

## Appendix A: Uniform Grading Procedures

### Exam Terms and Notation

**“Calculate”:** This word will allow for answers that are correct to at least 3 places to the right of the decimal, unless a different level of precision is specifically requested by the problem. “Correct to” includes both truncating and rounding. Naturally, answers in exact form are always acceptable, as are longer decimals (provided they are correct to the first 3 places).

**Determine exactly”:** This phrase will always call for an exact answer in simplest form.

#### Examples of “simplest form”:

<u>Unacceptable</u>	<u>Acceptable</u>	<u>Reason</u>
$\frac{6}{4}$	$\frac{3}{2}$	quotient of two relatively prime integers
$5 + 2$	$7$	simple arithmetic
$3^4$	$81$	arithmetic with numerical exponents
$\sqrt[3]{8}$	$2$	arithmetic with numerical roots
$\sin 30^\circ$	$\frac{1}{2}$	Commonly known “unit circle” trigonometric values
$\frac{5}{\sqrt{12}}$	$\frac{5\sqrt{3}}{6}$	“rationalized” radical form
$\frac{5}{1+2i}$	$1 - 2i$	a+bi format for complex numbers
$\frac{1}{\frac{1}{x} + x}$	$\frac{x}{1+x^2}$	complex fractions are not allowed

In cases where there is a question as to what form is “simplest”, alternate answers may be accepted. For example,  $\frac{3}{2}$ ,  $1\frac{1}{2}$ , 1.5, and 1.500 would all be acceptable.

**Angles:** Angle measurements written with the degree symbol ( $^\circ$ ) will be in degrees. All other angle measurements will be assumed to be in radians. This applies to both printed exams and student solutions.

*Note: All attempts will be made in problem writing involving trigonometric expressions to provide students with as much clarity as needed in the context of the problems with regard to range of expected solutions.*

**Area:** The area of a region will be denoted by the use of the word “*Area*”, followed by the name of the figure in square brackets. For example: *Area*[ $\Delta ABC$ ] or *Area*[**Circle P**]

**Bases:** Number bases will be indicated by a subscript at the end of the number. For example,  $632_4$  indicates the number 632 in base 4, or  $6(4^2) + 3(4^1) + 2(4^0)$ .

**Ceiling Function:** Also known as the “least integer function,” this shall be denoted by  $\lceil x \rceil$ , defined as the least integer greater than or equal to  $x$

**Combinations:** The number of combinations of  $r$  items chosen from a group of  $n$  items shall be denoted using binomial coefficient notation:  $\binom{n}{r}$

**Diagrams:** ... are not necessarily drawn to scale. Only specifically given lengths, angle measurements (etc.) should be trusted

**Digits:** When some digits of a number are unknown, underlines will be used to denote individual digits. For example,  $A\underline{13}B$  represents the four-digit number with  $A$  in the thousands place and  $B$  in the units place, *not* the product of  $A$ , 13, and  $B$ .

**Floor function:** Also known as the “greatest integer function,” this shall be denoted by  $\lfloor x \rfloor$ , defined as the greatest integer less than or equal to  $x$

**Lattice points:** Points whose coordinates are all integers.

**Logarithms:** The notation “log” shall denote a base-10 logarithm and “ln” shall denote the natural logarithm or base- $e$  logarithm. Other logarithm bases will be indicated using subscripts.

**Ordered pairs:** When a problem calls for an ordered pair, such as  $(a, b)$ , the solution must be given in precisely that form, including the parentheses and the comma. The same applies for other ordered  $n$ -tuples.

**Permutations:** The number of permutations of  $r$  items chosen from a group of  $n$  items shall be denoted using subscripts:  ${}_n P_r$

**Polygons:** If a polygon is named  $MATH$ , it is understood that the vertices  $M$ ,  $A$ ,  $T$ , and  $H$  occur in this adjacent order around the polygon, either clockwise or counterclockwise.

**Triangles:** If a triangle is named  $ABC$ , the sides opposite the vertices  $A$ ,  $B$ ,  $C$  (unless otherwise labeled in the problem) will have lengths denoted by  $a$ ,  $b$ , and  $c$  respectively.

### **Grading Conventions:**

It should always be remembered that the League desires to give credit to students on the basis of what they understand mathematically. The ideal would be to avoid withholding credit when a student has simply failed to observe some legalism. That being said, individual and team scores need to be compared across the League’s many divisions, with awards, scholarships, and appearances in the State Tournament dependent upon these comparisons. Therefore, it is essential that fundamental grading practices be as uniform as possible.

The following rules attempt to form a common grading foundation:

***Partial credit:*** Unless specific instructions are given to the contrary in the official solutions, no partial credit should be given on any individual or team question.

***Form of an answer:*** The words “calculate” and “determine exactly” in the statement of a problem will often dictate the acceptable form(s) of an answer. If a more specific form is required by the problem (such as  $a\sqrt{b}$ ), credit should only be given for the form requested. However, the absence of a written value where a value is implied (such as  $\sqrt{7}$  in the example above, as opposed to  $1\sqrt{7}$ ) shall be acceptable. If an answer could appear in multiple acceptable forms, the official solutions will display as many of these forms as space allows.

***“In terms of”:*** A problem that requests an answer in terms of particular variable(s) and/or constants shall have a solution that contains only those elements, possibly other numerals, but no other alphabetic characters. However, it should be noted that in some cases, a problem intends the student to “discover” that particular variable(s) are not needed. Students should not be penalized for providing non-trivial solutions that omit allowable terms.

***Units:*** Unless a problem obviously calls for attention to units (as when an answer requests both feet and inches, meters and centimeters, etc.), students should not be penalized for omitting units in their answers.

***Challenges:*** If the official solutions contain an error, and it is discovered prior to the meet, all efforts will be made to alert the division coordinators and coaches as to the correct answer. Divisions would then use the corrected answer to judge a response as acceptable or not.

If the official solutions contain an error, or if students believe they have been denied an alternate acceptable form for a solution, or if students believe their paper has been graded incorrectly, the students must submit a challenge to the grading room **no later than 15 minutes after the conclusion of the Team Event**. The meet host or Division Coordinator must make clear announcement of the timing of this challenge period. Errors noticed after this time period, especially if the team/individual has left the meet, shall remain unchanged.

Challenges submitted to the grading room usually fall in these categories – challenges of legibility, challenges of grading mistake by the graders (the student actually got it right but the graders mistakenly marked it wrong), challenges of whether the response is an acceptable form of the answer, or challenges caused by a unique interpretation of the question resulting in a different answer.

The challenges should be handled in this manner:

1. Challenges of legibility should be *adjudicated at the site*. Graders should make every effort to determine what was written. This may require the graders to ask for input from the student.
2. Challenges of mistakes made by the graders should be *fixed at the site*.
3. Challenges of whether the response is an acceptable form of the answer or challenges as to a different answer due to a unique interpretation of the question *should be sent to the League office*.

Process for submitting a challenge to the League office:

All coaches in the division should be made aware of the challenge. A pdf copy of the original paper, and a short explanation as to the reason for the challenge, should be emailed to [mathleague@augensburg.edu](mailto:mathleague@augensburg.edu) and to all schools in the division within 24 hours of the day of the meet. The student should write the explanation but may need a coach's assistance. The League will make every effort to rule on the challenge within 2 – 3 days. Schools in the division will be notified as to the final ruling. Scores will be adjusted as necessary.

Only students who challenge a solution can be awarded points. If a student does not make a challenge, yet that student's answer is judged to be correct, that student who did not challenge will NOT be awarded the point(s) for a correct solution. Therefore, it is wiser to challenge than not.

**Given this new challenge process, and to insure the most uniformity, graders should mark answers correct only if the student answer matches the answer provided in the League answer key.**

Ambiguities in the stated rules will undoubtedly arise, and grading experience will serve to resolve those ambiguities. League coaches, and particularly Division Coordinators, should monitor the League Notes on the MSHSML website through the season to watch for grading-related clarifications and other postings. As grading patterns arise, suggestions for further modification and improvement of these guidelines will be welcomed by the League Director, and review of such suggestions will be undertaken at the annual Board meeting(s).