

The MATHEMATICAL ASSOCIATION OF AMERICA
American Mathematics Competitions

5th/55th Annual Contests

AMC 10-B / AMC 12-B

Teachers'
Manual

Instructions and Reporting Forms for
School Contest Managers

Exams must be administered over a continuous 75-minute period to all students at the same time

Wednesday, February 25, 2004

Please read this booklet completely upon receipt

DATES OF THE 2004 EXAMINATIONS

AMC10/AMC12 - Tuesday, February 10, 2004
&/or Wednesday, February 25, 2004
AIME - Tuesday, March 23 or April 6, 2004
USAMO - April 27-28, 2004
AMC 8 - Tuesday, November 16, 2004



The MATHEMATICAL ASSOCIATION OF AMERICA

American Mathematics Competitions

Steven Dunbar
Director

To all Contest Managers:

I am very pleased that you will be providing the opportunity for your students to participate in the 55th annual American Mathematics Contest 12 (AMC 12) or its sister contest, the American Mathematics Contest 10 (AMC 10). I believe that your students will find these contests to be both interesting and challenging. Again this year a total of 4 contests (two AMC 10 and two AMC 12) were developed by the Committee on the American Mathematics Competitions and panelists under the leadership of Committee Chairs Professor Douglas Faires for the AMC 10 and Professor David Wells for the AMC 12. I extend special thanks to both of them for the extra effort involved in developing the separate set of contests.

This year, in response to your requests from last year, we include in this manual two handouts:

- * Worksheets for contest preparation
- * A handout for parents on why mathematics is important

You may reproduce these pages for your students.

Very sincerely,

Steven Dunbar
Director

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Changes and Important Procedures

*As you can see, we continue to change and grow.
We summarize some of the changes here.*

Format

The AMC 10 and AMC 12 are to be given at the same time, in each participating school on TUESDAY, February 10, 2004 (AMC 10-A & AMC 12-A), or WEDNESDAY, February 25, 2004 (AMC 10-B & AMC 12-B) in a convenient 75-minute interval, preferably in the morning. They will both consist of 25 questions. Each correct answer will be worth 6 points, again this year a blank will be worth 2.5 points to allow for a greater variety of scores. The AMC 10 and AMC 12 will 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.

Dates

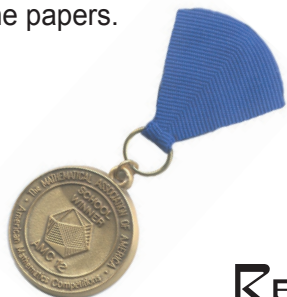
There are again two official dates for the AMC 10 & AMC 12. Complementing the usual second Tuesday in February (February 10, 2004, now the AMC 10-A and AMC 12-A), is an alternate AMC 10/12 Contest given fifteen days later, Wednesday, February 25, 2004 (the AMC 10-B & AMC 12-B). All rules and awards apply 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 will be allowed to take the contest booklets home with them the day of the contest.

Continued From Last Year

This year we have continued two items we added to this Teachers Manual last year: a set of practice questions to familiarize the students with the test format (starting on page 19), and a "Letter to Parents" sheet (on page 27) which can be duplicated and sent home with students or handed out at parent/teacher conference time, open house, etc....

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 will have instructions in black ink. Please be very careful to match the correct answer form with the appropriate contest when passing out the papers.



AIME

Qualification

Students who are in the top 5% of all AMC 12 participants or score at least 100 points on the AMC 12, and those who are in the top 1% of all AMC 10 participants or score at least 120 the AMC 10 are invited to participate in the American Invitational Mathematics Examination.



Results

Your school's results will be sent by 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.



I. Eligibility

Any student who is officially enrolled in high school (or below) and is taking at least one course at the school and has not graduated is eligible to take the AMC 10 or AMC 12 or AIME (with qualifying score). Please note that students in grades 11 & 12 can not take the AMC 10. However, students in grades 9 & 10 may choose which contest they take. Home School Students age 19.5 and under are eligible for AMC 12 and AIME (with qualifying score) and age 17.5 and under are eligible for AMC 10 or AMC 12 or AIME with qualifying score.

II. 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 from the AMC 12. There is no team score or ranking for the AMC 10. The AMC 10 and AMC 12 must be proctored by a faculty member of the participating school. 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 awards.

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.

III. Braille or Large Print Exams

The AMC 10/AMC 12 time limit set by the CAMC for students who are visually impaired or learning disabled is 120 minutes. Please note that it is permissible for a certified teacher or a school administrator to read the questions to the student and mark the answers as directed by the student. For the students who are learning disabled, please call for instructions. The cost of a Braille or Large Print exam is \$7.00 shipping and handling plus \$1.50 per exam for the AMC 12 and \$1.30 per exam for the AMC 10. They are mailed separately and must be ordered by January 15th.

IV. 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. Tell the students to pay special attention to marking their name and address accurately. Remind them that student names to be listed in the National Summary come from this form. The Lincoln Office will not do any editing of the information provided.

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 computerized school identification on the answer forms. Please do not use computer generated labels to provide this information.



4. Announce that the students may use scratch paper, graph paper, ruler, compass, protractor and four-function, scientific, or graphing calculators. No problems on the contest will require the use of a calculator. However, any non-typewriter keyboard calculator may be used during the exam. Students may not share a calculator.

5. Review past tests and solutions or inform your students how to order copies for themselves. Please make available to the students a copy of the Publications Order Form included with this package or download the order form found on the AMC Web page at www.unl.edu/amc, www.amc10.org or www.amc12.org. (or call, fax or write to the Lincoln 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 under the supervision of a certified teacher.

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. In order to assure the validity of the results we report, we take our rules very seriously.

V. Sickness and Other Special Situations

A student who is sick or on a field trip on the first contest day will be advised to register and take the alternate Contest B on Wednesday, February 25, 2004. **Please note that students who are ill or otherwise unable to take the AMC 10B or 12B on the official date will be ineligible to qualify for the 2004 AIME.**

VI. International Students and Non-Citizens in USA Schools

Any Student who is officially enrolled in high school (or below) and is taking at least one course at the school and has not graduated is eligible to take the AMC 10 or AMC 12

or AIME (with qualifying score). US Citizens and 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 or electronic type dual-language 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.

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

If today is not yet Wednesday, February 25, 2004. 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. Take the unopened contest package(s) and Certification Form to your Principal (or equivalent) to certify that the package was opened within an hour before the contest. Have the Principal sign the Certification Form at that time.
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, “Note carefully instructions 3 and 4 on the contest cover (see pages 17 and 18 of this manual). The AMC 10/AMC 12 has a unique 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.” Because of the revised scoring system which began in 2002, with 6 points for a correct answer, 2.5 points for a blank answer and 0 points for an incorrect answer, if a student can reduce the problem to two possible answers, it is advantageous to guess one of the two possible answers. If a student can only reduce to 3 possible answers by eliminating 2 of the possibilities, then it is not advantageous to guess.
6. Inform the participants that they may not talk or ask any questions during the contest, and that they must do their own work.
7. Remind students that they have 75 minutes, then tell them to BEGIN.
8. Students who finish the contest early may be dismissed



contest,

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 Lincoln, Nebraska for grading. You may have the students 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, and insert them along with the School ID Form (placed on top) inside the Report Envelope. There is only one ID FORM to be used with all the AMC 10/AMC 12 answer forms.

YOUR SCHOOL'S CEEB NUMBER IS THE NUMBER WRITTEN ON THE FRONT OF THE AMC 10/AMC 12 REPORT ENVELOPE.

14. Complete the Certification Form (only one form is needed) and place it on top of the School ID Form and the answer forms in the Report Envelope, seal and send it by First Class (please affix the proper postage before mailing) within 24 hours or as soon as possible.

15. 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 either orally, via email, www, copier or media of any type until the next day.
- b. Students may keep the contest booklets and take them home.

VIII. Policy Statements

Statement 1

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 10, The AMC 10-B/AMC 12-B will be given officially on Wednesday, February 25. 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 the Contest B on February 25 because:

- your school is closed,
- your school has an academic conflict,
- the class periods have been shortened due to an assembly or other reason,
- the majority of your best students will be on a field trip on contest day,

(Please Note: Students must participate in a contest on the assigned day, at the same time.)

then you may still give the contest unofficially on a later date, but your school, and students will not be eligible for state and national awards, and students will not be eligible for participation in the AIME. Please note 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: Tuesday, February 10, and Wednesday, February 25, 2004.

Statement 2

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 carry on its own investigation or retest the student in question before receiving instructions from the Lincoln Office. If it appears that a student has scored beyond his or her ability, this could be a case of previously unrecognized talent, or it might be a case of extremely lucky guessing, which is one of the grounds for reexamination.

Statement 3

Follow-up Inquiries and Reexamination

The results of this contest are used 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. A follow-up inquiry may be made of a school if one or more scores are unusually high compared to other scores at that school in recent years, or if a student scores high on the AMC 10/AMC 12 and low on the follow-up AIME. Reexamination will be requested when, after an inquiry, there is a reasonable basis to believe that a high score is well beyond a student's ability due to extremely lucky guessing, dishonesty or some other circumstance. Official status will not be granted if a student or school does not agree to a requested retesting.

Statement 4

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.

Statement 5

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.

IX. School Results

Your school's results will be mailed by first class 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.

In addition to the hard copy of the results and awards mailed via Postal Services, we offer an e-Mail copy of the results. If you would like to receive your results by e-Mail, and have not previously sent us your address, send a message, including your name, school name, address, and CEEB # to:

hstran@amc.unl.edu

Results are not official until the hard copy of your report is received, and that should be no longer than 30 days after AMC 10/AMC 12.

X. AIME Instructions

The 22nd annual American Invitational Mathematics Examination (AIME) will be held on Tuesday, March 23, 2004 with a second alternate exam given on the alternate date of Tuesday, April 6, 2004. These are the only days the exam may be taken officially. You may give the exam for practice (unofficially), on Wednesday, March 24, Thursday, March 25 or Friday, March 26, 2004. We will be pleased to grade it for you but your students will not be eligible to take the USAMO. 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.

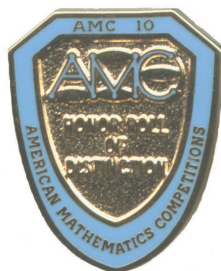
AIME Rules for AMC 10/AMC 12

Students who are in the top 5% of all AMC 12 participants or score at least 100 points on the AMC 12, and those who are in the top 1% of all AMC 10 participants or score at least 120 on the AMC 10 are invited to participate in the American Invitational Mathematics Examination.

PLEASE read the following participation rules to your students as soon as you receive the AMC 10/AMC 12 package so potential AIME students will be able to plan accordingly.

To the AIME School Manager:

1. All materials relating to the examination (including proctoring instructions for the exam) will be included with your AMC 10/AMC 12 results.
2. All questions or problems concerning the AIME should be directed to the Lincoln 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. The AIME Answer Forms are sent directly to the Lincoln office for grading and processing.
5. Each participating school will receive a report of their results, an AIME solution pamphlet, and a list of students who qualify for the USAMO.
6. All AMC 10/AMC 12 procedures for disqualification, follow-up inquiries and reexamination apply to the AIME as appropriate.
7. 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

There are THREE situations in which a student may take a second version of the AIME to be held on Tuesday April 6, 2004, keeping their USAMO eligibility open:

1. School is closed on March 23rd (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 23rd.

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 be returned by "express mail" so that they arrive in the AMC office by April 9, 2004.

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#, and complete mailing address.

Under no circumstances can a student take both AIME's.

We currently have no scholarship funding for high scores on the AIME.

XI. Participant Selection for the USAMO and IMO

The USA Mathematical Olympiad (USAMO) is a two day, nine-hour, six-question, essay-proof examination. Selection for the USAMO will be made according to the following rules:

1. The goal is to select about 250 of the top scorers from the prior AIME and AMC 12A, AMC 12B, AMC 10A and AMC 10B contests to participate in the USAMO.
2. Selection will be based on the USAMO index which is defined as 10 times the student's AIME score plus the student's score on the AMC 12 or the AMC 10.
3. The first selection will be the approximately 160 highest USAMO indices of students taking the AMC 12A or AMC 12B contest.
4. The lowest AIME score among those 160 first selected will determine a floor value. The second selection of USAMO participants will be from the highest USAMO indices among students who took the AMC 10A or AMC 10B and the AIME, and got an AIME score at least as high as the floor value.
5. The student with the highest USAMO index from each state, territory, or U.S. possession not already represented in the selection of the first and second groups will be invited to take the USAMO.
6. To adjust for variations in contest difficulty, the number of students selected from A & B contests will be proportional to the number of students who took the (A & B) Contests.
7. The selection process is designed to favor students who take the more mathematically comprehensive AMC 12A and AMC 12B contests.



The USAMO is scheduled for Tuesday and Wednesday, April 27 & 28, 2004 at your school. If you feel you may have a qualifier, please arrange for a space and proctor for these dates.

The top 12 scoring students on the USAMO will be invited to attend an award ceremony held in Washington, D.C., June 20-21, 2004. The USA International Mathematical Olympiad (IMO) Team will be chosen at the Mathematical Olympiad Summer Program (MOSP, June 13-July 3, 2004) after further testing (see Section XII, for more details).

XII. The MOSP Program

The top 12 USAMO students will be invited to attend MOSP regardless of their school grade.

During the first week of MOSP a final “IMO” type exam will be given to the top 12 USAMO students with the goal of identifying the USA IMO Team. This exam will replicate an actual IMO and will consist of 6 problems to be solved over two 4 1/2 hour sessions. The 12 equally weighted problems (6 on USAMO and 6 on this exam) will determine the tentative USA Team.

In order to assure that the strongest possible team has been formed, the MOSP Director/IMO Team Leader reserves the right to appoint up to one IMO team member. This appointment would happen only in a circumstance where a student’s performance during the first two weeks of MOSP clearly surpasses that of an existing team member.

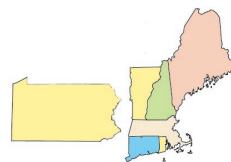
Seniors who did not earn a spot on the IMO Team will have the option to return home after the first two weeks of MOSP.

XIII. Contest 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



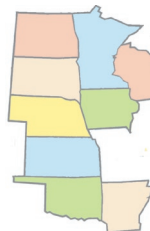
- 3 Alabama, American Embassy and APO/FPO Schools, Florida, Georgia, Puerto Rico, Virgin Islands



- 4 Indiana, Michigan, Ohio



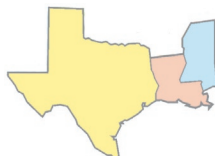
- 5 Arkansas, Iowa, Kansas, Minnesota, Nebraska, North Dakota, Oklahoma, South Dakota, Wisconsin



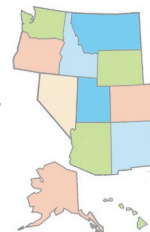
- 6 Illinois, Kentucky, Missouri, Tennessee



- 7 Louisiana, Mississippi, Texas



- 8 Alaska, Arizona, Colorado, Guam, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming



- 9 California




- 10 Canada




XIV. Intramural and National Awards


Intramural Awards


Intramural awards will be sent to you from the Lincoln Office, along with your school results. Your registration fee entitles you to pins, medals, certificates, and a copy of the National Summary of Results and Awards. An order form for additional intramural awards will be included with your results.


 Winner Pin — given to the top scoring student in your school for both the AMC 10 and AMC 12. Medals will be given for consecutive wins in both contests mentioned above. Details of how medals are awarded will be included with your school's results.


 Certificate of Distinction — awarded to all students who qualify for the AIME.

 Honor Roll of Distinction Pin — given to the top 1% of the AMC 12 and to the top 1% of AMC 10 participants.

 AMC 12 Certificate of Achievement — given to students in grade 10 and below who score 90 or above on the AMC 12 Contests.


 AMC 10 Certificate of Achievement — given to students in grade 8 and below who score 90 or above on the AMC 10 Contests.

 School Certificate of Honor — awarded to schools with a team score (AMC 12) of 400 or greater.

 School Certificate of Merit — awarded to schools with a team score (AMC 12) of between 300 and 399.


State/Provincial Awards


Some State/Provincial Directors offer various awards or scholarships in addition to the plaques.


 Plaques — Top Scoring Student Plaque awarded to a student in each state or province.

NATIONAL AWARDS

In each of the eleven regions into which the United States and Canada are divided, the five schools with the highest team scores (sum of the highest three scores by participants) are recognized by Donor or Committee Awards. The highest scoring team in each region will receive a Cup, the remaining four teams will receive one of the following three awards:


 Charles T. Salkind Memorial Silver Cup — silver cup awarded to the school with the highest team score over all, donated by the L.G. Balfour Company, Attleboro, MA.


 William H. Fagerstrom Memorial Silver Cup — silver cup awarded to the school with the second highest team score over all, donated by the L.G. Balfour Company, Attleboro, MA.


 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.

Schools not receiving a cup are eligible for these awards

The four remaining schools in each region will receive one of these awards. Distribution of awards is arranged so that schools do not receive duplicates of awards made to them in prior years.

 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.

 W. H. Freeman Books — in each of the eleven regions, a set of books, donated by W. H. Freeman Company, San Francisco, CA is awarded to one school having a high team score.

 Mathematics Magazine — in each of the eleven regions, a one-year subscription is donated by the Committee on the American Mathematics Competitions to two or more schools having a high team score.

Most Improved Team Score Award

Pedagogy Award -- awarded to one school in each of the 50 states, US Territories, Military Schools abroad, and Canada with the "Most Improved" Team Score on the AMC10 and AMC 12.

XV. CONTEST B CERTIFICATION

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 Principal, official or person with comparable title:

- (a) I certify that the exam package(s) were retained in their sealed condition within an hour of the start of the contest.
- (b) I accept for our school the rules and procedures described on this page and pages 3-6, and accept that failure to follow these rules and procedures may result in DISQUALIFICATION from official standing of all scores from our school.

Signature _____ Time _____

Title _____ Date _____

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 the back of this 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. The contest was held on Wednesday, February 25, 2004.
2. The AMC 10-B/AMC 12-B were given at the same time.
3. The participants were continually monitored during the contest, and they were separated by an empty space, if possible.
4. No aids were permitted other than scratch paper, graph paper, ruler, compass, protractor and calculator (see Section IV. Item 4).
5. Participants had exactly 75 minutes working time.
6. No students were permitted to proctor or grade the contest.
7. The instructions relating to the opening of the "Complimentary Solutions Envelope" and/or Solution Packets were followed.
8. After the contest, the answer forms were kept secure and no changes were made in the answers.
9. No Home School parent assisted in the administration of the contest.
10. 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 _____



EXCEPTIONS

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

Service Questionnaire

1. Did you receive the AMC High School Registration Brochure in a timely manner to get signed up for this years contest? ☐ YES ☐ NO

2. Would you like to get an electronic reminder before the registration deadlines? Email address: _____

3. Did you use the Student Practice Questions starting on page 19 of this Manual? ☐ YES ☐ NO

4. Did you use the Parents Letter provided on page 27 of this Manual? ☐ YES ☐ NO

5. What could we provide to help you teach math more effectively? ☐ Posters: _____
☐ Handout Masters: _____
☐ Other: _____

6. Do you recall seeing the 2003 AMC 10/12 Summary of Results and Awards? ☐ YES ☐ NO
 If you received the 2003 AMC 10/12 Summary of Results and Awards, rate the importance of the following sections (on a scale of 1-5, 5 high)

A. Perfect Scores listing	1	2	3	4	5
B. Historical Listing of Perfect Scores	1	2	3	4	5
C. Honor Roll (listing all students ranking in top 5%)	1	2	3	4	5
D. Distinguished Honor Roll (listing all students ranking in top 1%)	1	2	3	4	5
E. Statistical Tables on the AMC 10/12 Results	1	2	3	4	5
F. School Merit & Honor rolls by state and region	1	2	3	4	5
G. International Lists	1	2	3	4	5

 Instead of listing the Honor Roll in the Summary Book, would you accept listing these high-scoring students on the Web? ☐ YES ☐ NO

7. Would you appreciate receiving a commendation sent by the AMC to your principal/headmaster, commenting on "your promotion of mathematics in your school through your participation in the AMC contests"? ☐ YES ☐ NO

8. What would encourage your school to continue registering for the AMC Contests? What can we do to insure your school will register again next year?
 Please feel free to provide the name of a school or teacher in your area that you believe would be interested in our contests.

Comments on the Contest and/or its implementation:

XVI. 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 _____

AMC 10	Contest B Bundles of ten # _____ @ \$13/bundle =\$ _____
	B Solutions Sets of ten (optional) # _____ @ \$ 6/set =\$ _____

AMC 12	Contest B Bundles of ten # _____ @ \$15/bundle =\$ _____
	B Solutions Sets of ten (optional) # _____ @ \$ 6/set =\$ _____

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

Total \$ _____

P.O. Number _____

VISA/MC# : _____ Address: _____

Name (Please Print): _____

Exp. Date: _____

AMC ORDERING -- TERMS

1. VISA, MasterCard accepted.

FAX 402-472-6087 or 1-800-527-3690

2. Make checks payable to:

AMERICAN MATHEMATICS COMPETITIONS

3. PAYMENT IN U.S. FUNDS ONLY.

Please Send Your Order To:

4. U.S.A.: Order TOTAL Shipping Charge*

American Mathematics Competitions

\$ 6.00 -- \$40.00 \$7.00

ATTN: AMC 10/12 Additional Bundles

\$40.01 -- \$50.00 \$9.00

P.O. Box 81606

\$50.01 -- \$75.00 \$12.00

Lincoln, NE 68501-1606

\$75.01 -- UP \$15.00

5. CANADIAN: Same as above. Order will be sent by DHL.

* Orders after February 17th add \$10.00 additional for 1-day UPS.

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: _____

XVIII. Rescoring Request Form



I would like to have the following student's answer form rescored. I understand that there is a \$5.00 charge for each student answer form rescored

\$ 5.00/each

Student Name _____ \$ _____

Contest taken: AMC 10-A AMC 10-B AMC12-A AMC12-B

Student Name _____ \$ _____

Contest taken: AMC 10-A AMC 10-B AMC12-A AMC12-B

Grand Total _____ \$ _____

Teacher's Name _____ CEEB # _____

School Name _____

Address _____

City _____ State _____ Zip _____

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

XIX. Facsimile of AMC 10 Front Cover

Wednesday, FEBRUARY 25, 2004

5th Annual American Mathematics Contest 10

AMC 10



Contest B

**The MATHEMATICAL ASSOCIATION OF AMERICA
American Mathematics Competitions**

1. DO NOT OPEN THIS BOOKLET UNTIL TOLD TO DO SO BY YOUR PROCTOR.
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. The answers to the problems are to be marked 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, 2.5 points for each problem left unanswered, and 0 points for each incorrect answer.
5. No aids are permitted other than scratch paper, graph paper, ruler, compass, protractor, erasers and calculators that are accepted for use on the SAT. 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. When your proctor gives the signal, begin working the problems. You will have 75 MINUTES working time to complete the test.
8. When you finish the exam, *sign your name* in the space provided on the Answer Form.

Students who score 120 or above or finish in the top 1% on this AMC 10 will be invited to take the 22nd annual American Invitational Mathematics Examination (AIME) on Tuesday, March 23, 2004 or on Tuesday, April 6, 2004. More details about the AIME and other information are on the back page of this test booklet.

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.

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. Duplication at any time via copier, telephone, eMail, World Wide Web or media of any type is a violation of the copyright law.

XX. Facsimile of AMC 12 Front Cover

Wednesday, FEBRUARY 25, 2004

55th Annual American Mathematics Contest 12

AMC 12



Contest B

**The MATHEMATICAL ASSOCIATION OF AMERICA
American Mathematics Competitions**

1. DO NOT OPEN THIS BOOKLET UNTIL TOLD TO DO SO BY YOUR PROCTOR.
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. The answers to the problems are to be marked 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, 2.5 points for each problem left unanswered, and 0 points for each incorrect answer.
5. No aids are permitted other than scratch paper, graph paper, ruler, compass, protractor, erasers and calculators that are accepted for use on the SAT. 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. When your proctor gives the signal, begin working the problems. You will have **75 MINUTES** working time to complete the test.
8. When you finish the exam, *sign your name* in the space provided on the Answer Form.

Students who score 100 or above or finish in the top 5% on this AMC 12 will be invited to take the 22nd annual American Invitational Mathematics Examination (AIME) on Tuesday, March 23, 2004 or Tuesday, April 6, 2004. More details about the AIME and other information are on the back page of this test booklet.

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.

The publication, reproduction, or communication of the problems or solutions of the AMC 12 during the period when students are eligible to participate seriously jeopardizes the integrity of the results. Duplication at any time via copier, telephone, eMail, World Wide Web or media of any type is a violation of the copyright law.

XXI. AMC 10 Student Practice Questions

You will find these and additional problems for the AMC 10 and AMC 12 on AMC's web site: <http://www.unl.edu/amc>, available from the 2004 AMC 10/12 Teacher Manual directory, (<http://www.unl.edu/amc/d-publication/d1-pubarchive/2003-4pub/04tm12/04amc1012tm.html>) or from our Problems page archives (<http://www.unl.edu/amc/a-activities/a7-problems/problem81012archive.html>).

- What is the value of

$$(3x - 2)(4x + 1) - (3x - 2)4x + 1$$

when $x = 4$?

- (A) 0 (B) 1 (C) 10 (D) 11 (E) 12

2002 AMC 10 B, Number #4;
2002 AMC 12 B, Number #2—
“Factor to make easier”

- **Solution (D)** Since

$$\begin{aligned}(3x - 2)(4x + 1) - (3x - 2)4x + 1 &= (3x - 2)(4x + 1 - 4x) + 1 \\ &= (3x - 2) \cdot 1 + 1 = 3x - 1,\end{aligned}$$

when $x = 4$ we have the value $3 \cdot 4 - 1 = 11$.

Difficulty: Easy

NCTM Standard: Algebra Standard for Grades 9–12: Understand the meaning of equivalent forms of expressions.

Mathworld.com Classification:

Algebra > Polynomials > Polynomial;

Algebra > Polynomials > Polynomial Factorization

- Let $\{a_k\}$ be a sequence of integers such that $a_1 = 1$ and $a_{m+n} = a_m + a_n + mn$, for all positive integers m and n . Then a_{12} is

(A) 45 (B) 56 (C) 67 (D) 78 (E) 89

2002 AMC 10 B, Number #23—
“Create the sequence”

- **Solution (D)** By setting $n = 1$ in the given recursive equation, we obtain $a_{m+1} = a_m + a_1 + m$, for all positive integers m . So $a_{m+1} - a_m = m + 1$ for each $m = 1, 2, 3, \dots$. Hence,

$$a_{12} - a_{11} = 12, \quad a_{11} - a_{10} = 11, \quad \dots, \quad a_2 - a_1 = 2.$$

Summing these equalities yields $a_{12} - a_1 = 12 + 11 + \dots + 2$. So

$$a_{12} = 12 + 11 + \dots + 2 + 1 = \frac{12(12+1)}{2} = 78.$$

Difficulty: Hard

NCTM Standard: Algebra Standard for Grades 9–12: Generalize patterns using explicitly defined and recursively defined functions.

Mathworld.com Classification:

Discrete Mathematics > Computer Science > Algorithms > Recursion > Recursive Sequence;
 Discrete Mathematics > Recurrence Equations > Recursive Sequence

- Riders on a Ferris wheel travel in a circle in a vertical plane. A particular wheel has radius 20 feet and revolves at the constant rate of one revolution per minute. How many seconds does it take a rider to travel from the bottom of the wheel to a point 10 vertical feet above the bottom?

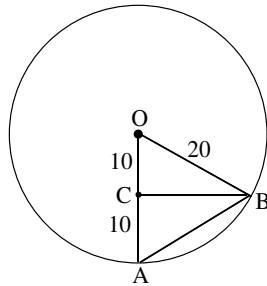
(A) 5 (B) 6 (C) 7.5 (D) 10 (E) 15

2002 AMC 10 B, Problem #24—

“Use 30-60-90 triangle geometry”

- **Solution (D)** In the figure, the center of the wheel is at O , and the rider travels from A to B . Since $AC = 10$ and $OB = OA = 20$, the point C is the midpoint of \overline{OA} . In the right $\triangle OCB$, we have OC half of the length of the hypotenuse OB , so $m\angle COB = 60^\circ$. Since the wheel turns through an angle of 360° in 60 seconds, the time required to turn through an angle of 60° is

$$60 \left(\frac{60}{360} \right) = 10 \text{ seconds.}$$



Difficulty: Hard

NCTM Standard: Geometry Standard for Grades 9–12: Use visualization, spatial reasoning, and geometric modeling to solve problems.

Mathworld.com Classification:

Geometry > Plane Geometry > Triangles > Special Triangles > Other Triangles > 30-60-90 Triangle;

Geometry > Plane Geometry > Circles

- Let d and e denote the solutions of $2x^2 + 3x - 5 = 0$. What is the value of $(d - 1)(e - 1)$?

(A) $-\frac{5}{2}$ (B) 0 (C) 3 (D) 5 (E) 6

2003 AMC 10 A, Problem #5—

“Use the sum and product of the roots formulas”

- **Solution (B)** If $x = d$ and $x = e$ are the roots of the quadratic equation $ax^2 + bx + c = 0$, then

$$de = \frac{c}{a} \quad \text{and} \quad d + e = -\frac{b}{a}.$$

For our equation this implies that

$$(d - 1)(e - 1) = de - (d + e) + 1 = -\frac{5}{2} - \left(-\frac{3}{2}\right) + 1 = 0.$$

One can also factor the quadratic directly, find the roots and evaluate the expression!

Difficulty: Easy

NCTM Standard: Algebra Standard for Grades 9–12: Represent and analyze mathematical situations and structures using algebraic symbols; understand the meaning of equivalent forms of expressions, equations, inequalities, and relations; write equivalent forms of equations, inequalities, and systems of equations and solve them with fluency.

Mathworld.com Classification:

Algebra > Algebraic Equations > Quadratic Equations;
Algebra > Polynomials > Vieta's Formulas

XXII. AMC 12 Student Practice Questions

You will find these and additional problems for the AMC 10 and AMC 12 on AMC's web site: <http://www.unl.edu/amc>, available from the 2004 AMC 10/12 Teacher Manual directory, (<http://www.unl.edu/amc/d-publication/d1-pubarchive/2003-4pub/04tm12/04amc1012tm.html>) or from our Problems page archives (<http://www.unl.edu/amc/a-activities/a7->

- The arithmetic mean of the nine numbers in the set $\{9, 99, 999, 9999, \dots, 999999999\}$ is a 9-digit number M , all of whose digits are distinct. The number M does not contain the digit

(A) 0 (B) 2 (C) 4 (D) 6 (E) 8

2002 AMC 12 B, Number #1— “Definition of mean, then factor”

- **Solution (A)** The number M is equal to

$$\begin{aligned}\frac{1}{9}(9 + 99 + 999 + \dots + 999,999,999) &= 1 + 11 + 111 + \dots + 111,111,111 \\ &= 123,456,789.\end{aligned}$$

The number M does not contain the digit 0.

Difficulty: Easy

NCTM Standard: Data Analysis and Probability Standard for Grades 9–12: For univariate measurement data, be able to display the distribution, describe its shape, and select and calculate summary statistics.

Mathworld.com Classification:

Calculus and Analysis > Special Functions > Means > Arithmetic Mean

- For how many integers n is $\frac{n}{20-n}$ the square of an integer?

(A) 1 (B) 2 (C) 3 (D) 4 (E) 10

2002 AMC 12 B, Number #12—
“Re-express, then use factors”

- **Solution (D)** If $\frac{n}{20-n} = k^2$, for some $k \geq 0$, then $n = \frac{20k^2}{k^2+1}$. Since k^2 and $k^2 + 1$ have no common factors and n is an integer, $k^2 + 1$ must be a factor of 20. This occurs only when $k = 0, 1, 2$, or 3 . The corresponding values of n are 0, 10, 16, and 18.

Difficulty: Hard

NCTM Standard: Number and Operations Standard for Grades 9–12: Use number-theory arguments to justify relationships involving whole numbers.

Mathworld.com Classification:

Number Theory > Diophantine Equations > Diophantine Equation

- A square and an equilateral triangle have the same perimeter. Let A be the area of the circle circumscribed about the square and B be the area of the circle circumscribed about the triangle. Find A/B .

(A) $\frac{9}{16}$ (B) $\frac{3}{4}$ (C) $\frac{27}{32}$ (D) $\frac{3\sqrt{6}}{8}$ (E) 1

2003 AMC 12 A, Number #11—
“Draw the figure, find the radius”

- **Solution (C)** Let the common perimeter be 1. Then the side length of the square is $1/4$, and the side length of the triangle is $1/3$. The radius of the circle circumscribed about the square is half the diagonal length or $\sqrt{2}/8$. The area $A = \pi(\sqrt{2}/8)^2 = \pi/32$. The radius of the circle circumscribed about the triangle is $(2/3)(\sqrt{3}/6) = \sqrt{3}/9$. The area $B = \pi(\sqrt{3}/9)^2 = \pi/27$. Then the ratio $A/B = 27/32$.

Difficulty: Medium

NCTM Standard: Geometry Standard for Grades 9–12: Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships.

Mathworld.com Classification:

Geometry > Plane Geometry > Triangles > General Triangles > Triangle Circumscribing

- How many non-congruent triangles with perimeter 7 have integer side lengths?

(A) 1 (B) 2 (C) 3 (D) 4 (E) 5

2003 AMC 12 A, Number #7—

“Use integer partitions and the triangle inequality”

- **Solution (B)** The perimeter 7 could possibly be written as the sums $5 + 1 + 1$, $4 + 2 + 1$, $3 + 3 + 1$, and $3 + 2 + 2$. The sum of the two shorter sidelengths must be greater than the third side length, so only $3 + 3 + 1$ and $3 + 2 + 2$ are possible triangles.

Difficulty: Medium-easy

NCTM Standard: Geometry Standard for 9-12: Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships. Explore relationships (including congruence and similarity) among classes of two- and three-dimensional geometric objects, make and test conjectures about them, and solve problems involving them.

Mathworld.com Classification:

Discrete Mathematics > Combinatorics > Enumeration > Triangle Counting;

Geometry > Plane Geometry > Triangles > General Triangles > Triangle Counting

XXIII. Why MATH & The AMC Contests are important



The MATHEMATICAL ASSOCIATION OF AMERICA

American Mathematics Competitions

Dr. Steven R. Dunbar
AMC Director

February, 2004

Dear Parent or Guardian:

On February 10, 2004 and/or February 25, 2004 your son or daughter participated in the 55th 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 chapter of the Mathematical Association of American to a sequence of contests involving over 250,000 students world-wide.

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. Our organization regularly receives requests from well-known colleges and universities for the names of high scoring students. A few colleges offer scholarships to students in their region with high scores on the contests.

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. Even so, if your son or daughter managed to solve only one or two problems, they should still be proud, because these problems are meant to be more challenging than they routinely encounter in their 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 want 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

XXIV. Certificate of Participation - AMC 10

(for reproduction)

page 29



XXV. Certificate of Participation - AMC 12

(for reproduction)





The Mathematical Association of America
American Mathematics Competitions

CERTIFICATE

Awarded to

for participating in the

American Mathematics Contest 10

Steven R. Dunbar

Director

American Mathematics Competitions

Year

J. Douglas Faires

Chair

AMC 10 Subcommittee



The Mathematical Association of America
American Mathematics Competitions

CERTIFICATE

Awarded to

for participating in the

American Mathematics Contest 12

Steven R. Dunbar

Director

American Mathematics Competitions

Year

David M. Wells

Chair

AMC 12 Subcommittee

XXVI. List of the Sponsors of the American Mathematics Competitions

The American Mathematics Competitions

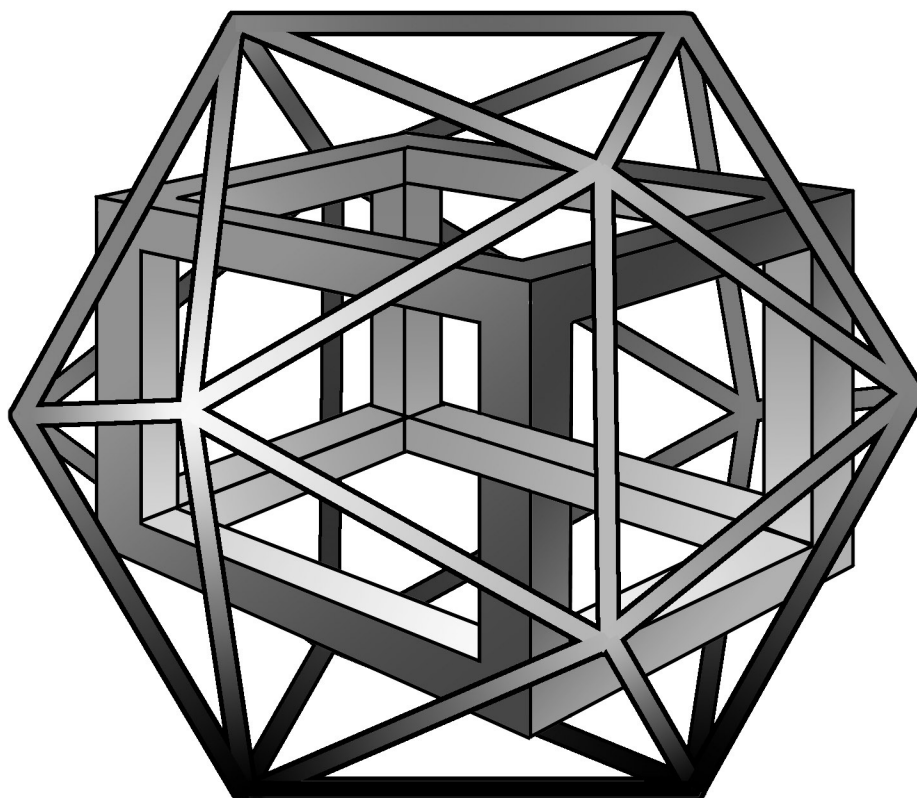
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The Mathematical Association of America — MAA www.maa.org/
University of Nebraska – Lincoln — UN-L www.unl.edu/

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Pi Mu Epsilon — PME www.pme-math.org/
Society of Actuaries — SOA www.soa.org/

The National Association of Secondary School Principals has placed the AMC 8, AMC 10 and the AMC 12 on the NASSP, National Advisory List of Contests & Activities for 2003-2004.



Can you think outside the box?

AMC 8 ☆ AMC 10 ☆ AMC 12 ☆ AIME ☆ USAMO ☆ MOSP ☆ IMO

The MATHEMATICAL ASSOCIATION OF AMERICA
AMERICAN MATHEMATICS COMPETITIONS