The MATHEMATICAL ASSOCIATION OF AMERICA
American Mathematics Competitions

## ANC 10-B / AnC 12-B

7th/57th Annual Contests

## Teachers' manual

## Wednesday, February 15, 2006

## Instructions and Reporting Forms for School Contest Managers

Please read this booklet completely upon receipt

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

## DATES OF THE 2006 EXAMINATIONS

AMC10/AMC12 - Tuesday, January 31, 2006
\&/or Wednesday, February 15, 2006
AIME - Tuesday, March 7, or Wednesday, March 22, 2006 USAMO - April 18-19, 2006
AMC 8 - Tuesday, November 14, 2006

The MATHEMATICAL ASSOCIATION OF AMERICA American Mathematics Competitions

Steven Dunbar AMC Director

## To all Contest Managers:

I am very pleased you will be providing the opportunity for your students to participate in the $57^{\text {th }}$ annual American Mathematics Contest 12 (AMC 12) or its sister contest, the 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 Professor Douglas Fairs for the AMC 10 and Professor David Wells 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 14)
* A handout for parents on why mathematics is important (page 22)
* A sample Press Release (page 23)
* A Certificate of Participation (pages $24 \& 25$ )

You may reproduce these pages for your students.

Very sincerely,


Steven Dunbar

## Director

## Table of Contents

Important Procedures ..... 4
I. Preliminary Instructions for Administering the AMC 10/AMC 12 ..... 4
II. Instructions For The Day of The AMC 10/AMC 12 ..... 5
III. Eligibility ..... 5
Home School Students ..... 5
International Students \& Non-Citizens in USA Schools ..... 5
IV. Team Score Identification ..... 5
V. School Results ..... 6
VI. Policy Statements ..... 6
Early Administration ..... 6
Official Administration ..... 6
Unofficial Administration ..... 6
Students with Visual or Learning Disablilities ..... 6
Sickness and Other Special Situations ..... 6
Questionable Scores ..... 6
Follow-up Inquiries and Reexamination ..... 6
Policy for Changes ..... 6
Refund/Credit Policy ..... 6
Request for Student Names Policy ..... 6
VII. AIME Instructions ..... 7
AIME Rules for AMC 10/AMC 12 ..... 7
AIME School Manager ..... 7
Second AIME Testing Date ..... 7
VIII. USAMO Participant Selection ..... 7
IX. The MOSP Program ..... 7
X. Regions of the AMC 10/AMC 12 ..... 8
XI. Intramural and National Awards ..... 8
Intramural Awards ..... 8
State/Provincial Awards ..... 8
National Awards ..... 8
Awards for Schools not receiving a Trophy Cup ..... 8
Most Improved Team Score Award ..... 8
XII. Contest A Certification ..... 9
Service Questionnaire ..... 10
XIII. Additional Forms used - (if the form you need is not here, please see our web site) ..... 11
Additional Bundles Form ..... 11
Proof of Intent to Pay ..... 11
Rescoring Request Form ..... 12
XIV. Classroom Accessories ..... 13
AMC 10 Student Practice Questions ..... 13
AMC 12 Student Practice Questions ..... 17
Letter to Parents (for Reproduction) ..... 21
Publicity ..... 22
AMC 10 - Certificate of Participation ..... 23
AMC 12 - Certificate of Participation ..... 24
Facsimile of AMC 10 Front Cover ..... 25
Facsimile of AMC 12 Front Cover ..... 26
Back Cover -- AMC Sponsors ..... 28

# Important Procedures 

## Format

There are two official dates for the AMC 10 \& AMC 12. The AMC 10 and AMC 12 are to be given at the same time within each participating school on TUESDAY, January 31, 2006 (AMC 10-A \& AMC 12-A), or WEDNESDAY, February 15, 2006 (AMC 10-B \& AMC 12-B) in a convenient 75 -minute interval, preferably in the morning. All four contests consist of 25 questions. Each correct answer scores 6 points, a blank scores 2.5 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 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.

## 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.

## 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 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 AMC 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 stick-on 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 accepted for use on the SAT may be used during the exam. See <http:// apps.collegeboard.com/cbsearch_code/ codeSearchHighschool.jsp>. Students may not share a

## calculator.

5. Review past tests and solutions or inform your students how to order copies for themselves. The Publications Order Form can be downloaded from the AMC Web page at www.unl.edu/amc, www.amc10.org or www.amc12.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 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.

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

If today is not yet Wednesday, February 15, 2006. 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 12red).
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 read instructions 3 and 4 on the contest cover." (see pages 26 and 27 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." Six points are given 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 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, 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 (trackable recommended) (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.

## III. Eligibility

Any student who is officially enrolled in high school (or below) and is taking at least one course at the high school level, and has not graduated, is eligible to take the AMC 10 or AMC 12 or AIME (with qualifying score). Please note: 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

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 and AIME (with qualifying score).

International Students \& Non-Citizens in USA Schools
US and Canadian 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 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 24hour 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. 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.

## V. School Results

The AMC office will send results by email (if available) and 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.
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 hard copy of your report, and that should be no longer than 30 days after AMC 10/AMC 12.

## 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, January 31, The AMC 10-B/AMC 12-B will be given officially on Wednesday, February 15. 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.
(Students must participate in a contest on the assigned day, at the same time.)

## Unofficial Administration

If you are unable to give the Contest A on January 31 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 15, 2006 (See Contest B Registration Form on page 13). You may still take either exam unofficially on other days, 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: Tuesday, January 31, and Wednesday, February 15, 2006.

## 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 certified 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 $\$ 7.00$ 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 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, February15, 2006. YOU MUST REGISTER FOR CONTEST B if you have not already done so. (see page 13 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 carry on its own investigation or retest the student in question before receiving instructions from the AMC Office.

## Follow-up Inquiries and Reexamination

The results of this contest 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 students. This information is used for recruiting and other 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 $23^{\text {rd }}$ annual American Invitational Mathematics Examination (AIME) will be held on TUESDAY, March 7, 2006 with a second alternate exam given on the alternate date of WEDNESDAY, March 22, 2006. These are the only days the exam may be taken officially. You may give the exam for practice (unofficially), on Thursday, March 23, or Friday, March 24, 2006. 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.

## AIME School Manager

1. The AMC office will include all materials relating to the examination (including proctoring 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. The AIME Answer Forms are sent directly to the AMC 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

Situations in which a student may take a second version of the AIME to be held on WEDNESDAY, March 22, 2006, keeping their USAMO eligibility open are:

1. School is closed on March 7th (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 7th. 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 March 24, 2006.

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.

## VIII. USAMO Participant Selection

The USA Mathematical Olympiad (USAMO) is a two day, nine-hour, six-question, essay-proof examination. Selection for the USAMO will be explained in the AIME Teacher Manual. 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.
The USAMO is scheduled for Tuesday and Wednesday, April $18 \& 19,2006$ 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., on May 21-22, 2006.

## 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 30 ninth-grade USAMO participants, grant funding permitting.
Watch for further details to be announced in the 2006 AIME/ USAMO Teachers' Manual and on the AMC website at www.unl.edu/amc.

## 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

The AMC Office will send you Intramural awards, 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) between 300 and 399, inclusive.

## State/Provincial Awards

Plaques - Top Scoring Student Plaque awarded to a student in each state or province.
Some State/Provincial Directors offer various awards or scholarships in addition to the plaques.

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

The nationally highest scoring team will receive the Charles T. Salkind Memorial Silver Cup, a silver Trophy Cup awarded to the school with the highest team score over all, donated by the L.G. Balfour Company, Attleboro, MA.
The second nationally highest scoring team will receive the William H. Fagerstrom Memorial Silver Cup, a silver Trophy Cup awarded to the school with the second highest team score over all, also donated by the L.G. Balfour Company, Attleboro, MA.
In each of the regions in which a silver cup is not awarded the Committee on the American Mathematics Competitions provides a Committee Bronze Cups to the school with the highest team score.

## Awards for Schools not receiving a Trophy Cup

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

Pedagoguery 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 AMC 10 and AMC 12.

## XII. Contest B Certification

The AMC 10 and AMC 12 must be administered by a teacher or an adult not associated with or 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 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 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.

Signature $\qquad$ Time $\qquad$

Title $\qquad$ Date $\qquad$

## 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 15, 2006.
2. The AMC $10-\mathrm{B} / \mathrm{AMC} 12-\mathrm{B}$ 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 I. 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 $\qquad$ E-mail (please print)
Day \& Date Test was given
Name of School
City State/Province $\qquad$

Telephone ( $\qquad$ ) $\qquad$ School CEEB Number $\qquad$

## PLEASE INDICATE THE EXACT NUMBER <br> OF AMC 10-B/AMC 12-B ANSWER FORMS RETURNED FOR GRADING.

$\qquad$

## Service Questionnaire

Please mark the answers to this questionnaire in the box on the back of the School ID form. Please use the scale:
0 -- Not Applicable
1 -- Disagree strongly
2 -- Disagree
3 -- Neutral
4 -- Agree
5 -- Strongly Agree

1. The AMC 10/12 offers a positive experience with mathematics to my students who have high mathematical ability.
2. The AMC $10 / 12$ offers a positive experience with mathematics to my students who have average mathematical ability.
3. The AMC $10 / 12$ reduces my students' confidence with mathematics.
4. It creates a problem for me as a teacher when the AMC 10/12 problems do not coordinate with my assigned curriculum.
5. I enjoy the fact that AMC 10/12 problems target mathematical skills not covered in our assigned curriculum.
6. The AMC 10/12 problems teach my students to think more clearly and deeply.
7. The competitive nature of the AMC 10/12 puts a lot of pressure on my students.
8. The students discuss the AMC 10/12 after the exam, either formally with me or informally among themselves, and learn from the experience.
9. I prepare my students ahead of the contest for the AMC 10/12 by working similar multi-step problems.
10. My students enjoy the AMC 10/12.

Open-ended question: How could we modify the AMC 10/12 to make it a better experience for you and your students?

## Comments on the Contest and/or its implementation:

## XIII. Additional Forms used. (if the form you need is not here, please see our web site) Additional Bundles Form - AMC 10B/12B

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 $\qquad$ CEEB \# $\qquad$
Address $\qquad$
City State $\qquad$ Zip
Teacher placing the order

P.O. Number $\qquad$
VISA/MC\# : ___ Address: $\qquad$
Name (Please Print): $\qquad$
Exp. Date: $\qquad$

## AMC ORDERING -- TERMS

1. VISA \& MasterCard accepted.
2. Make checks payable to:

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

## AMERICAN MATHEMATICS COMPETITIONS

3. PAYMENTIN U.S. FUNDS ONLY.
4.U.S.A.: $\quad \frac{\text { OrderTOTAL }}{\$ 1000-\$ 40}$ Shipping Charge*
\$10.00 -- \$40.00 \$7.00
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4. OUTSIDE U.S.A.: Add additional $\$ 10$ to U.S.A. shipping costs.

Please Send Your Order To:
American Mathematics Competitions
ATTN: AMC 10/12 Additional Bundles
P.O. Box 81606

Lincoln, NE 68501-1606
*Orders after January $18^{\text {th }}$ add $\$ 5.00$ additional for 2-day Service. Orders after January $25^{\text {th }}$ add $\$ 10.00$ additional for 1 -day Service.

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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.

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Signature: $\qquad$
Title: $\qquad$ Date:

## 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 $\qquad$ \$ $\qquad$
Contest taken: AMC 10-A AMC 10-B AMC12-A AMC12-B
Student Name
\$ $\qquad$
Contest taken: AMC 10-A AMC 10-B AMC12-A AMC12-B
Grand Total $\qquad$ \$ $\qquad$

Teacher's Name $\qquad$ CEEB \# $\qquad$
School Name $\qquad$
Address $\qquad$
City $\qquad$ State $\qquad$ Zip $\qquad$

Method of Payment:

Check (US funds only) made payable and mailed with this form to the:
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University of Nebraska-Lincoln
P.O. Box 81606

Lincoln, NE 68501-1606
Charge to Visa/Mastercard\#: $\qquad$
Name on card (print): $\qquad$
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Expiration Date: $\qquad$ Telephone: $\qquad$
FAX to: 402/472-6087

# XIV. Classroom Accessories <br> 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 2006 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/a7problems/problem81012archive.html).

- Brianna is using part of the money she earned on her weekend job to buy several equally-priced CDs. She used one fifth of her money to buy one third of the CDs. What fraction of her money will she have left after she buys all the CDs?
(A) $\frac{1}{5}$
(B) $\frac{1}{3}$
(C) $\frac{2}{5}$
(D) $\frac{2}{3}$
(E) $\frac{4}{5}$

2005 AMC 10 B, Problem \#5- "If she used one fifth of her money to buy one third of the CDs then what fraction of her money has she spent to buy three thirds of the CDs?"

[^0]
## AMC 10 Student Practice Questions continued

- Three tiles are marked X and two other tiles are marked O . The five tiles are randomly arranged in a row. What is the probability that the arrangement reads XOXOX?
(A) $\frac{1}{12}$
(B) $\frac{1}{10}$
(C) $\frac{1}{6}$
(D) $\frac{1}{4}$
(E) $\frac{1}{3}$

2005 AMC 10 A, Problem \#9- "What is the likelihood that the first spot will be an X..."

- Solution (B) There are three X's and two O's, and the tiles are selected without replacement, so the probability is

$$
\begin{gathered}
\frac{3}{5} \cdot \frac{2}{4} \cdot \frac{2}{3} \cdot \frac{1}{2} \cdot \frac{1}{1}=\frac{1}{10} \\
\text { OR }
\end{gathered}
$$

The three tiles marked X are equally likely to lie in any of $\binom{5}{3}=10$ positions, so the probability of this arrangement is $1 / 10$.

## AMC 10 Student Practice Questions continued

## - How many three-digit numbers satisfy the property that the middle digit is

 the average of the first and the last digits?(A) 41
(B) 42
(C) 43
(D) 44
(E) 45

2005 AMC 10 A, Problem \#14- "What are the conditions for the middle digit to be an integer?"

- Solution (E) The first and last digits must be both odd or both even for their average to be an integer. There are $5 \cdot 5=25$ odd-odd combinations for the first and last digits. There are $4 \cdot 5=20$ even-even combinations that do not use zero as the first digit. Hence the total is 45 .

Mathworld.com Classification:
Number Theory $>$ Arithmetic $>$ Number Bases $>$ Digit

## AMC 10 Student Practice Questions continued

- An equiangular octagon has four sides of length 1 and four sides of length $\frac{\sqrt{2}}{2}$, arranged so that no two consecutive sides have the same length. What is the area of the octagon?
(A) $\frac{7}{2}$
(B) $\frac{7 \sqrt{2}}{2}$
(C) $\frac{5+4 \sqrt{2}}{2}$
(D) $\frac{4+5 \sqrt{2}}{2}$
(E) 7


## 2005 AMC 10 A, Problem \#20- "What can we break the octagon into?"

- Solution (A) The octagon can be partitioned into five squares and four half squares, each with side length $\sqrt{2} / 2$, so its area is

$$
\left(5+4 \cdot \frac{1}{2}\right)\left(\frac{\sqrt{2}}{2}\right)^{2}=\frac{7}{2}
$$



The octagon can be obtained by removing four isosceles right triangles with legs of length $1 / 2$ from a square with sides of length 2 . Thus its area is


Difficulty: Hard
NCTM Standard: Geometry Standard: Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships

Mathworld.com Classification:
Geometry > General Geometry > Euclidean Geometry

## AMC 12 Student Practice Questions

- At the beginning of the school year, Lisa's goal was to earn an A on at least $80 \%$ of her 50 quizzes for the year. She earned an A on 22 of the first 30 quizzes. If she is to achieve her goal, on at most how many of the remaining quizzes can she earn a grade lower than an A?
(A) 1
(B) 2
(C) 3
(D) 4
(E) 5

2005 AMC 12 B, Problem \#3
2005 AMC 10 B, Problem \#6- "How many quizzes does she need to earn an A on?"

- Solution (B) To earn an A on at least $80 \%$ of her quizzes, Lisa needs to receive an $A$ on at least $(0.8)(50)=40$ quizzes. Thus she must earn an $A$ on at least $40-22=18$ of the remaining 20. So she can earn a grade lower than an $A$ on at most 2 of the remaining quizzes.


## AMC 12 Student Practice Questions continued

Square $E F G H$ is inside square $A B C D$ so that each side of $E F G H$ can be extended to pass through a vertex of $A B C D$. Square $A B C D$ has side length $\sqrt{50}$, and $B E=1$. What is the area of the inner square $E F G H$ ?

(A) 25
(B) 32
(C) 36
(D) 40
(E) 42

## 2005 AMC 12 A, Problem \#7- "What can one say about triangle BEC?"

- Solution (C) The symmetry of the figure implies that $\triangle A B H, \triangle B C E, \triangle C D F$, and $\triangle D A G$ are congruent right triangles. So

$$
B H=C E=\sqrt{B C^{2}-B E^{2}}=\sqrt{50-1}=7
$$

and $E H=B H-B E=7-1=6$. Hence the square $E F G H$ has area $6^{2}=36$.
OR
As in the first solution, $B H=7$. Now note that $\triangle A B H, \triangle B C E, \triangle C D F$, and $\triangle D A G$ are congruent right triangles, so

$$
\operatorname{Area}(E F G H)=\operatorname{Area}(A B C D)-4 \operatorname{Area}(\triangle B C E)=50-4\left(\frac{1}{2} \cdot 1 \cdot 7\right)=36
$$

NCTM Standard: Geometry Standard: Use visualization, spatial reasoning, and geometric modeling to solve problems. Mathworld.com Classification:
Geometry > Plane Geometry > Squares > Square

- What is the area enclosed by the graph of $|3 x|+|4 y|=12$ ?
(A) 6
(B) 12
(C) 16
(D) 24
(E) 25


## 2005 AMC 12 B, Problem \#7- "What is the shape of the region?"

- Solution (D) The graph is symmetric with respect to both coordinate axes, and in the first quadrant it coincides with the graph of the line $3 x+4 y=12$. Therefore the region is a rhombus, and the area is

$$
\text { Area }=4\left(\frac{1}{2}(4 \cdot 3)\right)=24
$$



Difficulty: Medium-hard
NCTM Standard: Geometry Standard: Specify locations and describe spatial relationships using coordinate geometry and other representational systems

Mathworld.com Classification:
Geometry > Plane Geometry > Quadrilaterals > Rhombus

## AMC 12 Student Practice Questions continued

- On a standard die one of the dots is removed at random with each dot equally likely to be chosen. The die is then rolled. What is the probability that the top face has an odd number of dots?
(A) $\frac{5}{11}$
(B) $\frac{10}{21}$
(C) $\frac{1}{2}$
(D) $\frac{11}{21}$
(E) $\frac{6}{11}$


## 2005 AMC 12 A, Problem \#14- "What are the effects on each face?"

- Solution (D) A standard die has a total of 21 dots. For $1 \leq n \leq 6$, a dot is removed from the face with $n$ dots with probability $n / 21$. That face is left with an odd number of dots with probability $n / 21$ if $n$ is even and $1-n / 21$ if $n$ is odd. Each face is the top face with probability $1 / 6$. Therefore the top face has an odd number of dots with probability

$$
\begin{aligned}
\frac{1}{6}\left(\left(1-\frac{1}{21}\right)+\frac{2}{21}+\left(1-\frac{3}{21}\right)+\frac{4}{21}+\left(1-\frac{5}{21}\right)+\frac{6}{21}\right) & =\frac{1}{6}\left(3+\frac{3}{21}\right) \\
& =\frac{1}{6} \cdot \frac{66}{21}=\frac{11}{21}
\end{aligned}
$$

OR
The probability that the top face is odd is $1 / 3$ if a dot is removed from an odd face, and the probability that the top face is odd is $2 / 3$ if a dot is removed from an even face. Because each dot has the probability $1 / 21$ of being removed, the top face is odd with probability

$$
\left(\frac{1}{3}\right)\left(\frac{1+3+5}{21}\right)+\left(\frac{2}{3}\right)\left(\frac{2+4+6}{21}\right)=\frac{33}{63}=\frac{11}{21} .
$$

[^1]
# The MATHEMATICAL ASSOCIATION OF AMERICA American Mathematics Competitions 

Steven Dunbar
Director

February, 2006
Dear Parent or Guardian:
On January 31, 2006 and/or February 15, 2006 your son or daughter participated in the 57th 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 America 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, one should still feel that they accomplished something, 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

## 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 2005 Summary of Results for statistics and figures from the 2005 contest. Statistics and figures for the 2006 Contest will be available on our website in March 2006.

## (School or School District) <br> FOR IMMEDIATE RELEASE

## (School) STUDENTS PARTICIPATE IN NATIONAL MATHEMATICS COMPETITION

(\#) students at (School) participated in the $57^{\text {th }}$ annual American Mathematics Contest 12, and/or the $7^{\text {th }}$ annual American Mathematics Contest 10. The contests were held on Tuesday, January 31, (or Wednesday, February 15 2006). 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 2005 over 250,000 students from 4,400 schools participated in the AMC $10 \&$ AMC 12 contest including (\#) students from (\#) schools in (State). Top scorers at (school) were ( $\qquad$ , $\qquad$ , 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)
American Mathematics Contest 10 (AMC 10)
American Mathematics Contest 12 (AMC 12)
American Invitational Mathematics Examination (AIME)
USA Mathematical Olympiad (USAMO)
Mathematical Olympiad Summer Program (MOSP)
International Mathematical Olympiad (IMO)

Grades 6-8
Grades 10 \& below 2 dates in January/February
$\begin{array}{ll}\text { Grades } 10 \& \text { below } & 2 \text { dates in January/February } \\ \text { Grades } 12 \& \text { below } & 2 \text { dates in January/February }\end{array}$
All who qualify
All who qualify
Qualify thru USAMO
Top six from USAMO, MOSP

November

2 dates in March
mid- to late-April
June
July

The AMC is located at the University of Nebraska - Lincoln. and receives support from the Akamai Foundation, American Mathematical Association of Two Year Colleges, American Mathematical Society, American Society of Pension Actuaries, American Statistical Association, Art of Problem Solving, Canada/USA Mathpath, Canada/USA Mathcamp, Casualty Actuarial Society, Clay Mathematics Institute, Institute for Operations Research and the Management Sciences, Mu Alpha Theta, National Association of Mathematicians, National Council of Teachers of Mathematics, Pedagoguery, Inc., Pi Mu Epsilon, and the Society of Actuaries. The Contests are given across the U.S.A, Canada, and in many schools abroad.

Details concerning the 2006 AMC 10/12 contests for High School, as well as the rest of AMC's programs are available on the AMC web site: www.unl.edu/amc/.

For further information contact the AMC -- telephone: 800/527-3690, email: amcinfo@unl.edu.


The Mathematical Association of America
American Mathematics Competitions
CERTIFICATE
Awarded to
for participating in the
American Mathematics Contest 10 (AMC 10)) 2006


Director
American Mathematics Competitions



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## CERTIFICATE

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Annericaun Mathematics Contest 12
(AMC 12)


American Mathematics Competitions

2006


MC 12 Subcommittee


The Mathematical Association of America American Mathematics Competitions

## CERTIFICATE

 $\mathcal{A}$ warded tofor participating in the
Annericaun Maithernaitics Contest 12
(AMC 12)
thrown P. Dunbar
2006
$\frac{\text { David MAgNets }}{\text { Chair }}$ ASMC12 Subcommittee

## Facsimile of AMC 10 Front Cover

## Wednesday, FEBRUARY 15, 2006

## $7^{\mathrm{h}}$ Annual American Mathematics Contest 10

AMC 10


## Contest B

## The MATHEMATICAL ASSOCIATION OF AMERICA <br> American Mathematics Competitions

1. DO NOT OPEN THIS BOOKLET UNTIL YOUR PROCTOR GIVES THE SIGNAL TO BEGIN.
2. This is a 25 -question, multiple choice test. Each question is followed by answers marked $\mathrm{A}, \mathrm{B}, \mathrm{C}, \mathrm{D}$ 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, 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 to complete the test.
8. When you finish the exam, sign your name in the space provided on the Answer Form.

Students who score in the top $1 \%$ on this AMC 10 will be invited to take the $23^{\text {rd }}$ annual American Invitational Mathematics Examination (AIME) on Tuesday, March 7, 2006 or Wednesday, March 22, 2006. 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. Dissemination at any time via copier, telephone, email, World Wide Web or media of any type is a violation of the competition rules.

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## Facsimile of AMC 12 Front Cover



This Pamphlet gives at least one solution for each problem on this year's contest and shows that all problems can be solved without the use of a calculator. When more than one solution is provided, this is done to illustrate a significant contrast in methods, e.g., algebraic vs geometric, computational $v s$ conceptual, elementary $v s$ advanced. These solutions are by no means the only ones possible, nor are they superior to others the reader may devise.
We hope that teachers will inform their students about these solutions, both as illustrations of the kinds of ingenuity needed to solve nonroutine problems and as examples of good mathematical exposition. However, 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. Dissemination at any time via copier, telephone, email, the World Wide Web or media of any type is a violation of the competition rules

Correspondence about the problems and solutions for this AMC 12 and orders for any of the publications listed below should be addressed to:

American Mathematics Competitions
University of Nebraska, P.O. Box 81606
Lincoln, NE 68501-1606
Phone: 402-472-2257; Fax: 402-472-6087; email: amcinfo@unl.edu
The problems and solutions for this AMC 12 were prepared by the MAA's Committee on the AMC 10 and AMC 12 under the direction of AMC 12 Subcommittee Chair:

Prof. David Wells, Department of Mathematics
Penn State University, New Kensington, PA 15068
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## The American Mathematics Competitions

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

## The MATHEMATICAL ASSOCIATION OF AMERICA AMERICAN MATHEMATICS COMPETHTIONS


[^0]:    - Solution (C) The number of CDs that Brianna will finally buy is three times the number she has already bought. The fraction of her money that will be required for all the purchases is $(3)(1 / 5)=3 / 5$. The fraction she will have left is $1-3 / 5=2 / 5$.

[^1]:    Difficulty: Hard
    NCTM Standard: Data Analysis and Probability Standard: Understand and apply basic concepts of probability Mathworld.com Classification:

    Probability and Statistics $>$ Probability $>$ Probability

