# MINNESOTA STATE HIGH SCHOOL MATHEMATICS LEAGUE

## COACH'S MANUAL 2007 – 2008




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# 1. Executive Summary

This page highlights new or changed rules. Also, this section of the manual is used to alert coaches to special events or items of interest.

************IMPORTANT Board Actions***************

| The 2007-2008 Schedule | | The 2008-2009 Schedule | |
|---|---|---|---|
| Meet 1 | November 5, 2007 | Meet 1 | November 3, 2008 |
| Meet 2 | November 26, 2007 | Meet 2 | November 24, 2008 |
| Meet 3 | December 17, 2007 | Meet 3 | December 15, 2008 |
| Meet 4 | January 14, 2008 | Meet 4 | January 12, 2009 |
| Meet 5 | February 11, 2008 | Meet 5 | February 9, 2009 |
| State Meet | March 10, 2008 | State Meet | March 9, 2009 |

At the 2006 meeting, the Board voted to try a new schedule starting in 2007 - 2008. The new schedule has 2 November meets. Hopefully, this will space the meets in a more appropriate manner. The new schedule will be in effect for 3 years and then be re-examined. The 2007 – 08 and 2008 - 09 schedules are listed above**.**

## Communication

The league assistant director would like every coach to provide their preferred email address and cell phone number to improve communication especially in emergencies.

Our website, www.macalester.edu/mathleague, is frequently updated. Please be sure to read the **League Notes,** which are posted on the website within 10 days after a meet. Important announcements, such as notice of "No Calculator Events," will also be posted. If you are not an avid surfer, appoint someone on your team to be responsible for checking the site, especially just before meets, in case a last minute change comes up.

## New Fax Number for Reporting Meet Results – 320-587-2936

## Summer Conference

Every year, the summer conference gives coaches the opportunity to renew friendships, learn new coaching techniques, discuss league rules, explore new mathematical ideas, and establish a sense of collegiality. This coming summer, the Coaches' Conference is: July 25 - 26, 2008
Contact the Math League office with Topic Ideas for the coming conference.

## Action Taken at 2007 Board Meeting

In divisions where schools meet in two different locations, the league **very strongly** encourages all teams to come together for at least one meet.

The league **very strongly** encourages no team/school to have a meet on its own.

The updated 2007-08 Coach's Manual will be on the league website. The league will mail printed copies of the manual only to Division Coordinators and New Coaches. A "veteran" coach may request a printed copy by contacting the league office.

## Check with Division Coordinator regarding proposed division realignment beginning with the 2008-09 season.

# 2. Introduction to the Math League and Its Purpose

The Minnesota State High School Mathematics League was founded in 1980-81 and was modeled after leagues that have flourished along the U.S. eastern seaboard since the mid-1940s. The first year four schools participated, followed by sixteen schools in the second year. It grew to over 160 schools in 2006 - 2007.

The League exists to identify students with unusual mathematical ability, to give them recognition and encouragement, to bring them together with similarly gifted students for mutual stimulation, and to prod them into the study of topics not commonly taught in the high school curriculum.

League activities are focused on students with unusual mathematical ability, but they are inextricably related to other concerns in mathematics education. We have always believed that a program for gifted students is shortsighted if it is not developed in a way that strengthens mathematics education for all students.

# 3. Eligible Individuals and Teams/ Registering a team

The Minnesota State High School Math League is a competition for both individuals and teams. Members are high schools in, or bordering on, the State of Minnesota.

Each year, schools need to notify the league of their intent to participate by September 15th. Each school is required to pay a fee of $500 to participate in the league. Payment of the registration fee must be received by October 15.

Individual contestants must be regularly enrolled students in a participating Senior High School or a Junior High School in the district of the Senior High School. The number of students that can participate from a school is unlimited.

<u>Individual Participation from a school without a Math team</u>
Students who attend schools having no mathematics team may come to meets with another team if that team's coach is agreeable, but such a participant's score only counts toward individual honors, not toward the score of the team that brings him or her.

<u>Fee for schools with small numbers of participants</u>
The league will allow up to four individuals from any school (public, private, or home school) to register as individuals in the league and to compete only in the individual events. The registration fee is $100 per student and the school must provide a chaperone.

# 4. Regular Season Rules

## a. <u>Overview of Season Structure and Competition</u>

The regular season of the league consists of 5 meets, as noted in the schedules. Teams and individuals compete in divisions; all teams in a division convene at a predetermined school on the day of the meet to compete. The number of students that can attend a meet is unlimited and each student's score is recorded for individual honors. However, only 8 ***pre-selected*** student scores are counted for the total team score (see further explanation below). Individual and team scores are kept for all meets and the cumulative score for an individual or team is used to determine invitations to the state tournament. The league acknowledges the difference

between large schools and small schools and recognizes team accomplishments by awarding trophies in two tiers (classes).

## b. Meet Rules

A meet is organized as follows:

Individual competition

Each student is given four events to choose from but can only compete in two of these four events. The events are labeled A, B, C, and D but are essentially Algebra I topics (event A), Geometry topics (event B), Trigonometry/Precalculus topics (event C) and Algebra II/Analysis topics (event D). Each event has 4 questions. The first question is worth 1 point while the other 3 are each worth 2 points for a total of 7 points per event. Questions often increase in difficulty. The students are given 12 minutes **(exception: Event 5A is a 20 minute event)** to solve as many of these 4 questions as they can. Students are not allowed to help each other during these individual events. Topics for these events vary by meet and are outlined later in the manual.

Team Competition

Since the number of participants is unlimited, larger schools would have an advantage if all student scores were counted for the total team score. To mitigate this advantage, coaches must choose 8 students before the meet to be scorers for the team. These 8 students must each be entered in 2 events, 4 students per event (students still compete in 2 events, to keep individual scores comparable). After the individual events are completed, these 8 students (but none of the others who have participated as individuals) compete in a final team event consisting of 6 questions. They are given 20 minutes for this event and they can discuss answers and help each other. Teams are sequestered in different rooms so that they cannot hear another team's discussion. Each question on the team event is worth 4 points, for a total of 24 points. The 8 pre-selected team members can vary from meet to meet.

Age Restrictions on team scoring members

**No more than six of the 8 team scoring members shall be beyond the 10th grade.** The 8 team scoring members representing a school in a particular meet shall be listed before the meet begins on forms to be provided to the coaches.

Distribution of Team Members across events A - D

**Important:** A school with 8 team members cannot allocate its 8 team members unevenly – e.g. have 5 students in event A and 3 students in event B**. Teams with 8 team members may only have 4 team members in any one event A - D**

**Exception:** Some teams may not have a full complement of 8 participants and therefore may not be able to get a full slate of 4 students per event. These teams can have uneven allocations but still cannot have more than 4 students per event.

See Uniform Grading procedures for explanation of **penalties for violation** of this rule.

Summation of Points

Individuals (team scorers or not) can earn up to 14 points in any one meet or 70 for the five-meet season. The maximum team score for a meet is 136 points (14 perfect score for each individual 8 team members + 24 perfect team score) for a possible 680 for the five meet season. Points are reported for teams and individuals to the league office and are tabulated and posted on the league web page for the top scoring teams and individuals.

Calculator Usage

The current policy states that **any calculator** can be used, though by Board action at its 2002 meeting, calculators may be banned from a particular event. In such cases, prior notice will be given. We allow 2nd language translators (which can have a calculator built in), pencil and eraser - **AND NOTHING ELSE - especially CELL PHONES (with or without a calculator built in)!!** Paper is supplied by host school. By Board action at its 2004 meeting, **a student may bring only one calculator to events where calculators are allowed.**

## c. Hosting/Running a Meet

Structure of a Meet :

Divisions run meets somewhat differently but often follow this structure:

i. convene all students in a central gathering space
ii. welcome students, serve refreshments and remind students of the rules
iii. gather graders in a separate room and review problems and solutions
iv. announce event A and move A participants to designated room(s)
v. administer event A, set up event B
vi. bring event A answers to graders
vii. post event A answers so students can learn solutions or challenge scoring
viii repeat steps iv. through vii. for events B,C,D
ix. allow students time to review all solutions to A,B,C,D or challenge scoring
x. announce team event and move teams to separate rooms
xi. administer team event
xii. bring answers to graders
xiii. post team solutions and allow challenges
xiv. terminate challenges after 15 minutes/finalize scores/ report scores

Proctoring

It is suggested that in Individual Events, tests and scratch paper be laid on desks, face down, before contestants enter the room. It is also suggested that contestants from the same school should not sit next to each other. In some divisions, contestants write their names and schools on the backs of the exams before turning them over on the signal to start. The proctor should give a two- minute warning before the end of the event. Contestants should lay their pencils down and turn their papers over when time is called. The proctor collects papers off the desks after contestants leave.

Coaches' Duties

Before the day of the meet, prepare an assignment sheet to be given to each coach upon arrival. This sheet should assign coaches (and perhaps extra people as needed from the host school) to:

- Serve as proctors of Events A, C
- Serve as proctors of Events B, D (This allows proctors for Event B to set up the room for Event B while A is underway, etc.)
- Serve as graders (2, preferably 3 or more)
- Monitor waiting areas, supervise distribution of refreshments (if any)

These assignments should leave the host coach free to respond to unexpected requests and generally oversee the meet. The assignment sheet should also give locations for the various events.

Rooms Needed

- Large meeting area for students (initial announcements, announcing of events, holding area, posting of solutions and scores, etc.)
- One room or set of rooms for Events A and C; similarly for B and D.
- A room for each team (and for alternate teams if your division allows them) for use during the team event.
- A room, preferably isolated from areas of activity, for grading. Keep exam materials here during the meet; proctors pick them up as needed. Materials should be turned over so they cannot be read while the meet is going on.

Displaying Scores

Before the meet, prepare a scoreboard large enough to be seen at some distance. The scoreboard should list team total points accumulated during the season so far. A large chalkboard will do, but many divisions use poster board which can then be awarded to the team winning that day's meet so they can display it the next day at their school. Some divisions use other technology (overheads, monitors) for displaying results.

Copying Materials

Try to have access during the meet to a duplicating machine, just in case you run short of materials.

Grading

Graders are to receive a computer-generated team roster that are supplied by the League Office from each coach before the meet begins. Graders should also assemble a packet of answers and solutions for each coach at the meet. In case of any questions not covered by the Uniform Grading Procedures, the decision of the **graders** shall be final for the division. Any cause of difficulty should be brought to the attention of the League Director.

Graders should complete the Meet Summary Sheet and give it, together with completed Team Rosters, to the host coach. **The host coach or division coordinator must fax the Meet Summary Sheet and the Team Rosters to the League Assistant Director as soon as possible (certainly no later than the next day).**

Refreshments

Some divisions serve refreshments to participants at each meet; some do not. Such a practice does, of course, appeal greatly to the participants, and can often be funded either by school funds, the PTA, etc. The League does not provide funds for meet refreshments. Host coaches should follow practices established in the division.

## d. Uniform Grading Procedures

Individuals and teams like to compare their scores with participants in other divisions. And, at season's end, invitations to participate in the state tournament are issued on the basis of scores achieved during the season. In order to make comparisons meaningful and invitations fair, it is important that grading practices be uniform from one division to another. These rules, necessarily arbitrary in some instances, are developed to assure as much uniformity as possible.

1. Unless specific instructions are given to the contrary in the problem statement or in the official answer key, no partial credit should be given on any individual or team question.

2. Questions sometimes call for answers in a particular form, as in "the quotient of two relatively prime integers," or in the form $a\sqrt{b}$, in which case credit should only be given for the form requested.

   It should always be remembered that we want to give credit to students on the basis of what they understand, and never want to withhold credit for failure to observe some legalism. (For example, if the form $a\sqrt{b}$ is called for, $\sqrt{7}$ is surely okay; no one should insist on $1\sqrt{7}$.)

   When no form is specified, answers expressed as a multiple of $\pi$, e, or a root of some number are always acceptable. Likewise, decimal answers correct to three places to the right of the decimal are acceptable; answers carried to more than three places are also acceptable if correct to three places.

   "Correct to" shall mean either truncated to or rounded to. If "rounded to" is asked for, then truncated is not given credit.

3. When a problem statement requires the simplification of radicals or complex numbers, the standard simplification rules apply; i.e., no radicals or complex numbers are allowed in the denominator. Thus,

   $\frac{4}{\sqrt{3}-1}$ is wrong; it should be $2(\sqrt{3}+1)$

   $\frac{1+i}{1-i}$ is wrong; it should be i

However, when simplification is not required, answers such as $\frac{1}{\sqrt{3}}$, $\frac{1}{1+i}$, $\frac{1}{\sqrt{2}+1}$ are acceptable.

4. Though participants should be able upon request to express the measure of an angle in either degrees or radians, either system shall, in the absence of instructions, be acceptable.

5. When fractions, either numeric or algebraic, occur as answers, any equivalent form, whether reduced or not, shall be accepted unless the directions specify otherwise. Thus, 51/34 and $(1-x^2)/(x-1)$ are correct unless directions specify that the student is to express the answer as the quotient of relatively prime integers (an expression that participants are expected to understand) or as a reduced fraction, in which case the correct answer is not (51/34), but 3/2; not $(1-x^2)/(x-1)$, but either -(1+x) or -1-x.

6. Roots of numeric terms need not be simplified unless simplification is a required part of the problem. Therefore $\sqrt[3]{8}$ and $\sqrt[6]{x^3}$ are acceptable in the absence of instructions to simplify.

7. Unless a problem obviously calls for attention to units (as when data is given in terms of both feet and inches, meters and centimeters, etc.), students should not be penalized for omitting units in their answer.

8. If the answers provided contain an error, participants who believe their answer to be correct must challenge the answer **before** leaving the meet, and the challenge must be submitted NO LATER than 15 minutes after the team event has concluded. Credit given on the basis of an error in the answer key that is undetected before the event is scored shall remain unchanged. Announcement of the 15-minute challenge period should be made before each meet by the coordinator or the host.

9. A student (team member or non-member) may not participate in more than two (2) events (A-D) at a meet. If three (3) tests are taken intentionally or in error, those situations need to be taken care of at the host site. If the error gets sent to the state office, the **highest score** will be thrown out, even if the student was on the team and scheduled to take that test.

   **No more than 4 scoring team members may participate in an individual event. If more than 4 participate, the 4 lowest scores are used.**

10. Graders are the final authority for the divisional scoring at a particular meet, and their decision at the meet is final. **No corrections or changes will be made after teams leave the meets, unless the office is assured that such a change is agreed to by all coaches in the division.**

    Experience will undoubtedly uncover ambiguities in the stated rules, together with a need for other rules to cover situations not here anticipated. Any suggestions should be made to the League Director, and review of such suggestions will be undertaken at meetings of the Division Coordinators.

## e. Topics for Events

**1A Prealgebra Topics**

- Fractions to add and express as the quotient of two relatively prime integers
- Complex fractions and continued fractions
- Decimals, repeating decimals
- Percentage, interest, and discount
- Least common multiple, greatest common divisor
- Number bases; change of base
- Challenge topic: the Euclidean algorithm

**1B Measuring Angles**

- Angle sums for triangles and polygons
- Complementary, supplementary, and vertical angles
- Interior and exterior angles of a triangle
- Angles formed by transversals cutting parallel lines
- Familiarity with isosceles, equilateral and 30°-60°-90° triangles

**1C Elementary Trigonometry**

- Definitions and solution of right triangles
- Elementary identities
- Radian measure and graphs of elementary functions
- Trigonometric functions of multiples of $\pi/6$, $\pi/4$, $\pi/3$, $\pi/2$.

**1D Roots of Quadratic and Polynomial Equations**

- Solution of quadratic equations by factoring, by completing the square, by formula
- Complex roots of quadratic equations; the discriminant and the character of the roots
- Relations between roots and coefficients
- Synthetic Division
- Challenge Topic: Rational functions and their graphs
- Function notation

**2A Linear Equations in One Unknown**

- Solving numeric equations (perhaps involving a second degree term which drops out)
- Solving literal equations
- Story problems leading to linear equations in one variable
- Linear inequalities

**2B Familiar Geometric Figures, Congruence and Similarity**

- Ratio and proportion
- Segments intercepted by parallel lines
- Medians, angle bisectors, and altitudes
- The Theorem of Pythagoras; familiar Pythagorean triples
- Relationships in 30°-60°-90° and 45°-45°-90° triangles
- Equilateral and isosceles triangles, associated terminology
- Challenge Topic: Number theoretic aspects of Pythagorean triples

**2C Trigonometry**

- Functions of sums of angles and sums of functions of angles
- Half and double angle formulas
- Reduction formulas
- (Not required: formulas for sin A + sin B, etc.)

**2D Analytic Geometry of Straight Lines and Circles**

- Slope, families of parallel, perpendicular, or coincident lines
- Point-slope, slope-intercept, intercept, normal forms of the straight line
- Intersections (solution of simultaneous systems)

**3A Systems of Linear Equations in Two (or on occasion three) Variables**

- Numeric and literal systems
- Relation to graphical procedures
- Word problems leading to such systems
- Systems of inequalities used to define a region in the plane
- Determinants

**3B Quadrilaterals and Polygons**

- Rectangles, parallelograms, the rhombus, and the trapezoid
- Intersecting diagonals
- Ptolemy's Theorem
- Regular polygons and inscribed or circumscribed circles

**3C Trigonometry**

- Law of sines, law of cosines
- Inverse functions and their graphs
- Solving trigonometric equations
- De Moivre's Theorem and the roots of unity

**3D Exponents and Logarithms**

- Use of fractional, negative exponents
- Simplifying expressions involving radicals
- Solving equations involving radicals
- Use of logarithms; identities involving logarithms
- Solving logarithmic equations
- Relationships between logarithms to different bases

**4A Algebraic Manipulation**

- Factoring (including $x^3 + y^3$ , $x^3 - y^3$)
- Sums, products, quotients of rational expressions
- Solving equations (including radical equations) involving these skills, but ultimately solvable by factoring or the quadratic formula (but no complex roots)
- Rational exponents
- Simplifying radical expressions
- Function notation and variational dependencies

**4B Circles**

- Inscribed angles
- Secants, intersecting chords
- Interior and exterior tangents of two circles
- The measurement of angles by intercepted arcs

**4C Miscellaneous Topics**

- Sequences: patterns and recursion formulas, arithmetic and geometric sequences
- Series: partial sums, formulas for $1+2+...n$, $1^2+2^2+...n^2$, $1^3+2^3+...n^3$
- Function notation; factorial notation and **Binomial Theorem**

**4D Analytic Geometry of the Conic Sections**

- Using the standard forms of equations of the conic sections
- Graphs, including the location of foci, directrices, and asymptotes
- Use of properties of conics to solve applied problems, including max-min for parabolas

**5A Puzzle Problems (20 minutes)**

- Word problems, one or more variables
- Max-min problems not requiring calculus
- Problems found in "brain-teaser" type books
- Logic puzzles, including the use of Venn Diagrams

**5B Areas, Perimeters, and Volumes**

- Triangles - including Heron's formula and ability to use ideas of elementary trigonometry to find certain lengths
- Trapezoids and parallelograms
- Circles, sectors of circles
- Volumes of familiar 3-dimensional objects

**5C Counting and Probability**

- Permutations, with and without replacement
- Combinations, with and without replacement
- Using the principle of inclusion, exclusion
- Using the binomial and multinomial expansions
- Nonnegative integer solutions to $x_1+x_2+...+x_n = b$.
- Definition, simple applications of probability (when to multiply, when to add)

**5D Variations of Problems appearing on the previous year's AMC 12 (contest A)**

## f. League Comments on Building a Team, Level of Difficulty

League policy requires that no more than 6 members of a school's 8-member team can be beyond 10th grade. The general expectation is that 2 members will be 10th graders, and 6 members will be 11th or 12th graders. Schools may include 9th or even 8th graders from their system, but to compete effectively, such students would have to be familiar with mathematical topics not usually taught at their grade level. A coach wishing to build for the future might encourage a 9th grader to come to meets and compete as an extra, particularly in Event A.

Event A is generally restricted to topics covered in Algebra One and Two. To emphasize the importance of geometry and to guarantee a second event in which a 10th grader has a good chance of scoring points, Event B always covers topics in geometry.

It must be understood that the topics listed for a particular event are intended as an indication of the primary emphasis, not as a complete list of everything a participant must know. An effort is made to draw upon material generally covered prior to the topics listed, but varying order of presentation from school to school makes this difficult, and certain topics (the theorem of Pythagoras, proportions, solving simple equations) are likely to crop up everywhere. Event A of a meet may use all topics of previous Event A's; similarly for events B, C, and D. By keeping the same topics for corresponding events from one year to the next, it is intended that a file of exams from previous years will help participants anticipate the kind of questions to be expected.

Review is, in fact, to be encouraged at every level. Team Events always emphasize topics drawn from Individual Events of the meet, sometimes using a question that is only a slight variation of one used in an Individual Event earlier in the meet. Also watch in Team Events for variations of some of the more difficult questions that were used in meets earlier in the season. NOTE that to prepare questions for event 5D, it is necessary for the problem writer to read through the previous year's AMC 12 (contest A) very carefully. The influence of this reading may be detected throughout the season, and the AMC contest materials can always be recommended as a source of sample questions.

Event A of meet 5, focuses on puzzle problems. This is because media coverage, if we get it, commonly reports on the final meet. Puzzle problems are the problems most easily worked into an article intended for the general public. At the same time, such problems frequently require more careful reading and more time to do some experimenting and guessing; and since we do want to legitimately claim that our students do solve such problems, the time limit for this Individual Event is 20 minutes.

## g. Division Coordinator

Each division should, as its last act of business at the conclusion of a season, appoint a Division Coordinator for the following season. It is permissible, even advisable, to have the same person serve as Coordinator for several successive years.

The Division Coordinator becomes a member of the League's Board of Directors and represents the division at the Annual Fall Meeting and at any special meetings of the Board. A Division Coordinator who cannot attend a meeting of the Board should appoint another coach from the division who then becomes a voting member for that meeting. An annual meeting will normally

be scheduled in late September. At this meeting, any pending questions about League rules will be settled, alignment of teams into divisions will be tentatively settled, and host schools in each division should be designated for the coming season. Coordinators should contact schools in their division before this meeting and come to the meeting with a list of host schools to give to the League Director.

## h. End of Season Honors and Awards

Division Coordinators, working with guidelines developed by Division Coaches, should plan a suitable awards ceremony at the conclusion of the regular season. This most often takes the form of a dinner (or a pizza party) paid for by an area industry (or by assessing each school in the division). Division Coordinators may forward bills for their recognition event of up to **$60** per team to the league office. Most award ceremonies have been held in conjunction with Meet 5, and include all students who have participated. This format may be changed by any division wishing to do so, but it should be remembered that one goal of the league is to recognize effort and achievement in mathematics, to give increased visibility to activities available to those with interest and ability in mathematics, and to encourage students with mathematical talent to pursue further training in the discipline. The recognition event should be consistent with that goal. Media coverage is of course desirable. To assist the schools in recognizing students at the end of the year, the Board of Directors has approved the following program of awards for participants in the Minnesota State High School Mathematics League.

The League will award plaques to the first and second place teams in each division. Three plaques will be awarded in divisions of 9-12 teams, 4 plaques in divisions of over 12 teams. Besides an engraved statement of achievement (identifying the League, the division, the year), each plaque will bear the names of the coach and each school participant who (1) participated as a team member or as an extra in at least three of the five regular meets, and (2) was selected at least once during the season as a member of the school's team.

The League will award a certificate suitable for framing and a pin to the individual on each team who has over the season accumulated the most points.

The League will provide awards to students in each division who accumulate the most points. The top three awards will be desk-top accessories (a pen holder, a marble paper weight, a mug) with a suitable inscribed plate. All top divisional students according to the schedule below will receive pins and certificates. The desk-top awards will change from year to year in anticipation that some students may win in successive years, and the number awarded in a division will vary with the size of the division

| Teams in Division | Desk Top | Division Pin | Team Pin | Plaques |
|---|---|---|---|---|
| 1-8 | 3 | 10 | 1 per school | 2 |
| 9-12 | 4 | 15 | 1 per school | 3 |
| Over 12 | 5 | 16 | 1 per school | 4 |

Unless the League Director is otherwise instructed by the Division Coordinator, the pins (or such) to be awarded will be sent to the Coordinator who should check them beforehand to see that all is in order.

Schools are also encouraged to recognize individuals who participate on their mathematics team. The awards (a school letter, a pin of some kind,..) and the method of representation should give recognition to the student and increase school awareness of the activity. These awards (cost, decision as to who receives them) are completely the responsibility of the local school.

The League will award trophies to the individuals that finish first, second, and third in individual scoring (overall across the state) during the League's regular five-meet season. These awards will be presented at the State Tournament.

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### i. Postponement of Meets

All meets are scheduled on Mondays. Postponement or cancellation of a meet because of weather conditions is a decision to be made at the divisional level, probably by the designated Division Coordinator, working within any guidelines the division has established. The League Director shall be notified as soon as possible of any postponement, and the Executive Committee shall, in exercising its right to extend special State Tournament invitations to top scoring individuals, weigh any possible effects of postponed meets.

## 5. State Tournament Rules

### a. Overview of State Tournament Structure and Competition

The league culminates its season with an end-of-the-year state tournament. There are three components to the state tournament: an Invitational Event in which top scoring individuals from the regular season compete directly with each other, a Math Bowl competition staged as a public quick response event between top scorers in the Invitational, and finally, a meet following the usual rules. Individuals and teams are invited to the state tournament on the basis of their standing in their division or their overall standing in the state (see further explanation below). Awards are given at the end of the meet for outstanding performance. Costs of this tournament, including the cost of the recognition dinner, are paid from League funds. Those who drive more than 50 miles to the tournament site may elect to be housed overnight by the League.

### b. Tournament Invitational Event

The Invitational Event is a 30 minute test with a maximum score of 24 pts. The event consists of eight quickie questions (one point each), four questions intended to be equivalent in difficulty to the three questions that normally appear on Individual Events (two points each), and two multiple part challenge questions (four points each).

The top ten scorers in the Invitational Event then compete in the Math Bowl. The Math Bowl is a quick-response, elimination competition.

**Math Bowl Rules/Procedures**

• The top ten students from the Invitational Event will be selected to participate. Seasonal scores will be used to break ties.
• The names of the participants will be announced at the time of the event. They will be asked to come up to the stage and proceed to a chair at the table on stage. They will be asked to print their name and school at the top of a white board, leaving the rest of the area to write their answers. A cloth and marker will be provided.
• Each student will be given a written problem (one at a time) with enough space under the problem to do their work. A time limit is imposed on the problem and when time is called, participants hold up their answers. A point is awarded for each student displaying a correct answer
• At the end of eight (8) problems the one(s) tied with the top number of correct answers (if any) will continue and the rest will leave the stage.
• After each additional question, those who had wrong answers will be asked to leave the stage. This will continue for 7 more questions. If at the end there are still ties, the Invitational scores will be used to break the ties.
• One winner is declared (if possible). The winner receives a trophy.

### Tournament Invitational Event participants

Invitations to individuals to participate in the Tournament Invitational Event will be extended according to the following procedures.

1. The top scoring individual from each division shall be invited.
2. From the list of top scoring individuals in the League, ranked on a statewide basis in order of total scores earned during the regular season, the top 50 students shall be invited.
3. The Executive Committee may invite other students who, because of individual circumstances, may not be selected in steps 1 and 2, but who have compiled outstanding individual records.

## c. Tournament Team Contest

Teams compete against each other at the state meet just as they did during each meet in the regular season. The usual rules that govern all meets (including the rule that a team includes two students not beyond 10th grade) will be followed, with the following modifications:

1. Individual events will be 15 minutes (Event A will cover any topic listed in any A event during the regular season; similarly for events B, C, and D).
2. The Team Event will be 30 minutes.
3. Challenges to answers must be submitted no later than 30 minutes after the team event has concluded.

Any ties occurring between teams will be settled on the basis of which of the tied teams scored the most points during the regular season

### Team Participants

Invitations to teams will be extended according to the following procedure:

1. The winning team from each division shall be invited. (This may, in cases of ties, require a tie breaking meet within a division.) In the case of divisions where the leading team cannot or chooses not to participate in the tournament, the second place team will be invited.
2. A second place team in a division shall be invited if it has finished second in the division behind the same school to which it finished second in the previous year, AND the team places in the top 50 of the state.
3. From a list of all schools in the League, ranked on a statewide basis in order of total scores during the regular season, the Executive Board will extend invitations to teams not already invited until a full complement of 38 teams have been invited to the tournament. Care should be taken to insure that the top 15 schools are invited.

### Tier I and Tier II

The league recognizes that smaller schools have a harder time competing against larger schools and therefore divides the state team competition into tiers. At the beginning of the year and following MSHSL state basketball rules, each team in the league shall be designated as a Tier II team (A/AA in MSHSL) or Tier I team (AAA/AAAA in MSHSL).

Any team qualified by size for classification as a Tier II team can, by notifying the league office, participate in Tier I. This notification must be received before the first meet.

### Number of students per school at Tournament Team Contest

Invited teams are to bring eight team members to represent their school in the tournament. Teams wishing to bring 1 alternate may do so, but will be asked to pay a fee for the alternate to cover the costs of room and board. Alternates will be formed into one or more teams to compete as Alternates Team 1, Alternates Team 2, etc. in the tournament, but these teams will not be eligible for awards.

Teams requesting extra facilities (a practice room, ...) or awards for Assistant Coaches will be asked to pay for extra costs incurred.

## d. Recognition of Individual Scoring Leaders

The League will award trophies to the individuals that finish first, second, and third in individual scoring at the state tournament. Those students who reach the Invitational Event at the tournament will receive certificates. The scores received at the Invitational together with the scores received at the tournament will determine the first, second and third place for Tournament Scoring Leaders. In order to be considered for an Individual Award for individual scoring honors, a student must be involved in at least one of events C or D.

When donors provide scholarship funds, these scholarships shall be awarded to individuals ranked highest on the basis of the sum of the season total score and the tournament total score. Such awards will be deferred until after high school graduation and sent directly to the student upon league receipt of letter indicating how the student plans to use the money to further

his/her education. If said letter is not received within 3 years of graduation, the student forfeits the scholarship and the monies are returned to the scholarship fund.

## e. Recognition of Top Scoring Teams

At the tournament there shall be 1st, 2nd and 3rd place trophies for teams in Tier I, and 3 similar trophies for teams in Tier II. **Any team that participates and wins a 1st or 2nd place trophy in Tier II for two consecutive years must, in the succeeding year, participate in Tier I**

## f. Tournament Weather Procedures

Owing to scheduling commitments made for hotel rooms, for the auditorium, cafeteria and classroom space at the host school (Eagan High School in 2007), our policy is to hold our tournament on the scheduled day if it is at all possible. This recognizes the fact that our tournament, once cancelled, would be almost impossible to reschedule.

If severe weather conditions seem to threaten our ability to proceed with the tournament, information shall be available via the following instruments:

1. on our web site: www.macalester.edu/mathleague
2. on the phone recording at the league office: 651-696-6475
3. from the office at Eagan High School: 651-683-6900
4. on the Eagan High School web site: www.eagan.k12.mn.us
5. on Metro radio/TV channels

The executive committee will try to make any determination on the cancelling of the tournament by 7 AM on the day of the tournament. Travel conditions typically vary across the state, as do intended modes of travel (bus, van, private automobiles). It is expected that participants in the tournament will in all cases follow the rules and directives of responsible officials of their school in deciding whether to attempt the trip to the tournament.

If participants from a school can assemble themselves locally but cannot make the trip to the tournament, they may, if arrangements are approved ahead of time by the League's Executive Committee, participate electronically. Scores obtained in this way by people taking the exams at the same time in another location shall be posted with the scores of teams at the meet, and shall qualify for awards as if they were present.

For teams and individuals unable to be present at the tournament to accept awards they have earned, the League Director shall make a good faith effort to personally present such awards in an appropriate venue (school awards night, honors banquet, etc.). In cases where several invited schools from the same area of the state cannot get to the tournament, the league shall cooperate with said schools in setting up a suitable recognition event in their area later in the spring.

# 6. Other Associated Competitions

**American Regions Mathematics League (ARML)**
Each spring approximately twenty-five to thirty students are invited to be participants on the state all-star math team, representing Minnesota at the national ARML competition. In addition, approximately five to ten students from grades nine and ten are invited to be ARML students in training. Selection for the all-star team and students in training is based on a combination of a student's individual performance during the regular League season, his or her score on the AMC 12 (or AMC 10), and his or her individual score at the state tournament. The top ten scorers in each of these three categories are each guaranteed an all-star team invitation.

A student who accepts an invitation to be a member of the state all-star math team has the following responsibilities:

- Attend three all-day practices held in the Twin Cities on the first three Saturdays in May. (Exceptions are granted on a case by case basis.)
- Participate at The ARML Competition held at the University of Iowa on the first weekend in June.
- Raise $250.00 to cover an individual's share of the cost of the program.

Letters of invitation should be sent to the students via their coaches within the week following the state tournament. A letter will also be sent to the principal of the school attended by each invitee recognizing the honored student and asking for help in raising the necessary funds.

A student who accepts an invitation to be a student in training has the following responsibilities:

- Attend three all-day practices held in the Twin Cities on the first three Saturdays in May. (Again exceptions are granted on a case by case basis.)
- Be willing to participate at The ARML Competition held at the University of Iowa on the first weekend in June if selected to be a member of the state all-star team.

After one or more of the practice sessions, the coaches may decided to invite one or more of the students in training to be members of the state all-star team. At that time, a letter will also be sent to the principal of the school attended by each invitee recognizing the honored student and asking for help in raising the necessary funds.

A total of thirty students, two teams of fifteen, will ultimately be selected for the all-star team and travel to Iowa for the competition.

The head coach of the all-star team and three or more additional coaches will be selected by the executive board. A small compensation will be given to each coach.

**American Mathematics Competitions**

While the American Mathematics Competitions (AMC) are not an official part of our League activities, they provide an additional opportunity for our most gifted students, and we encourage league members to participate. Our regular season builds towards the AMC 10 and

AMC 12. We also encourage participation in other members of the AMC family of tests: AMC 8, the Junior High School version of AMC 10 and AMC 12, AIME (the American Invitational Mathematics Examination), USAMO (the United States of America Mathematical Olympiad), and the IMO (the International Mathematics Olympiad).

## 7. Resources for Coaching

Each summer we invite coaches and their spouses to a two-day conference (free of charge) on the Macalester Campus. These Conferences were originally supported by a grant from the Blandin Foundation to whom we had proposed that the conferences should have the following goals:

1. Give specific help to coaches in some aspect of working with mathematically gifted students.
2. Create an esprit de corps among the coach/teachers by coming together in a congenial setting to discuss the season just past, possible changes to strengthen our League, and ways that we work with our teams.
3. Make it clear, both to coaches and to their spouses, that the extra time required for League activities is recognized and appreciated by a state increasingly dependent on people able to provide leadership in mathematics and technology.

The Summer Conference starts on Friday with work sessions during the day followed by dinner and social activities for coaches and their spouses. Saturday continues with work sessions designed to help coaches with the tasks of attracting students gifted in mathematics and with all the aspects of preparing them for competition. We have brought some of the country's best-known mathematics coaches and problem solvers to the conference. The conference will conclude on Saturday with a sponsored social event.

Efforts to realize goal 3 above have provided conference highlights for coaches and spouses.

**1985** Remmele Engineering and Sperry at a pop concert of the Minnesota Symphony, followed by desert at the Roberts' home.
**1986** The 3M Company at the Minnesota Club where we had dinner and entertainment by the 3M Music Makers.
**1987** Cray Research hosted us for dinner at the St. Paul Hotel, followed by the musical South Pacific at the Ordway Theatre.
**1988** Honeywell treated conference participants to a dinner cruise on the St Croix River.
**1989** Rosemont Inc. hosted the group at a Chanhassen Dinner performance of Guys and Dolls.
**1990** Medtronic hosted us for dinner at Canterbury Downs, followed by an evening of horse racing.
**1991** ADC Telecommunications hosted us for dinner and a play at the Old Log Theater.
**1992** IDS Ins., Lutheran Brotherhood Ins., and MN Mutual Ins. hosted us to a dinner cruise on the St Croix River.
**1993** MTS hosted the group at a Chanhassen Dinner performance of Fiddler on the Roof.
**1994** No sponsor, but the conference participates enjoyed dinner at Lee Ann Chin's followed by a play at the 7th Place Theater.
**1995** ADC Telecommunications hosted us for dinner and a play at the Old Log Theater. They also hosted us at a tour of their plant in Minneapolis.
**1996** MTS hosted the group at the Old Log Theater for dinner and a performance of "I Hate Hamlet".

**1997** Rosemount Inc. hosted us at the Chanhassen Theater for dinner and a performance of "State Fair.
**1998** We did not have a sponsor; therefore, the Conference was not held.
**1999** MTS hosted the group at the Plymouth Playhouse for the performance of "How to Speak Minnesotan"
**2000** MN Mutual Foundation hosted us at the River Room at Dayton's St. Paul for dinner followed by a performance of "The Last Night of Ballyhoo" at the Park Square Theater.
**2001** ADC Telecommunications hosted us for dinner and a performance of "South Pacific" at the Ordway Theater.
**2002** ADC Telecommunications hosted us for dinner and a performance of "My Husbands Wild Desires Almost Drove Me Mad" at the Old Log Theater.
**2003** ADC Telecommunications hosted us for dinner on the Jonathan Padelford and a performance of "Dracula" on the Centennial Showboat.
**2004** ADC Telecommunications hosted us for dinner a performance of Agatha Christie's performance of "The Mousetrap" on the Centennial Showboat.
**2005** ADC provided funds to take the group to see "Beauty and the Beast" at the Chanhassen
**2006** ADC provided funds to take the group to see "Singin' in the Rain" at the Chanhassen
**2007** ADC provided funds for the group to see "Les Miserables" at the Chanhassen

Some participants from outside of the Twin Cities metropolitan area have accepted the invitation to be guests of Macalester College by using their rooms on Saturday night so as to extend their stay.

Other Resources for Coaches

Coaches are encouraged to gather old tests from previous years for student practice. Some schools have burned CDs containing tests from past years. Online sites often have good problems for practice.

# 8. Governance

Having begun in 1980-81 as a group of four schools, and having grown to a group of 156 schools in 1986-87, we were, on September 10, 1987, officially incorporated under the laws of Minnesota Corporate Charter Number 18-388 with the name MINNESOTA STATE HIGH SCHOOL MATHEMATICS LEAGUE.

We include below a summary of the League Bylaws; a complete copy is available from the Macalester Office.

MEMBERSHIP: Members are high schools in, or bordering on, the State of Minnesota. Membership is granted for an academic year and must be renewed annually. Member schools must affiliate with an existing division of the Corporation or be assigned to a new division by the Board of Directors. **No division shall operate with less than five (5) member schools.** The Board of Directors sets dues which member schools must pay before the date of the first fall meet.

Following the state tournament, each division shall appoint a Coordinator for the following year. This Coordinator is a member of the Board of Directors.

DIRECTORS: The Board of Directors consists of

1. one Coordinator elected from each division in the spring of the year, to serve until the next spring.
2. one representative of the MCTM, and the Mathematics Specialist from the Minnesota Department of Education.
3. up to four (4) members elected at large by the Board, each to serve for a three-year term
4. the League Director, elected for a three-year term, serving as an ex officio non-voting member.

Directors may succeed themselves, and there are provisions for removal of any director.

MEETINGS: The annual meeting of the Board of Directors shall be held in the fall at a time agreeable to the members. Other meetings may be scheduled as needed, and the Executive Committee may call special meetings.

DECISIONS: A majority of the Directors constitute a quorum, and decisions at meetings having a quorum present shall be made by a majority of those present, unless a greater number is required by an applicable law or Robert's Rules of Order.

EXECUTIVE COMMITTEE: The Executive Committee, made up entirely of Directors, consists of the President, the Secretary, the Treasurer, the Director representing MCTM, the Director representing the MN Dept of Education, the League Director (non-voting). The Executive Committee exercises the power of the Board of Directors between meetings of the Board.

COMPENSATION: The League Director and such staff as the Board of Directors shall approve from time to time shall be compensated on an annual basis at rates to be set by the Board of Directors. Other members of the Board receive no compensation for services as Directors, but may be compensated for services rendered in a capacity other than that of a member of the Board.

COACH'S MANUAL: The League Director shall prepare, or cause to be prepared, a Coach's Manual for each academic year, which shall consist of a compilation of the rules adopted by the Board of Directors from time to time and then in effect, and which shall be subject to the approval of the Board of Directors. The Coach's Manual shall include all rules for meets, information regarding League business and affairs, and topics to be included in the tests for the year.

AMENDMENTS: The Board of Directors may amend the Articles of Incorporation of the Bylaws at a meeting of the Board of Directors for which proper notice, stating the purpose thereof including the proposed amendment, has been given at least five (5) days in advance of the meeting. If notice required by this Article has been given, the proposed amendment or a duly modified version thereof, may be adopted at any meeting of the Board of Directors by a two-thirds (2/3) vote of the Directors present at the meeting and entitled to vote.

**Officers and At-Large Board Members**

**Officers**
Tom Young, President, Spring Lake Park High School (elected Oct 1, 2007 for a 3 year term)
Dale Kain, Treasurer (elected Oct 1, 2007 for a 3 year term)
Lynn Fryberger, Secretary, Coordinator St. Louis River Division (elected Oct 1, 2007 for a 3 year term)

**At-Large Board Members**
Bill Linder-Scholer
Mike Reiners
Lucie Taylor

# 9. Division Alignment Rules

In spite of the clear statement (that is in bold face in the Manual) that, "No division shall operate with less than five (5) member schools." we have at times had divisions with fewer schools. This usually comes about when a school drops out of a 5 school division, and it proves impossible to recruit a new school in the area.

There are several reasons for wanting, in so far as possible, to have divisions of at least 5, and more desirably, about 8 teams. They are as follows:

1. First and foremost, small divisions give rise to a feeling of inequity in the drive to get to the state tournament. Schools in a division of 8 or 10 teams clearly have a harder time getting to the tournament than those in a division of 4 or 5 teams.

2. Costs of the tournament are rising dramatically. Our budget remains tight and we must do what we can to control it. Aiming at an average of one tournament invitation for every 8 teams seems to be a reasonable goal.

3. As already mentioned, we face increasing pressure from teams in large divisions to break themselves into smaller divisions. This exacerbates the problem described above (2), but it is hard to resist when supplicants can point to divisions already smaller than the ones they propose to create by dividing.
Recognizing the difficulty of always finding 5 schools in a geographic area that want to participate, the League Board passed at its September 2001 meeting the following motion:

In cases where distance makes it impractical for teams in a division to come together at one site for each of the five meets of our season, the division may designate two sites, so long as at least three teams gather at each site. Provisions should be made to have the sites in electronic communication so that teams at each site can see their standing in the meet as each event is graded, and the results should come to the league office as the report of a single division.

**Division Alignment Policy**

New schools, merging of existing schools, schools dropping out of or joining the League, the forming of new athletic conferences: these and other changes require that each fall we do some

reorganizing of our divisional structure. In setting up divisions, the office staff should observe the following guidelines:

a. Member schools should, in so far as possible, be put in a division with schools where they are most comfortable.
b. Unless prompted by external requests, we should attempt to keep intact the same divisions from year to year.
c. When an existing division is to be changed slightly by addition or deletion of a team or two, this should be done with the cooperation of the Division Coordinator.
d. Great effort should be made to have divisions consist of at least five teams.
e. When major realignments are undertaken, coaches of all teams affected should be invited to a meeting to discuss implementation issues. In all cases, alignment of divisions worked out through negotiations between the office staff and the affected teams, must be approved by the League's Executive Committee.

# 10. Divisions for 2007 – 2008 (unofficial)

| Name | Number of Schools | Coordinator |
|---|---|---|
| Big 9 | 6 | Kent Miller |
| Canterbury | 11 | Ellen Goettsch |
| Central Gopher | 5 | Bob Boatz |
| Classic Suburban | 9 | Karen Hyers |
| Dynamic Hiawatha | 9 | Garret Fritzmeier & Don Nitti |
| Iron Range | 6 | Mike McNulty |
| Metro Alliance | 5 | Ben Blackhawk |
| Minneapolis | 6 | Ryan Voeks |
| Minnesota Valley | 9 | Joyce Diels |
| Northwestern Lights | 8 | Terry Hewitt & Jerome Holicky |
| North Suburban | 6 | Tom Young |
| Polar | 6 | Karl Olesen |
| Prairie | 5 | Daryl Anderson |
| Rum River | 8 | Mike Sorn |
| St Louis River | 7 | Lynn Fryberger |
| St Paul City | 9 | Michael O'Connell |
| South Suburban | 8 | Sean Foley |
| Southwest MN | 5 | Steve Johnson |
| Southwest Suburban | 7 | Tom Kilkelly |
| Suburban East | 5 | Stacy Paleen |
| Three Rivers | 6 | Craig Walz |
| Tri Metro | 6 | Bill Boulger |
| TC Suburban West | 8 | Tim Gove |
| Wasioja | 7 | Karen Davidson |

# 11. Schedules

**MN State HS Mathematics League - Schedule**

| | 2007-08 | 2008-09 | 2009-10 |
|---|---|---|---|
| Meet 1 | Nov 5 | Nov 3 | Nov 2 |
| Meet 2 | Nov 26 | Nov 24 | Nov 23 |
| Meet 3 | Dec 17 | Dec 15 | Dec 14 |
| Meet 4 | Jan 14 | Jan 12 | Jan 11 |
| Meet 5 | Feb 11 | Feb 9 | Feb 8 |
| State Meet | Mar 10 | Mar 9 | Mar 8 |
| ARML | June 7 | | |
| Summer Conference | July 25-26 | July 24 - 25 | July 30 - 31 |

**American Mathematics Competitions - Schedule**
AMC 8 November 13, 2007
AMC 10/AMC 12 February 12, 2008 FORM A or February 27, 2008 FORM B
AIME March 18, 2008 or April 2, 2008
USAMO April 29 & 30, 2008

# 12. Hall of Fame

In 2005, in celebration of its 25th anniversary, the Math League instituted a Hall of Fame. These people were inducted into the inaugural class:

| | | |
|---|---|---|
| Bill Boulger | Roger Sadlowsky | Stan Vee |
| Marlys Henke | Roy Schuman | Judy Cognetta |
| Jerome Holicky | Kay Shager | Kathy Grundhoefer |
| Wayne Hysjulien | Bill Shimek | Stan Hill |
| Tom Kilkelly | Jack Sorteberg | Brant Klepel |
| John Kunz | Kathy Trier | Wayne Roberts |

In the fall of 2005, the Board voted to select more members for the hall of fame during 2010, in conjunction with the League's 30th anniversary.

Also, to celebrate the 25th anniversary, Wayne Roberts wrote a book looking at the history of the Math League. The book is filled with anecdotes about instrumental people who help form the league, students who have left a big impression during their tenure and statistics from all the years the league has been in existence. That book is available by contacting the league office.