

**MAINE ASSOCIATION OF MATH LEAGUES**  
**RULES CONCERNING NOTATION AND FORMS OF ANSWERS**  
2009 - 2010

1. Unless otherwise stated, all variables, constants, and answers are assumed to be real numbers.
2. All answers should be given using standard mathematical notation. Calculator specific notation is not acceptable. The following are examples of notations that are not acceptable. This is not intended as a complete list, but rather as guidelines to follow:

1.4 E -32 will not be accepted as  $1.4 \times 10^{-32}$

1.4 E -32 will not be accepted as 0

The ordered pair (2,3) will not be accepted as the complex number  $2 + 3i$

$\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$  will not be accepted as the matrix  $\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$

$x^2$  will not be accepted as  $x^2$ .

3. All numerical answers must be exact and not rounded, with two exceptions: (a) if the question asks for specific rounding, or (b) on a calculator round when the question does not specify rounding the answer may be given properly rounded to four decimal places. Any rounding required in a problem should be done only at the end of the problem. When a problem asks for a "value", a numerical answer is expected, as opposed to an answer including a variable. Unless otherwise stated, a numerical answer is understood to be a real number. A graph will never be an acceptable form of an answer.
4. Answers should always be simplified, unless otherwise specified by the problem writer. The following guidelines should be followed:
  - a. In an expression without variables, simplest means perform all operations. Any fractions given must be in reduced form, either mixed or improper.
  - b. In an algebraic expression containing one or more variables, simplest means to combine all like terms with integral coefficients. For example,  $3a + 2b - 4a$  should be written as  $-a + 2b$ , whereas  $ka - 3b + 2a$  is acceptable as written.
  - c. Ratio form: "A : B", "A to B", or "A/B"  
If A and B are rational, they must be relatively prime integers. If either A or B is a radical, the rules for simplifying radicals with fractions must be used. For example,  $\sqrt{3}:\sqrt{2}$  must be written as  $\sqrt{6}:2$ , and  $2:\sqrt{3}$  must be written as  $2\sqrt{3}:3$ . Both  $\sqrt{3}:2$  or  $1:4$  are acceptable forms of an answer.

- d. In radical expressions, simplest means:
- leaving no radical in a denominator
  - leaving no fraction within a radical
  - simplifying integral radicands so no integral radicand has an integral factor the  $n$ th power of any integer other than 1,  $\sqrt{8} = 2\sqrt{2}$
  - All radicands must be stated using the lowest possible index,  $\sqrt[4]{9} = \sqrt{3}$
- e. In complex numbers **where either the real or the imaginary parts are fractions, either  $\frac{a+bi}{c}$  or  $\frac{bi+a}{c}$  form is acceptable, as well as the traditional  $a+bi$  form**, provided that  $a$ ,  $b$ , and  $c$  are relatively prime and  $c \neq 1$ . Polar form of a complex number is **NOT** acceptable, unless the problem writer indicates otherwise. The problem writer has been instructed to NOT ask for the form “ $a+bi$ ”. Furthermore, an answer of the form  $5+0i$  should be considered simplified and acceptable within the complex numbers category. **If the real part and the imaginary part of a complex number are both integers, then the answer may not be given in factored form.**
- f. In any algebraic equation, the integral coefficients that occur must be relatively prime. For example, the line  $4x - 2y = 6$  must be written as  $2x - y = 3$ . In problems requiring the equation of a line, standard form, general form, or slope-intercept form will be acceptable, unless the problem writer requests a specific form. In a problem with an unspecified form, the arrangement of variables does not matter. In a problem with a specified form, the arrangement of the variables **MUST** follow the stated order by the problem writer.
- g. In polynomial expressions, the following examples are not considered simplified:  $x^2 + 4(x+3)$  and  $x(2x^2 + 10x + 12)$ . Either of the following would be acceptable:  $x^2 + 4x + 12$  for the first example, and either  $2x^3 + 10x^2 + 12x$  or  $2x(x+3)(x+2)$  for the second example.
- h. Unless otherwise specified, negative exponents are acceptable, provided the exponent is not in the denominator. For example,  $\frac{2}{x^{-2}}$  is NOT considered simplified, while  $5x^{-3}$  is acceptable.
- i. When stating the equation of lines or curves in the plane that have common forms, it is acceptable to include a “0” within the equation. For example, the equation of the unit circle centered at the origin may be given as  $(x-0)^2 + (y-0)^2 = 1$ , and the equation of a line with a slope of zero may be given as  $y = 0x + 5$ .

5. Commas in answers will be accepted only in lists and will always mean "or". In inequalities, no commas are to be used. Use the words "and" or "or". In addition, in compound inequalities, the variable between the inequality signs must be completely isolated. For example, the statement  $3 < x + 4 < 7$  is unacceptable. Interval notation correctly used is also acceptable. For example, if the solution to an inequality is real numbers less than 3 or real numbers greater than or equal to 8, the following are acceptable ways to write the answer:

$$x < 3 \text{ or } x \geq 8$$

$$(-\infty, 3) \cup [8, \infty)$$

The following is unacceptable:

$$x < 3, x \geq 8$$

Either of the following is also considered an acceptable form.

$$x < 2, \text{ except } x \neq 0$$

$$x < 2, x \neq 0$$

6. Any set notation used by the student must be correct. This includes the difference between the statements  $x = \{3,5\}$  and  $x \in \{3,5\}$ . When giving the solution to an equation, the first statement is not acceptable, as it indicates that  $x$  is a set, rather than an element of a set.
7. In any situation, a numeral stated without a base is considered to be base ten, unless the problem writer has said, "Find the answer in base  $n$ ." In such a case the answer is assumed to be in the base  $n$ , even if the student does not indicate this. The base may be indicated in numerals or words or with the use of parenthesis as follows:
- $$314_5 \qquad 314_{\text{five}} \qquad 314)_5$$
8. Trigonometric answers must be given in the units specified by the problem writer.
9. The following symbols will be used for matrices and determinants:  $\begin{vmatrix} \end{vmatrix}$  will refer to determinants; whereas  $[ ]$  or  $( )$  will represent matrices.
10. Variables may not be substituted on an answer. If a problem says to solve for " $a$ ", a student may not write " $x =$ ". If a problem asks a student to find  $f(c)$ , a student may not write  $f(x)$ . **In addition, students may not replace a lower case variable with an upper case, or vice-versa.**
11. Probabilities should be written as a fraction reduced to lowest terms, decimal, or a percent. For example,  $3/4$ ,  $.75$ , or  $75\%$  are all acceptable (unless the problem writer specifies a form). The ratio form " $3:4$ " or " $3$  to  $4$ " will not be accepted, as this notation, when used within the context of probability, signifies the odds of something occurring.

Deleted: ¶

12. The sides opposite vertices  $A$ ,  $B$ , and  $C$  of triangle  $ABC$  will be represented by the lower case letters  $a$ ,  $b$ , and  $c$ , respectively. Depending on the context,  $A$  can represent the vertex, or the angle, or the measure of the angle, and  $a$  can represent the side or its length. A similar convention holds for other choices of letters representing a triangle. If a quadrilateral is named  $MATH$ , it is understood that the vertices  $M$ ,  $A$ ,  $T$ , and  $H$  occur in this order around the polygon (either clockwise or counterclockwise). This convention holds for other choices of letters and for the naming of polygons in general. When referring to polygons (including triangles), we are referring to non-degenerate ones.

13. When stating a domain or a range, answers may be given using either interval notation or inequalities. If a student chooses to use an inequality with a variable, the correct variable must be used. For example, if a function is given as  $f(x) = \sqrt{x}$ , the following are possible answers for the domain and the range:

DOMAIN	RANGE
All reals $\geq 0$	All reals $\geq 0$
$[0, \infty)$	$[0, \infty)$
$x \geq 0$	$y \geq 0$
	$f(x) \geq 0$

Note that it would NOT be acceptable to state  $f \geq 0$ .

14. **The only form of translator allowed in any MAML sponsored competition is a paper-bound translator. This translator must be a word-for-word translator, and may not contain any mathematical formulae, tables, or any conversion factors.**

15. **The problem writer will specify the units in any problem that has units as part of the answer. Students are not required to provide units, as this is indicated in the problem. Any answer with incorrect units will be marked wrong.**

16. **When a problem asks students to give answers to multiple values (for example, find the values of  $a$  and  $b$  in a certain equation), and the problem writer does not specify how to format the answer, students may choose to specify " $a =$ " and " $b =$ ", or they may choose to write the answer as an ordered pair. If a student chooses to use an ordered pair, then the standard to follow on the order of the variables is that they will be alphabetical. Furthermore, ordered pairs (or ordered triples, etc.) must have parentheses to indicate it is an ordered pair.**