-1974, contests & solutions# ___ @ \$20/ea=\$ _____
- CD-AHSME 2, 1975-1999, contests & solutions# ___ @ \$20/ea=\$ _____
- CD-AIME, 1983-2008 + USAMO, 1972-2008.....# ___ @ \$20/ea=\$ _____
- MAA AMC T-Shirt# ___ @ \$15/ea=\$ _____
- Men's sizes: Small ___ Medium ___ Large ___ X-Large ___
- Colors: Black ___ Light Blue ___
- AMC 8 Math Club Package w/ decade CD# ___ @ \$25/ea = \$ _____
- AMC 10/12 Math Club Package w/ decade CD# ___ @ \$25/ea = \$ _____
- TOTAL (Minimum order \$10)**.....\$ _____
- Postage & Handling (See TERMS below)**.....\$ _____
- GRAND TOTAL**.....\$ _____

PAYABLE in U.S. Funds ONLY
ALLOW 2-3 WEEKS FOR DELIVERY

MAA AMC Ordering – TERMS

1. Minimum order \$10 is required.
2. VISA and MasterCard accepted.
3. Make checks payable to: AMERICAN MATHEMATICS COMPETITIONS
4. PAYMENT IN U.S. FUNDS ONLY.
5. **U.S. contiguous 48 states only:** There is no additional fee for shipping.
6. **All other including Canadian & International Orders:**
Additional shipping required for International/overseas addresses, please contact the AMC office at amcinfo@maa.org for more information.
7. Purchase Orders, and checks in U.S. funds will also be accepted.
8. Prices good until September 1, 2011.
9. Please allow 2-3 weeks for delivery.

FAX: 402-472-6087

Please fax or send your order to:
MAA American Mathematics Competitions
ATTN: AMC Publications
PO Box 81606
Lincoln, NE 68501-1606

Shipping Address

PLEASE FILL IN ALL THE INFORMATION

If other than a school, please strike out school and any other irrelevant headers and fill in the name, and ship-to address.

(Please Print)

Name: _____

School Name: _____

Street Address: _____

City: _____ State: _____ Zip: _____

Phone #: _____ (_____) _____

E-mail address: _____

CHARGE INFORMATION:

Card Name (Print): _____

VISA/MC #: _____

Exp. Date: _____

E-mail address: _____

Address: _____

For additional publications please visit the MAA online store
<https://www.maa.org/EbusPPRO/>

XIV. Classroom Accessories

Publicity

The sample Contest Announcement news release below, should be prepared and distributed to the newspapers, radio and television stations in your region. To make preparation of the news release easier, visit our web site, and download the text from the on-line copy of the AMC 10/12 Teachers' Manual. See the AMC website, or the 2010 Summary of Results for statistics and figures from the 2010 contest. Statistics and figures for the 2011 Contest will be available on our website in March 2011.

(School or School District)
FOR IMMEDIATE RELEASE

(School) STUDENTS PARTICIPATE IN NATIONAL MATHEMATICS COMPETITION

(#) students at (School) participated in the 62nd annual American Mathematics Contest 12, and/or the 12th annual American Mathematics Contest 10. The contests were held on Tuesday, February 8, 2011 (or Wednesday, February 23, 2011). The students competed for local, regional and national student and school awards. The contest, which covers high school mathematics, is given in participating schools. Its purpose is to spur interest in mathematics and develop talent through the excitement of friendly competition at problem solving in a timed format. In 2010 over 220,000 students from 4,200 schools participated in the AMC 10 & AMC 12 contest including (#) students from (#) schools in (State). Top scorers at (school) were (_____, _____, etc.).

According to Prof. Steven Dunbar, who serves as Director of the American Mathematics Competitions, the AMC 12 (first offered in 1950), and the AMC 10 (first offered in 2000), are part of a series of contests sponsored each year by The Mathematical Association of America, through their program, the American Mathematics Competitions. The AMC offers the only math competition series in the country leading to the United States of America Mathematical Olympiad (USAMO) and the Mathematical Olympiad Summer Program (MOSP). From this group of students, the AMC sends the highly competitive USA Team to the prestigious annual International Mathematical Olympiad.

The AMC program includes :

American Mathematics Contest 8 (AMC8)	Grades 6- 8	November
American Mathematics Contest 10 (AMC 10)	Grades 10 & below	2 dates in February
American Mathematics Contest 12 (AMC 12)	Grades 12 & below	2 dates in February
American Invitational Mathematics Examination (AIME)	All who qualify	2 dates in March-April
USA Mathematical Olympiad (USAMO)	All who qualify	late-April
Mathematical Olympiad Summer Program (MOSP)	Qualify thru USAMO	June
International Mathematical Olympiad (IMO)	Top six from USAMO, MOSP	July

The AMC is located at the University of Nebraska - Lincoln. and receives support from the Akamai Foundation, Academy of Applied Sciences, American Mathematical Association of Two Year Colleges, American Mathematical Society, American Statistical Association, Art of Problem Solving, Awesome Math, Canada/USA Mathcamp, Casualty Actuarial Society, IDEA Math, Institute for Operations, Research and the Management Sciences, Jane Street, MathPath, Math Zoom Academy, Mu Alpha Theta, National Council of Teachers of Mathematics, Pi Mu Epsilon, Society of Actuaries, USA Math Talent Search, W. H. Freeman and Company. The Contests are given across the U.S.A, Canada, and in many schools abroad.

Details concerning the 2011 AMC 10/12 contests for High School, as well as the rest of AMC's programs are available on the AMC web site: amc.maa.org/.

For further information contact the AMC -- email: amcinfo@maa.org, telephone: 800-527-3690.



American Mathematics Competitions

February, 2011

Dear Parent or Guardian:

On February 8, 2011 and/or February 23, 2011 your son or daughter will participate in the 62nd annual American Mathematics Competitions contest. This contest has grown from a single city-wide competition in New York City in 1950, organized by the local section of The Mathematical Association of America to a sequence of contests. In 2010, over 220,000 students from over 4,200 US and international schools competed for school, regional, and national awards in this contest and found it fun and rewarding. Top 10, well-known U.S. universities and colleges, including internationally recognized U.S. technical institutions, ask for AMC scores on their application forms. Your students deserve the chance to list these scores on their applications!

Each year the AMC 10 and AMC 12 are on the **National Association of Secondary School Principals Advisory List of Contests and Activities**. The AMC Contests are sponsored by the Mathematical Association of America, and are considered to be such a valuable stimulus to student interest in mathematics that 21 professional societies and organizations, including the National Council of Teachers of Mathematics and those represented below, support the contests with financial contributions.



DE Shaw & Co



With these contests, there are awards in each school for the student with the highest score, certificates for high-scoring students in each school, state-wide awards, regional awards, and even national awards. These contests lead to other more selective math contests, even all the way to the USA team sent to the International Mathematical Olympiad, the premier international high school level problem solving contest.

But the real rewards come from challenging each student with mathematics that is new, different, and “outside of the box.” The problems on the contest are hard, but designed to be within reach. Just by participating in the contest your student should still feel accomplishment, because these problems are meant to be more challenging than routinely encountered in mathematics courses.

Mathematics is increasingly important in our technological and scientific age. Taking enough mathematics in high school is the gateway to jobs and careers of all kinds, even those that are not explicitly mathematical, scientific, or technological. We hope that by offering these contests, we can challenge and inspire students to learn more mathematics. We hope that your son or daughter enjoyed the contests, and will continue to take mathematics courses and competitions in high school and beyond.

Sincerely,

Dr. Steven R. Dunbar
AMC Director



MAA

MATHEMATICAL ASSOCIATION OF AMERICA

American Mathematics Competitions

Participate in the 2011

AMC 10 and the

AMC 12 Contests!

Tuesday, February 8, 2011 and/or

Wednesday, February 23, 2011

Practice Materials
can be found at:
amc.maa.org

For more information, contact:





American Mathematics Competitions
CERTIFICATE

Awarded to

for participating in the

American Mathematics Contest 10
(AMC 10)

Steven R. Dunbar

Steven R. Dunbar, Director
American Mathematics Competitions

2011

LeRoy Wenstrom

LeRoy Wenstrom, Chair
AMC 10 Subcommittee



American Mathematics Competitions
CERTIFICATE

Awarded to

for participating in the

American Mathematics Contest 10
(AMC 10)

Steven R. Dunbar

Steven R. Dunbar, Director
American Mathematics Competitions

2011

LeRoy Wenstrom

LeRoy Wenstrom, Chair
AMC 10 Subcommittee



American Mathematics Competitions
CERTIFICATE

Awarded to

for participating in the
American Mathematics Contest 12
(AMC 12)

Steven R. Dunbar

Steven R. Dunbar, Director
American Mathematics Competitions

2011

Bernardo Ábrego

Bernardo Ábrego, Chair
AMC 12 Subcommittee



American Mathematics Competitions
CERTIFICATE

Awarded to

for participating in the
American Mathematics Contest 12
(AMC 12)

Steven R. Dunbar

Steven R. Dunbar, Director
American Mathematics Competitions

2011

Bernardo Ábrego

Bernardo Ábrego, Chair
AMC 12 Subcommittee

Facsimile of AMC 10 Front Cover

Tuesday, FEBRUARY 8, 2011



MAA

MATHEMATICAL ASSOCIATION OF AMERICA

American Mathematics Competitions

12th Annual

AMC 10 A

American Mathematics Contest 10 A

Tuesday, February 8, 2011

INSTRUCTIONS

1. DO NOT OPEN THIS BOOKLET UNTIL YOUR PROCTOR TELLS YOU.
2. This is a twenty-five question multiple choice test. Each question is followed by answers marked A, B, C, D and E. Only one of these is correct.
3. Mark your answer to each problem on the AMC 10 Answer Form with a #2 pencil. Check the blackened circles for accuracy and erase errors and stray marks completely. Only answers properly marked on the answer form will be graded.
4. SCORING: You will receive 6 points for each correct answer, 1.5 points for each problem left unanswered, and 0 points for each incorrect answer.
5. No aids are permitted other than scratch paper, graph paper, rulers, compass, protractors, and erasers. No calculators are allowed. No problems on the test will *require* the use of a calculator.
6. Figures are not necessarily drawn to scale.
7. Before beginning the test, your proctor will ask you to record certain information on the answer form.
8. When your proctor gives the signal, begin working on the problems. You will have **75 minutes** to complete the test.
9. When you finish the exam, *sign your name* in the space provided on the Answer Form.

The Committee on the American Mathematics Competitions (CAMC) reserves the right to re-examine students before deciding whether to grant official status to their scores. The CAMC also reserves the right to disqualify all scores from a school if it is determined that the required security procedures were not followed.


Students who score 120 or above or finish in the top 2.5% on this AMC 10 will be invited to take the 29th annual American Invitational Mathematics Examination (AIME) on Thursday, March 17, 2011 or Wednesday, March 30, 2011. More details about the AIME and other information are on the back page of this test booklet.

The publication, reproduction or communication of the problems or solutions of the AMC 10 during the period when students are eligible to participate seriously jeopardizes the integrity of the results. Dissemination via copier, telephone, e-mail, World Wide Web or media of any type during this period is a violation of the competition rules. After the contest period, permission to make copies of problems in paper or electronic form including posting on web-pages for educational use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear the copyright notice.

© 2011 Mathematical Association of America

Facsimile of AMC 12 Front Cover

Tuesday, FEBRUARY 8, 2011




MAA
MATHEMATICAL ASSOCIATION OF AMERICA

American Mathematics Competitions

62nd Annual

AMC 12 A

American Mathematics Contest 12 A
Tuesday, February 8, 2011



INSTRUCTIONS

1. DO NOT OPEN THIS BOOKLET UNTIL YOUR PROCTOR TELLS YOU.
2. This is a twenty-five question multiple choice test. Each question is followed by answers marked A, B, C, D and E. Only one of these is correct.
3. Mark your answer to each problem on the AMC 12 Answer Form with a #2 pencil. Check the blackened circles for accuracy and erase errors and stray marks completely. Only answers properly marked on the answer form will be graded.
4. SCORING: You will receive 6 points for each correct answer, 1.5 points for each problem left unanswered, and 0 points for each incorrect answer.
5. No aids are permitted other than scratch paper, graph paper, rulers, compass, protractors, and erasers. No calculators are allowed. No problems on the test will *require* the use of a calculator.
6. Figures are not necessarily drawn to scale.
7. Before beginning the test, your proctor will ask you to record certain information on the answer form.
8. When your proctor gives the signal, begin working on the problems. You will have **75 minutes** to complete the test.
9. When you finish the exam, *sign your name* in the space provided on the Answer Form.

The Committee on the American Mathematics Competitions (CAMC) reserves the right to re-examine students before deciding whether to grant official status to their scores. The CAMC also reserves the right to disqualify all scores from a school if it is determined that the required security procedures were not followed.

Students who score 100 or above or finish in the top 5% on this AMC 12 will be invited to take the 29th annual American Invitational Mathematics Examination (AIME) on Thursday, March 17, 2011 or Wednesday, March 30, 2011. More details about the AIME and other information are on the back page of this test booklet.

The publication, reproduction or communication of the problems or solutions of the AMC 10 during the period when students are eligible to participate seriously jeopardizes the integrity of the results. Dissemination via copier, telephone, e-mail, World Wide Web or media of any type during this period is a violation of the competition rules. After the contest period, permission to make copies of problems in paper or electronic form including posting on web-pages for educational use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear the copyright notice.

© 2011 Mathematical Association of America

AMC 10 Student Practice Questions

You will find these and additional problems for the AMC 10 and AMC 12 on AMC's web site: amc.maa.org, available from the current and previous AMC 10/12 Teacher Manuals, amc.maa.org/amc/e-exams/e6-amc12/archive12.shtml or from our Problems page archives (amc.maa.org/amc/a-activities/a7-problems/problem81012archive.shtml).

A ferry boat shuttles tourists to an island every hour starting at 9 AM until its last trip starting at 3 PM. One day the boat captain notes that on the 9 AM trip there were 100 tourists on the ferry boat, and that on each successive trip, the number of tourists was 1 fewer than on the previous trip. How many tourists did the ferry take to the island that day?

- (A) 585 (B) 594 (C) 672 (D) 679 (E) 694

2010 AMC 10 A, Problem #3—

2010 AMC 12 A, Problem #2—

“The ferry boat makes 7 trips to the island everyday.”

Solution

Answer (D): The ferry boat makes 7 trips to the island. The number of tourists shuttled was

$$\begin{aligned} 100 + (100 - 1) + (100 - 2) + (100 - 3) + (100 - 4) + (100 - 5) + (100 - 6) \\ = 7 \cdot 100 - (1 + 2 + 3 + 4 + 5 + 6) \\ = 700 - 21 \\ = 679. \end{aligned}$$

Difficulty: Easy

NCTM Standard: Number and Operations Standard for Grades 9–12: compute fluently and make reasonable estimates.

Point $A = (4, 3)$ is rotated counterclockwise 90° around the origin to point A' . The point A' is reflected across the x -axis to point A'' . What is the distance between A and A'' ?

- (A) $\sqrt{2}$ (B) 8 (C) $7\sqrt{2}$ (D) 10 (E) 14

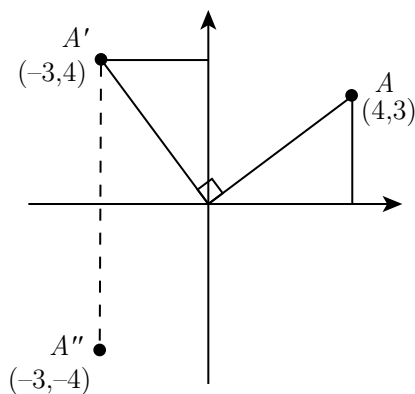
2010 AMC 10 A, Problem #6—

“Visualize the transformations by drawing.”

Solution

Answer (C): The figure shows that $A' = (-3, 4)$ and $A'' = (-3, -4)$. The distance between A and A'' is

$$\sqrt{(4 - (-3))^2 + (3 - (-4))^2} = \sqrt{7^2 + 7^2} = 7\sqrt{2}.$$



Difficulty: Medium-easy

NCTM Standard: Geometry Standard for Grades 9–12: apply transformations and use symmetry to analyze mathematical situations.

AMC 10 Student Practice Questions continued

In a certain town bicycle license plates are to have 3 different letters, each letter chosen from A through F , followed by 3 different digits, each digit chosen from 1 through 6. The letters will appear in alphabetical order and the digits in numerical order. For example, $ACE236$ is allowed and $ADB124$ is not allowed. How many such license plates are possible?

- (A) 36 (B) 72 (C) 120 (D) 240 (E) 400

2010 AMC 10 A, Problem #13—

“There are $\binom{6}{3} = 20$ letter combinations to choose from.”

Solution

Answer (E): There are

$$\binom{6}{3} = \frac{6 \cdot 5 \cdot 4}{3 \cdot 2 \cdot 1} = 20$$

letter combinations to choose from, and each particular choice results in exactly one possible configuration for the letters in a license plate. Similarly, there are $\binom{6}{3} = 20$ possible configurations for the digits. Hence there are $20 \cdot 20 = 400$ possible license plates.

Difficulty: Medium

NCTM Standard: Algebra Standard for Grades 9–12: understand relations and functions and select, convert flexibly among, and use various representations for them.

Three children have a foot race in which the leader after 1 minute is declared the winner. Each child runs at a constant speed. At the end of the minute, Alicia has run 720 feet. Ben, who started 40 feet in front of Alicia, has run 600 feet from his starting point. Cheryl, who started 40 feet in front of Ben, has run 400 feet from her starting point. For how many seconds during the race was Ben in the lead?

- (A) 8 (B) 10 (C) 12 (D) 15 (E) 20

2010 AMC 10 A, Problem #16—

2010 AMC 12 A, Problem #9—

“Use inequalities to represent the relationships.”

Solution

Answer (A): The distance of Alicia, Ben, and Cheryl from Alicia's starting point after t minutes are, respectively, $720t$, $40 + 600t$, and $80 + 400t$ feet. For Ben to be in the lead we must have

$$40 + 600t > 720t \quad \text{and} \quad 40 + 600t > 80 + 400t.$$

These inequalities are equivalent to

$$40 > 120t \quad \text{and} \quad 200t > 40$$

or

$$\frac{1}{3} > t \quad \text{and} \quad t > \frac{1}{5}.$$

Therefore Ben is in the lead when $\frac{1}{3} > t > \frac{1}{5}$, a time interval of $\frac{1}{3} - \frac{1}{5} = \frac{2}{15}$ minutes, or $\frac{2}{15} \cdot 60 = 8$ seconds.

Difficulty: Medium-hard

NCTM Standard: Algebra Standard for Grades 9–12: write equivalent forms of equations, inequalities, and systems of equations and solve them with fluency-mentally or with paper and pencil in simple cases and using technology in all cases.

Suppose that $ABCD$ is a square, M is the midpoint of \overline{AB} , and E is the intersection of \overline{CM} and \overline{BD} . What is $\frac{EB}{EM}$?

- (A) 1 (B) $\frac{5}{4}$ (C) $\frac{2\sqrt{10}}{5}$ (D) $\frac{\sqrt{15}}{3}$ (E) $\frac{4}{3}$

2010 AMC 10 A, Problem #18—

“Let F be the foot of the altitude to \overline{AB} from E .”

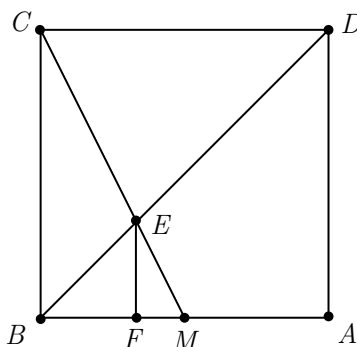
Solution

Answer (C): Let F be the foot of the altitude to \overline{AB} from E and let $EF = x$. Then $EB = \sqrt{2}x$ because $\triangle BEF$ is a $45-45-90^\circ$ triangle. Triangle EMF is similar to triangle CMB , so $FM = \frac{x}{2}$. By the Pythagorean Theorem applied to $\triangle EMF$,

$$EM = \sqrt{x^2 + \left(\frac{x}{2}\right)^2} = \frac{\sqrt{5}}{2}x.$$

Thus

$$\frac{EB}{EM} = \frac{\sqrt{2}x}{\frac{\sqrt{5}}{2}x} = \frac{2\sqrt{2}}{\sqrt{5}} = \frac{2\sqrt{10}}{5}.$$



Difficulty: Hard

NCTM Standard: Geometry Standard for Grades 9–12: analyze properties and determine attributes of two- and three-dimensional objects.

AMC 12 Student Practice Questions

How many integers in the set $\{1, 2, 3, \dots, 15\}$ cannot be the degree measure of the exterior angle of a regular polygon?

- (A) 4 (B) 5 (C) 6 (D) 7 (E) 8

2010 AMC 12 B, Problem #7—

“The sum of the degree measure of the exterior angles of a convex polygon is 360 .”

Solution

Answer (A): The sum of the degree measure of the exterior angles of a convex polygon is 360, so the degree measure of each exterior angle of a regular n -gon is $\frac{360}{n}$ for $n \geq 3$. This is a positive integer k precisely when k is a factor of 360 and $k \leq 120$. For $k \leq 15$, all values are factors of 360 except 7, 11, 13, and 14.

Difficulty: Medium-easy

NCTM Standard: Geometry Standard for Grades 9–12: analyze properties and determine attributes of two- and three-dimensional objects.

AMC 12 Student Practice Questions continued

Let f be a function such that $f(x - y) = f(x) + y$ for all real numbers x and y and $f(40) = 20$. What is $f(30)$?

- (A) 10 (B) 20 (C) 30 (D) 40 (E) 50

2010 AMC 12 B, Problem #11—

“ $f(30) = f(40 - 10)$.”

Solution

Answer (C): Note that

$$f(30) = f(40 - 10) = f(40) + 10 = 20 + 10 = 30.$$

The function $f(z) = -z + 60$ satisfies the given conditions.

Difficulty: Hard

NCTM Standard: Algebra Standard for Grades 9–12: understand relations and functions and select, convert flexibly among, and use various representations for them.

AMC 12 Student Practice Questions continued

Let A and B be two independent events such that the probability that A occurs but B does not is $\frac{1}{4}$, and the probability that B occurs but A does not is $\frac{1}{10}$. There are two possible values, p and q , for the probability that A and B both occur. What is $p + q$?

- (A) $\frac{7}{20}$ (B) $\frac{9}{20}$ (C) $\frac{11}{20}$ (D) $\frac{13}{20}$ (E) $\frac{3}{4}$

2010 AMC 12 B, Problem #17—

“Let c be the probability that A and B both occur.”

Solution

Answer (D): Let c be the probability that A and B both occur. Then the probability of A is $c + \frac{1}{4}$, and the probability of B is $c + \frac{1}{10}$. Because A and B are independent, $c = (c + \frac{1}{4})(c + \frac{1}{10})$, so $c^2 - \frac{13}{20}c + \frac{1}{40} = 0$. The two roots of this quadratic polynomial sum to the negative of the coefficient of c , which is $\frac{13}{20}$.

Note: The two roots are $c = \frac{13 \pm \sqrt{129}}{40}$; they are both positive and less than $\frac{3}{4}$.

Difficulty: Hard

NCTM Standard: Data Analysis and Probability Standard for Grades 9–12: understand and apply basic concepts of probability.

In a right triangle, one altitude has length 60, and the sine of one angle is 0.6. What is the largest possible area of this triangle?

- (A) 2250 (B) 2400 (C) 3000 (D) 3750 (E) 4250

2010 AMC 12 A, Problem #11—

“Because the sine of one angle is 0.6, we have a $3x - 4x - 5x$ right triangle.”

Solution

Answer (D): Because the sine of one angle is 0.6, we have a $3x - 4x - 5x$ right triangle. The area of the triangle is $\frac{1}{2}$ times 60 times the length of the side corresponding to the altitude of length 60. To maximize the area this side should be the one measuring $5x$. In this case the area of the triangle is both $\frac{1}{2} \cdot 3x \cdot 4x$ and $\frac{1}{2} \cdot 60 \cdot 5x$. Therefore $6x^2 = 150x$, $x = 25$, and thus the area is $\frac{1}{2} \cdot 60 \cdot 125 = 3750$.

Difficulty: Medium-hard

NCTM Standard: Geometry Standard for Grades 9–12: analyze properties and determine attributes of two- and three-dimensional objects.



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