

## What a Mathematician Has to Offer

In the years that I have been a mathematics professor, I have thought carefully about what part I play in the education of my students. My view is that professors have specialized, but valuable knowledge and understanding of the world, and it is our role to show students how looking at the world through our eyes can help them become more valuable people in our society. In the previous document, I explained what my perspective is as a mathematician and how I create activities to help students look at the world like a mathematician. It is now my responsibility to explain how my classes help students become valuable people.

The most important skill that a mathematics course can help a student achieve is problem solving. This is easy to say, and everyone may agree, but we should ask ourselves what problem solving actually makes a person more valuable. The problems that people are most desperate to solve are those without a set of rules to follow. They are difficult. They demand persistence and patience. Making a plan for the solution is not obvious. You need to be creative and clever. You need to make sure you have considered all possible scenarios, and that your solution has no chance (or minimal chance) of failure. These are the habits of mind that mathematics can foster, and they suggest what mathematical problems we should value. We should have minimal (although not non-existent) emphasis on routine, “recipe” problems. We should greatly emphasize difficult problems that demand creative solutions. This perhaps suggests that the material we teach in our courses is not nearly as important as the problems we assign. Many people I know believe the role of problems is to help students understand the material better. I believe the role of the material is to give students a context in which to solve problems. If we believe that problem solving is important, shouldn't problems be at the center of our teaching? Problem solving in my classes can be grueling, frustrating, and yet inspiring when a problem is solved. In my view, this is how all important problems function (both mathematical and non-mathematical). Isn't it our responsibility to teach this to our students?

One of my high school mathematics teachers once told our class that our most important class was English. This was rather shocking coming from a mathematics teacher. His reasoning was that nothing is more important than being able to write well. To express your ideas and reasoning clearly and eloquently was important enough even to outshine mathematics. I share his sentiments. Whether you are an engineer who must write a technical report to your supervisor, a supervisor who must craft a memo, or a citizen who wants to write a compelling and coherent letter to the editor, writing is the means for getting the ideas out of your head and out to others. The fact that writing is so important in mathematics gives mathematicians a wonderful opportunity to become writing instructors to students. Difficult problems require complex ideas that cannot be adequately expressed by symbols. By demanding that students write their solutions in paragraphs along with the symbols, we help them develop their ability to communicate. While my students often are irritated by my insistence on clear and careful writing, they make wonderful improvements on their exposition. I am as proud of them for that as the improvement in their problem solving.

Finally, mathematics gives students an opportunity to explore their curiosity. By requiring students to pose problems in my upper level classes, I give them an opportunity to think about the material we covered and choose something interesting that they do not know how to solve. How I would love a world inhabited by curious people. I do not suggest that my student's questions will create such a world, but it is a step in the right direction.

Diligence, creativity, communication, curiosity. These are among the values that I believe we can help our students achieve through mathematics. These qualities are vital to our students' education, and I believe we should be conscious of them when we design and organize our courses.