



2005-2006 Problems

Maine Mathematics Science and Engineering Talent Search

Round (2005-2006) **Grades 9-12**

Deadline: (Postmark) November 29

Mail solutions to: MMSETS

P.O. Box 496

Orono ME 04473

NOTE: Please read and follow the GUIDELINES TO PREPARE SOLUTIONS (after the problems). Print out, complete and attach the cover sheet to your solution. The cover sheet is after the GUIDELINES

1. Five students work to each receive cash prizes for their volunteer work. Any integer prize from \$0 to \$1,000 inclusive is possible. If the median prize is \$500, what is the largest possible average prize of the five students?
2. There are eight distinct integers. When we add seven of the eight integers the possible sums are

46, 43, 40, 39, 35, 44, 47, 42

Find the sum of the eight integers.

3. A restaurant prepares a lunch menu for each of the days Monday, Tuesday, Wednesday, Thursday, Friday and Saturday. The management decides that each day should have seven different lunches, with exactly four of them not appearing on any other day of the week. What is the greatest number of distinct meals that could be offered by this restaurant? (The restaurant is closed on Sunday.)

4. $H(x) = 144^{\sin^2 x} + 144^{\cos^2 x}$ Find the values of x , to get integer value for $H(x)$.

5. Zach left Albertville at x minutes past 6:00 p.m. and reached Bordertown at y minutes past 6:00 p.m. the same day. He noticed that at both at the beginning and the end of the trip the minute hand made the same angle of 110 degrees with the hour hand on his watch. How many minutes did it take Zach to travel from Albertville to Bordertown ?

6. Find the smallest positive integer k such that $2^{69} + k$ is divisible by 127.

7. Let AB be a diameter of a circle and P be a point outside the circle and not on the line determined by P and B cuts the circle again at V .

If

$$\frac{PU}{PA} = \frac{1}{2} \text{ and } \frac{PV}{PB} = \frac{3}{2} \text{ find the angle } \angle ABP.$$

8. The Queen in Wonderland decided to have a square shaped rose garden made of 64 smaller square shaped rose beds. Initially she ordered white roses. Each day, a soldier walks through the garden repainting the roses of all the rosebeds he passes, so that white is changed to red and red is changed back to white. Can he do this so that after several days, the rose beds in the rose garden would be colored red and white like a chessboard?

9. Let a and b real numbers such that $0 < a < b$. Suppose that $a^3 = 3a - 1$ and

$$b^3 = 3b - 1. \text{ Find the value of } b^2 - 1.$$

10. In an 8×8 square board 24 unit squares are colored yellow, the rest are colored orange. When the board is folded half along a line parallel to one edge of the board, exactly 9 pairs of yellow unit squares coincide. Find the number of orange unit squares that coincide.

Questions? Please e-mail to evaszillery-mmsets@me.acadia.net

Guidelines to prepare solutions

- Purpose: The purpose of organized writing is to help you explore and understand important mathematical concept. Written communication is key to comprehension: you can best understand mathematical ideas by explaining them clearly in writing.
- Write at a classmate's level: Specifically, write in such a manner that one of your classmates who are unfamiliar with the problem could easily follow your work. Thus, your solutions should be a well-organized, lucid explanation of what you're doing. In particular: clearly label all drawings and graphs. Identify any variables you use and, when appropriate, give their units. Don't pull formulas out of a hat (give a reference).
- Strike a balance between English sentences and mathematical equations: If your paper contains mathematical "chicken scratches" it will be almost impossible for a reader to follow what you have done.
- Make your paper presentable: Your paper need not be word-processed, but should be clean and neat. Don't scribble.
- Get an early start: many problems are challenging and require some experimentation. Starting a solution the night before it's due is a very bad idea.
- [Use our enclosed Cover Sheet](#), fill out and attach to your solution set.
- Students in grade 6-9 can submit solutions to both problem sets (6-9 and/or 9-12).

Deadlines

In general, the participants of the MMSETS will have at least one month for the submission of their solutions. The deadlines for the seven rounds are:

- Round 1 Due: October 4
- Round 2 due November 1
- Round 3 Due November 29
- Round 4 due January 4 (Wednesday)
- Round 5 January 31
- Round 6 February 28
- Round 7 March 28

These are the dates for postmarking the submissions; hence there is no need to utilize various special delivery services. We don't accept solutions submitted by e-mail.

The solutions submitted will be evaluated by a team of faculty members and graduate students. The scores will be sent to the students after each round. Except in cases of obvious oversights on our part, the scoring of the problems will be final. Appeals should be addressed to the coordinator of MMSETS.

MMSETS Cover Sheet 2005 - 06

Name:.....

Phone:

Address:

E-mail:

Grade:

School Name.....

School Address:.....

Math Teacher's Name:

Signature:

Date:

Remember, Complete this cover sheet and attach it to your solution set. Solutions should be postmarked by the due date for each problem set. They should be mailed to: MMSETS, P.O.BOX 496, Orono, ME 04473