Survey of Mathematical Problems I

Instructor's Guide

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December 1996

Preface

> Everybody talks about the weather, but nobody does anything about it. *Mark Twain*

College mathematics instructors commonly complain that their students are poorly prepared. It is often suggested that this is a corollary of the students' high school teachers being poorly prepared. International studies lend credence to the notion that our hard-working American school teachers would be more effective if their mathematical understanding and appreciation were enhanced and if they were empowered with creative teaching tools.

At Texas A&M University, we decided to stop talking about the problem and to start doing something about it. We have been developing a Master's program targeted at current and prospective teachers of mathematics at the secondary school level or higher.

This course is a core part of the program. Our aim in the course is not to impart any specific body of knowledge, but rather to foster the students' understanding of what mathematics is all about. The goals are:

- to increase students' mathematical knowledge and skills;
- to expose students to the breadth of mathematics and to many of its interesting problems and applications;
- to encourage students to have fun with mathematics;
- to exhibit the unity of diverse mathematical fields;
- to promote students' creativity;
- to increase students' competence with open-ended questions, with questions whose answers are not known, and with ill-posed questions;

- to teach students how to read and understand mathematics; and
- to give students confidence that, when their own students ask them questions, they will either know an answer or know where to look for an answer.

We hope that after completing this course, students will have an expanded perspective on the mathematical endeavor and a renewed enthusiasm for mathematics that they can convey to their own students in the future.

We emphasize to our students that learning mathematics is synonymous with doing mathematics, in the sense of solving problems, making conjectures, proving theorems, struggling with difficult concepts, searching for understanding. We try to teach in a hands-on discovery style, typically by having the students work on exercises in groups under our loose supervision.

This Guide contains materials that we prepared for the second iteration of the course, taught during the fall semester of 1996. We distributed the main body of the Guide to the students, reserving the appendices for the use of the instructor.

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