30th Annual

American Mathematics Competitions

American Invitational Mathematics Examination

TEACHERS’ MANUAL

Instructions and Reporting Forms
for School Contest Managers

dates to remember:
AIME - Thursday, March 15, 2012
Alternate AIME - Wednesday, March 28, 2012

Please read this booklet thoroughly upon receipt.

PLEASE NOTE: USA(J)MO TEACHERS’ MANUAL ON FLIP SIDE
To All AIME Managers:

Please read this manual regarding the AIME rules and regulations thoroughly. Note our policy for the official administration of the AIME. The AIME I can only be given officially on THURSDAY, March 15th, and the AIME II can only be given officially on WEDNESDAY, March 28, 2012. The contest should be scheduled from 9AM to 12 noon if possible.

All students who are in the top 5% of all American Mathematics Contest 12 (AMC 12) participants or score at least 100 points on the AMC 12 and those with a score in the top 2.5% of the American Mathematics Contest 10 (AMC 10) participants or score at least 120 points, are invited to take the AIME. The AIME is the second in the sequence of mathematics contests which leads to participation in the USA Mathematical Olympiad and the designation of Winners of the USA(J)MO. The AIME is a 15-question, 3-hour examination. All answers are integers ranging from 000 to 999, inclusive. The score is the number of correct answers. There is neither partial credit nor a penalty for wrong answers.

I call your attention to several items found in this manual which answer inquiries I frequently receive from AIME Managers:

1. All administrations of the AIME must take place on the scheduled dates. There will be a expedited handling 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 copy of the Alternate AIME Payment Form may be found on page 11 of your AIME Teachers’ Manual. All AIME answer forms must be returned by “express mail” so that they arrive in the AMC office by March 30, 2012.

2. Email requests for the second AIME may be sent to: AMCINFO@MAA.ORG Email requests should include the school’s CEEB number and complete mailing address, teacher name, teacher email address, number of students taking the AIME II, and method of payment. You may also register online using a credit card at amc-reg.maa.org

3. Under no circumstances can a student take both AIMEs.

4. In section V you will find a discussion of how and when you will receive results.

5. On the reverse side of this Manual you will find a section relating to the USAMO & USAJMO. In this section you will find all the information and forms relevant to the taking of the USA(J)MO. If you have had students qualify for the USA(J)MO in the past, or you are anticipating this to be so this year, please look over this new material. REGARDLESS, do not throw this Manual away until you have received the results of this year’s AIME. You may need the USA(J)MO forms.

6. The second AIME on Wednesday, March 28, 2012 is a new set of 15 questions, completely different from, but comparable in difficulty to the AIME on March 15, 2012.

7. Selection of USAMO & USAJMO participants will depend on the AMC 10/12 score, and AIME score.

We feel that the 2012 AIME will be interesting and challenging to your student(s). On behalf of the Committee on the American Mathematics Competitions, I send my appreciation to you for assisting with the implementation of this examination.

Sincerely,

Steven R. Dunbar
Director
MAA, American Mathematics Competitions
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I.  List of the Sponsors

The American Mathematics Competitions

are Sponsored by
The Mathematical Association of America – MAA .......................................................... www.maa.org
The Akamai Foundation ...........................................................................................................www.akamai.com

Contributors
Academy of Applied Sciences - AAS ................................................................................ www.aas-world.org
American Mathematical Association of Two-Year Colleges – AMATYC .................................... www.amatyyc.org
American Mathematical Society - AMS ...................................................................................... www.ams.org
American Statistical Association – ASA ........................................................................................ www.amstat.org
Art of Problem Solving - AoPS ........................................................................................................ www.artofproblemsolving.com
Awesome Math ...................................................................................................................... www.awesomemath.org
Casualty Actuarial Society – CAS .............................................................................................. www.casact.org
D.E. Shaw & Co. ............................................................................................................................... www.deshaw.com
IDEA Math ........................................................................................................................................ www.idea.math.org
Jane Street .......................................................................................................................................... www.janestreet.com
Math for America ....................................................................................................................... www.mathforamerica.org
Mu Alpha Theta – MAT ................................................................................................................. www.mualphatheta.org
National Council of Teachers of Mathematics – NCTM ............................................................... www.nctm.org
Pi Mu Epsilon – PME ....................................................................................................................... www.pme-math.org
Society for Industrial and Applied Math – SIAM ............................................................................ www.siam.org
W.H. Freeman and Company .............................................................................................................www.whfreeman.com
II. Contents of Package

You will find enclosed, in addition to this Teachers’ Manual, the following material:

- A list of your qualified AIME students.
- A sealed envelope containing one AIME for each of your qualified students and an extra copy for you. The envelope must NOT be opened until just before the examination is given on the authorized date.
- AIME Answer Forms. One for each participating student.
- One AIME School Identification Form.
- One AIME Report Envelope.
- One Alternate AIME Payment Form (page 11 in this Manual) and Return Envelope

We will mail the Solutions for the AIME with your AIME school report.

III. Preparation Instructions

1. Please study the contents of this Teachers’ Manual.
2. Reserve a room for 3 1/2 hours from 8:45 AM - 12:15 PM to administer the AIME on Thursday, March 15, 2012 from 9AM - 12 noon. This allows 15 minutes for pre- and post-examination activities and 3 hours for the examination itself. In extreme cases where you cannot administer the AIME between 7:00 am and 3:00 pm, please complete the academic integrity pledge form on page 13.
3. Inform the students well in advance of the time and place. Urge them to prepare for the AIME by studying past AIME exams and solutions and other challenging problems. Refer to Form C- PUBLICATION ORDER FORM on Page 10 in this manual for ordering information relating to prior year AIME exams.
4. Review the Examination Rules printed on the sealed envelope which contains the examination.
5. Obtain a supply of:
   a. Number 2 lead pencils with good erasers
   b. Unmarked scratch paper
   c. Rulers, compasses, protractors, and graph paper
6. Calculators and Computers are NOT permitted.
7. Complete the AIME School Identification Form using the instructions found on the Form.
8. Please study the AIME STUDENT ANSWER FORM. Have each student complete Side 1 of the Form using the instructions found on the Form. Please carefully follow the marking instructions printed on both the identification and student answer forms, and double check to see that all the items are filled out correctly. Students may not complete the personal information after the time allowed for the test. Only the information which has been properly blackened will be read by the Opscan reader. Be sure to mark the AMC 10 or AMC 12 score in the appropriate area, including decimals if needed.
9. The AIME Answer Form is now ready for distribution to your qualified students on Thursday, March 15th.
10. Make arrangements to mail your AIME Report Envelope by First Class Mail (or Express Mail if taking the alternate date). Please note that this is an oversized envelope and thus requires special postage even if it weighs one ounce or less.

IV. Day of the AIME Instructions

1. Sign the Certification Form to certify that the package was opened within an hour before the contest (on page 7).
2. Seat participants in alternate seats.
3. Ensure that each participant has the supplies listed on Item 5 under Section III.
4. Inform the students that they are not to open the exam booklet until instructed to do so.
5. Pass out the examination and have the students read the instructions on the front cover.
6. Next, distribute the AIME Answer Forms (which you or your students previously marked) to the students. Inform them that their answers should be marked with a pencil on SIDE 2 of the Form and that each problem has only one correct answer, an integer between 000 and 999 inclusive.
7. Read aloud the following instructions for recording answers to the problems:
   a. For each question you answer, USING A #2 PENCIL, for your reference write your answer at the top of the problem answer columns using 3 digits, then in each of these columns blacken the one circle which is labeled with the digit you have written at the top. PLEASE NOTE: A single digit answer, such as 7, should be written and blackened as 007 and a two digit answer, such as 43, should be written and blackened as 043.
   b. DO NOT BLACKEN ANSWERS UNTIL YOU ARE CERTAIN OF YOUR FINAL CHOICE. AVOID, IF POSSIBLE, ERASURES IN THE CIRCLES.
   c. The results will be graded by computer. Only the blackened circles will be graded.
8. Ask the students if they have any questions about using the AIME Answer Form or about the instructions for the examination.
9. Start the Examination.
10. Check to see if each student is marking his/her Answer Form properly.
11. Allow exactly 3 hours working time.
12. If there is an urgent need to use a bathroom, inform the students that only one student may leave at one time and the AIME answer form and exam should be retained by you during the departure period. If there is a health or medical emergency a backup exam manager should be available for such a contingency.
13. At the end of 3 hours, instruct the students to:
   a. STOP.
   b. Put aside the booklet and scratch paper and look again to be sure the AIME Answer Form has been filled out correctly.
   c. Be sure the written answers on the top of the AIME Answer Form are in agreement with the blackened circles’ coded answers.
   d. Sign their name on Side 2 of the answer form.
   e. Hand in the AIME Answer Form.
   f. Keep the examination booklet for their reference in conjunction with your review of the Solutions. Inform the students that they may now leave the examination room.
14. Complete the Certification Form (form A) and USA(J)MO Information Form (form B) found on pages 7 and 8.
V. Report of the AIME Results
The AIME score of your student(s), Certificates of Participation, an AIME Solutions Pamphlet and the list of USA(J)MO selectees will be sent to you.

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

VI. 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 AIME (with qualifying score). US and Canadian Citizens and students residing in the United States (with qualifying scores) are eligible to take the USA(J)MO.

Home School Students age 19.5 and under are eligible for the AIME (with qualifying score).

Students learning “English as a Second Language” (ESL) may use a book or 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 AIME. 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. Policy on AIME Administration
You must give the AIME on the official date (March 15th) to all students in the same place and at the same time; invited students who cannot be there miss this opportunity. Be advised that if students miss the exam, Thursday, March 15, 2012, they may take the alternate sitting of the exam, Wednesday, March 28, 2012. The second AIME on Wednesday, March 28, 2012 is a new set of 15 questions completely different from, but comparable to the AIME on March 15, 2012.

If you need to have a student or students sit for the second exam on March 28th, read below for the applicable details and then contact the AMC office if you have questions. There is a minimal charge for the second exam due to compressed shipping considerations. These two dates will be the only dates acceptable for qualifying for the USA(J)MO.

There is a processing fee for the second AIME as follows: 1-10 students = $25, 11+ students = $50. We need your payment before we grade the answer forms. The Alternate AIME payment form can be found on page 11 of this manual. All Alternate AIME (AIME II) answer forms must be returned by “express mail” so that they arrive in the AMC office by March 30, 2012.

Email requests for the second AIME may be sent to: AMCINFO@MAA.ORG

Email requests should include the school’s CEEB number and complete mailing address, teacher name, teacher email address, number of students taking the AIME II, and method of payment. Or, you may wish to register online using a credit card at amc-reg.maa.org. The AMC office will send a confirmation of registration for the AIME II. Please note that you will be billed for all AIME II shipped, unless you cancel your order before March 15, 2012.

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

VIII. Visually Impaired and Learning Disabled Students
If one of your AIME qualified students is visually impaired and/or learning disabled please call the AMC office and we will discuss the options available to you. We do not have copies available in braille. The time allowance for students with learning disabilities is 4.5 hours.

IX. Request for Student Names
The following statement appears on the student answer forms for the AMC 10 and AMC 12:

1. 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 academic purposes.

2. 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.
X. Fascimile of the March 15, 2012 AIME Front Cover

1. **DO NOT OPEN THIS BOOKLET UNTIL YOUR PROCTOR GIVES THE SIGNAL TO BEGIN.**

2. This is a 15-question, 3-hour examination. All answers are integers ranging from 000 to 999, inclusive. Your score will be the number of correct answers; i.e., there is neither partial credit nor a penalty for wrong answers.

3. No aids other than scratch paper, graph paper, ruler, compass, and protractor are permitted. In particular, **calculators and computers are not permitted.**

4. A combination of the AIME and the American Mathematics Contest 12 are used to determine eligibility for participation in the USA Mathematical Olympiad (USAMO). A combination of the AIME and the American Mathematics Contest 10 are used to determine eligibility for participation in the USA Junior Mathematical Olympiad (USAJMO). The USAMO & the USAJMO will be given in your school on TUESDAY and WEDNESDAY, April 24 & 25, 2012.

5. Record all of your answers, and certain other information, on the AIME answer form. Only the answer form will be collected from you.

After the contest period, permission to make copies of individual problems in paper or electronic form including posting on web pages for educational use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear the copyright notice.

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FORM A – Examination Certification 2012 AIME

Certification by the Examination Manager:

I certify that the 2012 American Invitational Mathematics Examination was given today, Thursday, March 15, 2012 / Wednesday, March 28, 2012 (circle appropriate date); that all students who took it did so at the same time and place; that only invited students took it; that the 3-hour time limit was strictly enforced; that the test envelope was sealed until the time of the test; that no student had access to the test questions in advance; that the students were continually supervised by a proctor while they were taking the test; that I am returning those materials as required in Section IV; and that all other rules for administering the test were followed.

☐ YES  ☐ NO  If no, describe the exceptions on a separate sheet of paper.

I also certify that I understand and accept the following for our school. The Committee on the American Mathematics Competitions reserves the right to:

1. Disqualify all scores from our school if it is determined that the required security procedures were not followed.
2. Re-examine students if, after an inquiry, there is a reasonable basis to believe that the scores do not validly represent the ability of the students. (The procedures for disqualification, follow-up inquiries and re-examination are similar to those for the AMC 10 and AMC 12, as outlined in the AMC 10/12 Teachers’ Manual.)

Signature of AIME School Manager ________________________________

Email ___________________________________________________________________________________

Date __________________ School Telephone # ________________________________

Name of School ____________________________________________________________________________

State _________________________  School Identification Number (CEEB) ___ ___ ___ ___ ___ ___

The AIME was administered on (circle correct date)  March 15, 2012       March 28, 2012

Starting Time ________________________________  Ending Time _________________________________

Student(s) who qualified for the AIME at multiple locations:

Student Name: ________________________________________________________

Reg.attended school: CEEB#:___ ___ ___ ___ ___ ___ Name:________________________________________

Other location:     CEEB#:___ ___ ___ ___ ___ ___ Name:________________________________________

Student Name: ________________________________________________________

Reg.attended school: CEEB#:___ ___ ___ ___ ___ ___ Name:________________________________________

Other location:     CEEB#:___ ___ ___ ___ ___ ___ Name:________________________________________

If there are more than 2 students, please attach a separate page with this information listed for each student.

The Examination Manager and the Principal, Vice Principal, or Headmaster must sign this form. Return it with your student Answer Forms.

Certification by the Principal, Official or person with comparable title:

I agree that the contest manager followed all the rules and procedures listed above.

Signature __________________________________________________________ Time ____________________________

Title ___________________________________________________________________________  Date ____________________________

Please also complete the OLYMPIAD INFORMATION Form B, found on Page 8.
FORM B – USAMO/USAJMO Information Form

When a student qualifies for the United States of America Mathematical Olympiad (USA(J)MO), both the student and the USA(J)MO School Manager are notified at least one week before the USA(J)MO date. Don’t worry about an invitation getting lost in the mail. When a USA(J)MO invitation is extended, both the student and the USA(J)MO School Manager must complete and return a USA(J)MO Response Form. If the Form is not returned, we do a follow-up.

Please provide the information requested below if you agree to administer the USA(J)MO. There is no fee for participating in the USA(J)MO.

AGREEMENT STATEMENT:
In the event that I have a qualifying student(s), I or my designee (indicated below) agree to:

1. Serve as the USA(J)MO School Manager.
2. Administer the USA(J)MO on Tuesday, April 24th, and Wednesday, April 25th, 2012 to the student(s) in my school who qualify and not to any other students.
3. Arrange for the exclusive use of a room for four and a half hours (from 12:30pm to 5:00pm, eastern daylight time or your time zone equivalent, see below) on the designated days which will be used to administer the USA(J)MO.
4. Have a proctor present in the room to supervise the student(s) during the entire nine hours duration of the examination.
5. Have the ability to fax the students answer sheets to the AMC fax number immediately, to be graded with the rest of the papers by the AMC.

I understand that results of my participating USA(J)MO students could be voided if the rules and procedures associated with the administration of the USA(J)MO are not followed.

Signature ___________________________________________________________________________________

Telephone Number ___________________________________________ Date __________________

Name of USA(J)MO School Manager ____________________________________________________________

eMail _____________________________________________________________________________________

School _____________________________ CEEB#: __ __ __ __ __

City _____________________________ State _________ Zip ___________

PLEASE NOTE THIS YEARS 4.5 HOURS PER DAY TIME LENGTH AND 2 DAYS LENGTH
FOR THE 2012 USA(J)MO:

TUESDAY, April 24, 2012
12:30-5:00 p.m., Eastern Daylight Time
11:30-4:00 p.m., Central Daylight Time
10:30-3:00 p.m., Mountain Daylight Time
9:30-2:00 p.m., Pacific Daylight Time

WEDNESDAY, April 25, 2012
12:30-5:00 p.m., Eastern Daylight Time
11:30-4:00 p.m., Central Daylight Time
10:30-3:00 p.m., Mountain Daylight Time
9:30-2:00 p.m., Pacific Daylight Time

All other time zones, contact the AMC office at amcinfo@maa.org
American Mathematics Competitions

Available Publications - Descriptions

For more complete descriptions please see our website: amc.maa.org

For additional publications please visit the MAA online store at: www.maa.org

AMC Middle School Publications

1. Individual AJHSME/AMC 8 Practice Sets
   Please refer to #10, the AJHSME & AMC 8 CD or #16, the MAA AMC 8 Math Club Package.

2. AMC 8 Summary of Results .......................................................... $6.00 each
   Contains a listing of school and student award recipients, etc., and statistical tables.

AMC High School Publications

3. Individual AMC 10 Practice Sets .............................................. $2.00 each
   AMC 10A or AMC 10B. Each set contains an exam booklet and a solutions pamphlet.

4. Individual AHSME/AMC 12 Practice Set ...................................... $2.00 each
   AMC 12A or AMC 12B. Each set contains an exam booklet and a solutions pamphlet.

5. Individual AIME Practice Sets .................................................. $2.00 each
   AIME I or AIME II. Each set contains an exam booklet and a solutions pamphlet.

6. AMC 10/12 Summary of Results .............................................. $11.00 each
   Contains a listing of school and student award recipients, etc., and statistical tables.

School Awards

7. Recognition for Achievement Award Pin ...................................... $3.50 each

8. AMC 8 Merit Certificate .............................................................. $3.00/set
   Contains 10 certificates per set.

9. AMC 10/12 Merit Certificate ....................................................... $3.00/set
   Contains 10 certificates per set.

10. CD -- AJHSME & AMC 8 (1985-2007) ......................................... $20 each
    Contains all the Junior High/Middle School contests, from the first AJHSME in 1985 through the name change in 2000 to AMC 8. Includes all the class worksheets currently developed, 1999-2007.

11. CD -- AHSME 1 (1950-1974) ......................................................... $20 each
    Contains the first 25 years of the original Annual high school contests, from the first Math Contest in 1950 through the name change to Annual High School Math Examinations (AHSME) in 1956 to 1974.

12. CD -- AHSME 2 (1975-1999) ......................................................... $20 each
    Contains the second 25 years of the Annual High School Math Examinations (AHSME), from 1975 to 1999.

    Contains AIME and USAMO contests and solutions for stated years along with selected Math Olympiad Summer Program materials.

14. MAA AMC T-Shirt ....................................................................... $15 each
    Choose from a black t-shirt with the theme, “6 Decades of the American Mathematics Competitions.” Design on back, logo on front left chest; or choose a light blue t-shirt featuring the new MAA logo. Design on front chest and upper back. Men’s sizes available: Small, Medium, Large and X-Large. Quantities are limited in black.

15. MAA AMC Men’s Dress Ties ....................................................... $12 each
    Navy blue with mathematical terms.

16. MAA AMC 8 Math Club Package ................................................ $25 each
    Tips and ideas for Middle School - use with your Math Club or Circle, or with students in class. Includes 50 new question worksheets and an appendix on “Elusive Formulas.” Contains a CD of the AMC contests for the 21st century AMC 8, AMC 10, and AMC 12 and for the AIME and USAMO. The CD also includes problem worksheets from the AMC 8 and the AMC 10 and AMC 12.

17. MAA AMC 10/12 Math Club Package ........................................... $25 each
    Tips and ideas for High School - use with your Math Club or Circle, or with students in class. Includes 50 new question worksheets and an appendix on “Elusive Formulas” Contains a CD of the AMC contests for the 21st century AMC 8, AMC 10, and AMC 12 and for the AIME and USAMO. The CD also includes problem worksheets from the AMC 8 and the AMC 10 and AMC 12.
MAA AMC Publications Ordering – TERMS

1. School or Contest Manager: ______________________________________________
2. School Name: _______________________________________________________
3. School Street Address: _________________________________________________
5. School Phone #: ____(____________) ____________________________________
6. Email Address: _______________________________________________________
7. CHARGE INFORMATION:
   a. Credit Card: VISA/MC: _______________________________________________
   b. Exp. Date: ___________
   c. Credit Card Holder’s Name: _________________________________________
8. Payment Information:
   a. Check: payable to: American Mathematics Competitions
   b. Check in U.S. Funds Only
   c. U.S. Contiguous 48 States Only: $0.00
   d. Additional shipping required for International/overseas addresses, please contact AMC office at amcinfo@maa.org for more information.
9. Order is for: AMC 10A/11A or AMC 10B/11B
10. Minimum order $10 is required.
11. VISA and MasterCard accepted.
12. Additional shipping fee for International/overseas addresses, please contact AMC office at amcinfo@maa.org for more information.
13. Purchase Orders accepted.
14. Prices good until September 1, 2012
15. Please allow 2-3 weeks for delivery.
16. MAA AMC Men’s Navy Blue Dress Ties ..............................................
17. MAA AMC 10/12 Math Club Package w/ decade CD ..........................
18. MAA AMC 8 Math Club Package w/ decade CD .................................

AMC Middle School Publications

1. Individual Practice Set (exams & solutions) for AJHSME/AMC 8
   a. 11A___ 11B___ 08___09___ 97___98___99___ 11A___ 04B___08B___10B___11B___
   b. 91___93___95___96___97___98___99___ AIME I00___01___03___04___05___07___08___09___10___11___
   c. AIME II00___01___03___04___05___06___07___08___09___10___00___01___02___03___04___05___10___
2. AMC 8/10/12 Math Club Package w/ decade CD
3. AMC 8 Math Club Package w/ decade CD
4. AMC 10/12 Math Club Package w/ decade CD
5. AMC 8/10/12 Math Club Package w/ decade CD
6. AMC 8/10/12 Math Club Package w/ decade CD
7. AMC 8/10/12 Math Club Package w/ decade CD
8. AMC 8/10/12 Math Club Package w/ decade CD

AMC High School Publications

1. Individual Practice Set (exams & solutions) for AMC 10/A/B
2. AMC 8/10/12 Math Club Package w/ decade CD
3. Individual Practice Set (exams & solutions) for AMC 10/A/B
4. Individual Practice Set (exams & solutions) for AMC 10/A/B
5. Individual Practice Set (exams & solutions) for AMC 10/A/B
6. Individual Practice Set (exams & solutions) for AMC 10/A/B
7. Individual Practice Set (exams & solutions) for AMC 10/A/B
8. Individual Practice Set (exams & solutions) for AMC 10/A/B

Other Items

1. CD–AJHSME/AMC 8 1985-2007, contests, solutions & worksheets #___ @ $20/ea = $_______
2. CD–AHSME 1, 1950-1974, contests & solutions .......................................#___ @ $20/ea = $_______
3. CD–AHSME 2, 1975-1999, contests & solutions .......................................#___ @ $20/ea = $_______
4. CD–AIME, 1983-2008 + USAMO, 1972-2008 ...................#___ @ $20/ea = $_______
5. MAA AMC T-Shirt ...............................................................#___ @ $15/ea = $_______
6. MAA AMC Men's Navy Blue Dress Ties ..............................................#___ @ $12/ea = $_______
7. MAA AMC 8 Math Club Package w/ decade CD .............................#___ @ $25/ea = $_______
8. MAA AMC 10/12 Math Club Package w/ decade CD .....................#___ @ $25/ea = $_______
9. 2009-2010 AMC 10 A/B Contest w/ CD .................................#___ @ $25/ea = $_______
10. 2011 AMC 10 A/B Contest w/ CD .............................................#___ @ $25/ea = $_______
11. 2012 AMC 10/12 A/B Contest w/ CD .............................................#___ @ $25/ea = $_______
12. 2011 AMC 10 A/B Contest w/ CD .............................................#___ @ $25/ea = $_______
13. 2007-2008 AMC 10/12 A/B Contest w/ CD .............................................#___ @ $25/ea = $_______
14. 2007-2008 AMC 10/12 A/B Contest w/ CD .............................................#___ @ $25/ea = $_______
15. 2007-2008 AMC 10/12 A/B Contest w/ CD .............................................#___ @ $25/ea = $_______
16. 2007-2008 AMC 10/12 A/B Contest w/ CD .............................................#___ @ $25/ea = $_______
17. 2007-2008 AMC 10/12 A/B Contest w/ CD .............................................#___ @ $25/ea = $_______
18. 2007-2008 AMC 10/12 A/B Contest w/ CD .............................................#___ @ $25/ea = $_______
19. 2007-2008 AMC 10/12 A/B Contest w/ CD .............................................#___ @ $25/ea = $_______
20. 2007-2008 AMC 10/12 A/B Contest w/ CD .............................................#___ @ $25/ea = $_______
21. 2007-2008 AMC 10/12 A/B Contest w/ CD .............................................#___ @ $25/ea = $_______
22. 2007-2008 AMC 10/12 A/B Contest w/ CD .............................................#___ @ $25/ea = $_______
23. 2007-2008 AMC 10/12 A/B Contest w/ CD .............................................#___ @ $25/ea = $_______
FORM D – Alternate AIME Payment Form

2012 Alternate AIME
Wednesday, March 28, 2012

The Alternate AIME on Wednesday, March 28, 2012 is a new set of 15 questions, completely different from, but comparable to the AIME on March 15, 2012. Please send payment before March 23, 2012. If you are using a credit card, you may register online at amc-reg.maa.org

PLEASE PRINT

School CEEB # __ __ __ __ __ __ __ __ __
Contest Manager: ____________________________________________________________
School Name: _____________________________________________________________________
School Address: _______________________________________________________________________
City: __________________________ State: ____________ Zip: _______________________
School Phone #: _____________________________________________________________________
Email: ____________________________________________________________________________

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 has been included with your AIME material. All AIME answer forms must be returned by “express mail” so that they arrive in the AMC office by March 30, 2012.

Number of AIME qualifiers who will be taking the Alternate AIME on Wednesday, March 28, 2012:

Number of Alternate Exams Requested: #______
☐ 1-10 student qualifiers @ $25.00 = $_______
 OR
☐ 11+ student qualifiers @ $50.00 = $_______

Method of Payment:
☐ Check enclosed (US funds only) made payable and mailed with this form

☐ Charge to Visa/Mastercard #: __________________________________________________________________________

Name on card (print): ________________________________________________________________________________
Signed: ________________________________________________________________________________________________
Expiration Date: _____________ Telephone: _______________________________________________________________________
Email: ________________________________________________________________________________________________

AMERICAN MATHEMATICS COMPETITIONS
University of Nebraska-Lincoln
PO Box 880658
Lincoln, NE 68588-0658

1-800-527-3690  Email: amcinfo@maa.org  Fax: 402-472-6087
AIME 2012 Teacher Manual

Form E – Rescoring Request Form

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

<table>
<thead>
<tr>
<th>Student Name</th>
<th>Contest taken: AMC 10-A AMC 10-B AMC12-A AMC12-B AIME AIME II</th>
<th>$</th>
<th>10.00/each</th>
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Grand Total | $ | 10.00/each |

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<tr>
<th>School Name</th>
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<th>City</th>
<th>State:</th>
<th>Zip</th>
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</table>

Method of Payment:
Check (US funds only) made payable and mailed with this form to:
AMERICAN MATHEMATICS COMPETITIONS
University of Nebraska-Lincoln
P.O. Box 81606
Lincoln, NE 68501-1606

Charge to Visa/Mastercard#:

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<th>Name on card (print):</th>
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Signed

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<th>Expiration Date:</th>
<th>Telephone:</th>
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</table>

FAX to: 402-472-6087
American Invitational Mathematics Examination (AIME)

**On-site Official**

**Section 1 – Student**

This disclaimer statement is to be completed by all students taking the AIME in their school on the scheduled date of the contest, but at a later time from the other students, due to the requirement of attendance at an official academic function, which conflicted with the regularly scheduled time of the administration of the AIME. Reexamination may be requested if, 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.

I certify that prior to my taking of the 2012 AIME on Thursday, March 15, 2012, I had absolutely no contact or communication with any student who participated in the contest, nor had I seen any of this year's contest questions.

Signed: ___________________________________________    Date:  __________________________________
Name of School: __________________________________________________

**Section 2 – Contest Administrator**

This section is to be completed by the teacher who administered the AIME on the day of the contest (Thursday, March 15, 2012) but at a time different from the regularly scheduled time.

This student (these students) participated in an officially sanctioned academic function. The student(s) had no contact or communication with any student who participated in the contest, nor had they seen any of this year’s AIME. All contest papers were collected after any previous administrations, and students were instructed not to discuss the questions.

I administered the AIME to the student(s) indicated in Section 1 on (DATE):  _________________________
Contest time period: From ______________  to _______________
Name (please print): __________________________________________________________
Title (please print): _____________________________________________________________
Signature:  ______________________________________________________________________
School name and address: ______________________________________________________

Date this form completed: ________________________

PLEASE INCLUDE THIS FORM WITH THE ANSWER FORMS OF THE STUDENTS.
Jar A contains four liters of a solution that is 45% acid. Jar B contains five liters of a solution that is 48% acid. Jar C contains one liter of a solution that is \( k \)\% acid. From jar C, \( \frac{m}{n} \) liters of the solution is added to jar A, and the remainder of the solution in jar C is added to jar B. At the end both jar A and jar B contain solutions that are 50% acid. Given that \( m \) and \( n \) are relatively prime positive integers, find \( k + m + n \).

**2011 AIME I, Problem #1—**

"How much acid is in the mixture of all three jars?"

**Solution**

**Answer (085):** If the contents of all three jars were mixed together, the mixture would be ten liters that is 50% acid. Thus the total amount of acid in the three solutions is 

\[ 4 \cdot 0.45 + 5 \cdot 0.48 + 0.01k = 5, \text{ so } k = 80. \]

When \( x \) liters from jar C are added to jar A, the final proportion of acid in jar A is 

\[ 0.5 = \frac{4 \cdot 0.45 + 0.8x}{4 + x}. \]

Solving gives \( x = \frac{2}{3} \), and so the requested sum is \( 80 + 2 + 3 = 85. \)

**CCSS-M:** N-Q.1. Use units as a way to understand problems and to guide the solution of multi-step problems;
In rectangle $ABCD$, $AB = 12$ and $BC = 10$. Points $E$ and $F$ lie inside rectangle $ABCD$ so that $BE = 9$, $DF = 8$, $BE \parallel DF$, $EF \parallel AB$, and line $BE$ intersects segment $AD$. The length $EF$ can be expressed in the form $m\sqrt{n} - p$, where $m, n,$ and $p$ are positive integers and $n$ is not divisible by the square of any prime. Find $m + n + p$.

2011 AIME I, Problem #2—
"Take advantage of the Pythagorean Theorem."

Solution

Answer (036):

Let $G$ be the foot of the perpendicular from $E$ to $AB$, and let $H$ be the foot of the perpendicular from $F$ to $CD$. Note that $\triangle BEG$ is similar to $\triangle DFH$, thus $\frac{EG}{FH} = \frac{BE}{DF}$. Therefore $\frac{10 - FH}{FH} = \frac{9}{8}$, and $FH = \frac{80}{17}$. Note that

$$EF = P_1P_2 - P_1E - P_2F = AB - AG - CH = AB - (AB - BG) - (CD - DH) = BG + DH - CD = \frac{9}{8} \cdot DH + DH - CD = \frac{17}{8} \cdot DH - CD = \frac{17}{8} \sqrt{DF^2 - FH^2} - CD = \frac{17}{8} \sqrt{8^2 - \left(\frac{80}{17}\right)^2} - 12 = 3\sqrt{21} - 12.$$

Thus $m + n + p = 36$.

CCSS-M: G-SRT.8. Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.
Let \( L \) be the line with slope \( \frac{5}{12} \) that contains the point \( A = (24, -1) \), and let \( M \) be the line perpendicular to line \( L \) that contains the point \( B = (5, 6) \). The original coordinate axes are erased, and line \( L \) is made the \( x \)-axis and line \( M \) the \( y \)-axis. In the new coordinate system, point \( A \) is on the positive \( x \)-axis, and point \( B \) is on the positive \( y \)-axis. The point \( P \) with coordinates \((-14, 27)\) in the original system has coordinates \((\alpha, \beta)\) in the new coordinate system. Find \( \alpha + \beta \).

2011 AIME I, Problem #3—
"What are the equations for \( L \) and \( M \)?"

Solution

Answer (031): The equations for \( L \) and \( M \) are \( 5x - 12y - 132 = 0 \) and \( 12x + 5y - 90 = 0 \), respectively. Because \( P \) lies in the second quadrant in the new coordinate system, it follows that

\[
\alpha = \text{negative distance from } P \text{ to } M = \frac{-|12 \cdot (-14) + 5 \cdot 27 - 90|}{\sqrt{12^2 + 5^2}} = -\frac{123}{13}, \quad \text{and}
\]

\[
\beta = \text{positive distance from } P \text{ to } L = \frac{|5 \cdot (-14) - 12 \cdot 27 - 132|}{\sqrt{12^2 + 5^2}} = \frac{526}{13}.
\]

Thus \( \alpha + \beta = -\frac{123}{13} + \frac{526}{13} = 31 \).

CCSS-M: A-CED.2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
In triangle $ABC$, $AB = 125$, $AC = 117$, and $BC = 120$. The angle bisector of angle $A$ intersects $BC$ at point $L$, and the angle bisector of angle $B$ intersects $AC$ at point $K$. Let $M$ and $N$ be the feet of the perpendiculars from $C$ to $BK$ and $AL$, respectively. Find $MN$.

2011 AIME I, Problem #4—
“Try to extend $CM$ and $CN$ to meet $AB$.”

Solution

Answer (056): Extend $CM$ and $CN$ to meet $AB$ at points $P$ and $Q$, respectively. Triangles $BPM$ and $BCM$ are congruent. Thus $M$ is the midpoint of $PC$. Analogously, $N$ is the midpoint of $QC$. Hence $MN$ is a midline of triangle $PQC$, and $MN = \frac{PQ}{2}$. Furthermore,

$$PQ = AQ + BP - AB = AC + BC - AB = 112.$$

Thus $MN = 56$.

CCSS-M: G-SRT.5. Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.
The vertices of a regular nonagon (9-sided polygon) are to be labeled with the digits 1 through 9 in such a way that the sum of the numbers on every three consecutive vertices is a multiple of 3. Two acceptable arrangements are considered to be indistinguishable if one can be obtained from the other by rotating the nonagon in the plane. Find the number of distinguishable acceptable arrangements.

2011 AIME I, Problem #5—
"What are the digits at the vertices adjacent to the vertex labeled 1"

Solution

Answer (144): Let the nonagon be $ABCDEFGHJ$, and let the digits on the vertices be $a, b, c, d, e, f, g, h,$ and $j$, respectively. It may be assumed that $a = 1$, so $b + c \equiv 2 \pmod{3}$. If \{b, c\} = \{4, 7\}, it is impossible for $b + c + d$ to be a multiple of 3. Therefore one of $b$ and $c$ belongs to the set \{2, 5, 8\}, and the other belongs to \{3, 6, 9\}. It follows that the only possible sequences of digits (mod 3) are \{(1, 2, 0, 1, 2, 0, 1, 2, 0)\} and \{(1, 0, 2, 1, 0, 2, 1, 0, 2)\}. In each of the two sequences, there are 2 possible choices for the ordered pair $(d, g)$ and 6 possible choices for each of the ordered triples $(b, e, h)$ and $(c, f, j)$. Thus the total number of distinguishable acceptable arrangements is $2 \cdot 2 \cdot 6 \cdot 6 = 144$.

CCSS-M: S-CP.9. Use permutations and combinations
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 online copy of the AIME Teachers’ Manual. See the AMC website, or the 2011 Summary of Results for statistics and figures from the 2011 contest. Statistics and figures for the 2012 Contest will be available on our website in late March and early April 2012. Printing this on a sheet of school stationery gives an official look to the page.

(School or School District)
FOR IMMEDIATE RELEASE

(School) STUDENTS PARTICIPATE IN NATIONAL MATHEMATICS COMPETITION

( # ) students at (School) participated in the 30th annual American Invitational Mathematics Examination (AIME). (Student names) qualified for the AIME by scoring in the top 2.5% of the American Mathematics Contest 10 (AMC 10, 10th grade and below). (Student names) qualified for the AIME by scoring 100 or more out of a possible 150 (approximately the top 5%) on the American Mathematics Contest 12 (AMC 12, 12th grade and below).

The AIME was held on Thursday, March 15, 2012, (or Wednesday, March 28, 2012). This contest was established in 1973 as an intermediate step between the high school (AMC 10 and AMC 12) contests and the U. S. A. Mathematical Olympiad (USA(J)MO). The AIME is a 15 question, 3 hour examination in which each answer is an integer number from 0 to 999, students are very unlikely to obtain the correct answer by guessing. The questions on the AIME cover high school mathematics, and are much more difficult than those on the AMC 10 and AMC 12. All problems on the AIME can be solved by pre-calculus methods. The use of calculators is not allowed. This contest leads to the USA(J)MO, MOSP (Mathematical Olympiad Summer Program) and the selection of the USA team sent to the International Mathematical Olympiad (IMO), the premier international high school level problem solving contest. This year the IMO will be held in Mar del Plata, Argentina, July 8-16, 2012.

According to Prof. Steven Dunbar, who serves as Director of the American Mathematics Competitions, the AIME is one of a series of contests sponsored each year by The Mathematical Association of America, through their program, the American Mathematics Competitions (AMC). The AMC offers the only math competition series in the country leading to the USA(J)MO 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)
- USA Junior Mathematical Olympiad (USAJMO)
- Mathematical Olympiad Summer Program (MOSP)
- International Mathematical Olympiad (IMO)

The AMC is located at the University of Nebraska - Lincoln, and receives direct financial contributions from The Mathematical Association of America, The Akamai Foundation, Academy of Applied Sciences, American Mathematical Association of Two-Year Colleges, American Mathematical Society, American Statistical Association, Art of Problem Solving, Awesome Math, Casualty Actuarial Society, IDEA Math, Jane Street, Math For America, Mu Alpha Theta, National Council of Teachers of Mathematics, Pi Mu Epsilon and W. H. Freeman and Company. The Contests are given across the U.S.A, Canada, and in many schools abroad.

Details concerning the 2012 AIME contests for High School, as well as the rest of AMC’s programs are available on the AMC web site: amc.maa.org.
March 2012

Dear Parent or Guardian:

On March 15, 2012 or March 28, 2012 your son or daughter participated in the 30th annual American Invitational Mathematics Examination (AIME). This contest was established in 1973 as an intermediate step between the high school (AHSME) contest and the USA Mathematical Olympiad (USA(J)MO). The AIME is taken by students who achieved a score of 100 or more out of a possible 150 (approximately the top 5%) on the AMC 12, and students who achieve a score of 120 or more (approximately the top 2.5%) on the AMC 10.

The AIME is a 15 question, 3 hour examination in which each answer is an integer number from 0 to 999. The questions on the AIME are much more difficult than those on the AMC 10 and AMC 12, and students are very unlikely to obtain the correct answer by guessing. All problems on the AIME can be solved by pre-calculus methods. The use of calculators is not allowed.

This contest leads to the USAJMO, USAMO, MOSP (Mathematical Olympiad Summer Program) and the selection of the USA team sent to the International Mathematical Olympiad (IMO), the premier international high school level problem solving contest. This year the IMO will be held in Mar del Plata, Argentina, July 8-16, 2012.

The AIME provides the exceptional students who are invited to take it with yet another opportunity to challenge their mathematical abilities. Like all examinations, it is but a means towards furthering mathematical development and interest. The real value of the examination is in the learning that can come from the preparation beforehand and from further thought and discussion of the solutions.

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
Director
MAA American Mathematics Competitions