$$\left(1+\frac{1}{1!}+\frac{1}{2!}+\frac{1}{3!}+\frac{1}{4!}+\cdots\right)^{i\pi}=-1$$

NYS MATH LEAGUE

Some Mathematical Ideas Whose Understanding Will Be Assumed For This Contest

1. The word "compute" will always call for an answer in simplest form. Thus, final answers like $\frac{6}{4}$, $5\div 2$, 2^5, and $2\sin 30^\circ$, for example, would not be satisfactory. In cases where there is a question as to what is "most simplified", alternate answers may be accepted. For example, $\frac{3}{2}$ and $1\frac{1}{2}$ are both acceptable.

2. When an answer is called for as an ordered pair (a,b), it must be given in precisely that form, including the parentheses and the comma. The same applies for other choices of letters and for ordered n-tuples.

3. 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 pentagon is named NYSML, it is understood that the vertices N, Y, S, M, and L occur in the 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 mean non-degenerate ones.

4. The Fibonacci sequence is the sequence 1, 1, 2, 3, 5, 8, 13, . . ., where each term is the sum of the two previous terms. More formally, $F_1 = F_2 = 1$, and $F_n = F_{n-1} + F_{n-2}$ for $n \geq 3$.

5. The Greatest Integer Function, symbolized by brackets, is defined as follows: if n is an integer and if $n \leq x < n+1$, then [x] = n. Since brackets are often used in much the same way as are parentheses, any problem using brackets to represent the Greatest Integer Function will clearly say so.

6. Logs are base 10 unless otherwise indicated; the use of log x also implies that x is positive. In general, when bases are not indicated, numbers referred to are in base 10. If another base is being used, the base will usually be written as a subscript.

Example: $\log_4 64$ **(3) or** 102.13_4 $(18\frac{7}{16})$.

7. The italicized letter *i* will always be used for $\sqrt{-1}$.

8. Some symbols of Combinations and Permutations: $\binom{n}{r} = {}_nC_r = \dfrac{n!}{r!(n-r)!}$; **this is the number of combinations of n things taken r at a time.** ${}_nP_r = \dfrac{n!}{(n-r)!}$; **this is the number of permutations of n things taken r at a time. Note 0! = 1.**

9. The capital A that begins the expressions Arc sin x, Arc cos x, and Arc tan x calls for the principal values of these inverse trigonometric functions. The ranges are as follows: $-\frac{\pi}{2} \leq \operatorname{Arc}\sin x \leq \frac{\pi}{2}$; $0 \leq \operatorname{Arc}\cos x \leq \pi$; $-\frac{\pi}{2} < \operatorname{Arc}\tan x < \frac{\pi}{2}$. **When degrees are to be used instead of radians, the problem will so indicate.**

10. Lattice points are points on a grid, both of whose coordinates are integers.

11. Divisors or factors of an integer refers to the positive integer divisors only. Proper divisors of an integer are divisors that are less than the integer itself.

12. The designation primes refers to positive primes only.

13. Sometimes, problems refer to the digits of a number; in that case, those digits are unusually underlined. Examples: "Let N = 7 7 7 . . . 7, where the digit 7 occurs 100 times"; or "Find the missing digits A and B if K = A 2 5 B and K is a multiple of 72". [The number K is not to be interpreted as the product of A, 2, 5, and B.]

14. If a diagram is given with a problem, it is not necessarily drawn to a scale.

15. It is often helpful to have a basic knowledge of elementary number theory, including modular arithmetic, and of analytic geometry, including the conic sections, for these contests.

[Revised: March, 2006]