

SEARCH

Mount Holyoke College
June 29 – July 26, 2008

Problem Packet

You are about to embark on an unusual and, what we think is, stimulating collection of exercises!

The main objective for this exercise is to gauge your curiosity about mathematics and your interest in being a part of a mathematics “research” team. But, we also hope that you have fun with the problems.

IMPORTANT! Although we are asking you to try to solve some problems, we are much more interested in hearing about your SEARCH for solutions and for understanding. So don’t be upset if you aren’t able to solve a problem, we’ll be happy to hear your ideas and your failed attempts, your questions about a problem and your conjectures about other problems.

Ground Rules:

- Do any 1 of the 3 Problem Groups.
- You may consult with someone – just tell us what help and ideas you got and from whom.
- You may also use computer software if you wish – Again, just acknowledge and describe how you used this resource.
- However, **DO NOT** search for solutions in books or on the web!

Suggestion: Talk through each problem with someone, and use a picture to help you solve each problem. We at the SEARCH program will be happy to talk with you about your problem-solving attempts by phone (413/538-2608) or over the internet (search@mtholyoke.edu).

In each of the problem groups in the pages that follow, a fundamental problem is stated. It will be helpful to you if you don’t spend a lot of time trying to solve it at first, but, rather, work through the list of exercises, in order. For example, the solution attempts to the original HEX problem in Problem Group 1 below aren’t requested until exercise #4 in the problem group.

(Don’t forget! Do any 1 of the 3 Problem Groups of your own choosing.)

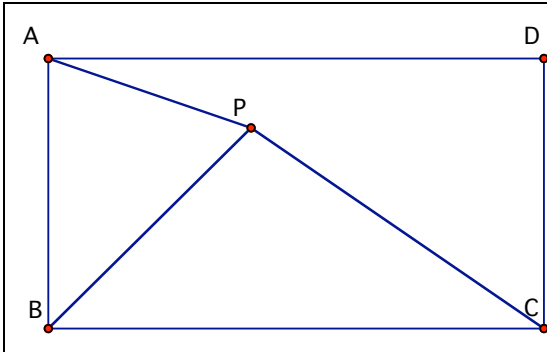
Problem Group 1

WHY. For any positive integer n , the fraction $(21n+4)/(14n+3)$ can be formed. Show that there is no positive integer n for which this fraction reduces.

1. Give some numerical evidence that the fraction never reduces.
2. Show your solutions, including pictures, or attempts to solve WHY.
3. Now think up another problem that is stimulated by WHY or your attempts to solve WHY. It should be some sort of variation on the original problem.

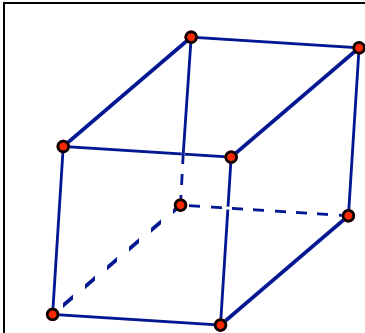
Problem Group 2

SEE. In the diagram below, ABCD is a rectangle. The distances PA, PB, and PC are 3, 4, and 5, respectively. What is the distance PD?



1. Describe your first thoughts and questions about the problem SEE, and try to think up a problem that is simpler than, but in some way related to, problem SEE.
2. Show your solutions, including pictures, or attempts to solve SEE.
3. What do you think is interesting about the problem SEE?

Problem Group 3



How many ways are there of coloring the edges of a cube with 4 different colors?

1. Think up a problem that is simpler than, but in some way related to, CUBE.
2. Show your solutions, including pictures, or attempts to solve the problem CUBE.
3. What are some different meanings for two colorings to be called different?