**MAO National Convention 2014 Alpha School Bowl #1**

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**MAO National Convention 2014 Alpha School Bowl #2**

2. The set S consists of all the complex numbers such that the following inequalities are satisfied:

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Let A be the area of S.

Let B be the number of Gaussian integers in S. (Gaussian integers are the set ).

What is ?

**MAO National Convention 2014 Alpha School Bowl #2**

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**MAO National Convention 2014 Alpha School Bowl #3**

3. Triangle ABC has sides of length 5, 6, and 7. What is the probability that a randomly chosen point that lies in the triangle’s circumcircle also lies in its incircle?

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4. Solve the following system of equations where .

Now find the value of the limit:

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**MAO National Convention 2014 Alpha School Bowl #5**

5. Find the values of and below.

Compute .

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**MAO National Convention 2014 Alpha School Bowl #6**

6. Let be some integer with . The decimal expansion of is divided by to get

where are digits between 1 and 9 inclusive. Furthermore, and .

(Spaces have been added for readability, but do not reflect the place values of the digits.)

Compute the sum .

(Hint: Try divisibility rules)

**MAO National Convention 2014 Alpha School Bowl #6**

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Compute the sum .

(Hint: Try divisibility rules)

**MAO National Convention 2014 Alpha School Bowl #7**

7. For this question, and .

Let A be the period of .

Let B =

Let C be the number of times the graph intersects the graph of .

Let D be the fraction of the interval that is in the domain of the function .

Evaluate

**MAO National Convention 2014 Alpha School Bowl #7**

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**MAO National Convention 2014 Alpha School Bowl #8**

8. If and , then find the sum of all possible values of .

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**MAO National Convention 2014 Alpha School Bowl #9**

9. Two positive, real numbers and are chosen uniformly and randomly on the real number line, satisfying .

A = the probability that

B = the probability that

C = the probability that the point is contained within the unit circle

D = the probability that

Evaluate

**MAO National Convention 2014 Alpha School Bowl #9**

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**MAO National Convention 2014 Alpha School Bowl #10**

10. Let .

 the length of the range of

 the positive difference in length between the domains of and

 the area contained between the graphs of and

Evaluate .

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**MAO National Convention 2014 Alpha School Bowl #11**

11. Consider the function

Let be the horizontal asymptote of .

Let , , …, be the vertical asymptote(s) of , for some positive integer .

Let the sum of all the values for which .

Calculate

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**MAO National Convention 2014 Alpha School Bowl #12**

12. Define the complex number

Let A be the magnitude of , or .

If , the smallest positive integer for is B.

What is ?

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What is ?

**MAO National Convention 2014 Alpha School Bowl #13**

13. Let be the determinant of the matrix

Let be the sum of the elements in .

Let the vector-valued function be defined as

Let be the sum of the squares of all possible such that if there exists a vector such that for some real number , then .

What is A+B+C?

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**MAO National Convention 2014 Alpha School Bowl #14**

14. Let and be vectors with and .

Let A be the area of the triangle bounded by and .

Let B be .

Find .

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