

# MATHEMATICS TALKS FOR HIGH SCHOOLS

Members of the Mathematics Department at the University of Alberta have prepared a list of talks which are suitable for High School students, Mathematics clubs and/or teachers. Anyone interested in scheduling any of these talks for their school is asked to contact Ivan Baggs, Department of Mathematics, University of Alberta, Edmonton, or phone 432-3385. A partial list of these talks together with an abstract and names of the speakers is given below. If you would like to have a talk on a mathematical topic not listed below, let us know and we can probably accommodate you.

1. CANONICAL CALCULATION by Professor H.I. Freedman

Summary: History of calculation and calculating instruments from ancient through medieval up to the present time. Topics include finger reckoning, ancient Roman hand calculators, bank accounts in the middle ages, the first mechanical adding machine. Slides and models utilized.

2. TRANSCENDENTAL  $\pi$ -DITATION by Professor H.I. Freedman

Summary: A chronology of  $\pi$  from ancient times to the present. Topics include methods of calculating  $\pi$ ,  $\pi$  in the Bible, irrationality of  $\pi$ , squaring the circle, anecdotes on  $\pi$ . Charts and slides utilized.

3. MATHEMATICAL BIOLOGY by Professor H.I. Freedman

Summary: How mathematics can be used as an aid in explaining biological phenomena. Why is a louse not as big as a house? How do genes distribute from one generation to the next? This talk is intended for an audience of "better" students.

4. LARGE NUMBERS by Professor H.I. Freedman

Summary: How does one write a large number? Can you ever own a complete set of bingo cards? What is a googol? Charts utilized.

5. THE ART OF PROBLEM SOLVING by Professor M.S. Klamkin

Summary: The art of problem solving is related to that of problem proposing. For by considering other problems related to the one to be solved, we are often led to a key idea which unlocks its solution. This is illustrated by an elementary geometric minimization problem which is rather difficult to solve. To obtain its solution, we will consider the general patterns of "level lines," "relaxation," "homotheticity," and "symmetry." Each pattern in turn will be illustrated by several other problems.

6. PROBLEM SOLVING VIA TRANSFORMS by Professor M.S. Klamkin

Summary: Here we take a broad viewpoint in solving problems via transformations. We illustrate (with slides) the philosophy and applications of transform theory by a series of problems starting off with some simple ones in arithmetic and geometry. We then consider some other problems in algebra, probability, number theory, combinatorics and physics. The choice of problems illustrated will depend on the background of the audience attending.

7. MATHEMATICAL CREATIVITY by Professor M.S. Klamkin

Summary: Although the psychological aspects of creativity in mathematics are important, we shall dwell mainly on the mathematical aspects. We will show how one can start with some rather elementary mathematical results and often end up with some rather sophisticated results.

8. ON THE TEACHING OF MATHEMATICS SO AS TO BE USEFUL by Professor M.S. Klamkin.

9. VECTOR PROOFS IN SOLID GEOMETRY by Professor M.S. Klamkin

Summary: In solving problems, one usually has the choice of using analytical geometric, synthetic geometric or vectorial methods. We discuss, with many illustrations, the advantages and disadvantages of these three general approaches. For many problems, especially higher dimensional ones, it seems that the vectorial approach is a good compromise insofar as the case of setting up the problem is concerned as well as its subsequent solution.

10. OPTIMIZATION BY MEANS OF LEVEL LINES AND INEQUALITIES by Professor M.S. Klamkin

Summary: We show, with many illustrations, how one can solve maximum and minimum problems with dispatch using level lines and/or inequalities. Also one can obtain the condition for the maximum or minimum of a rational function of one variable, in a given interval, without calculus.

11. MATHEMATICAL COMPETITIONS by Professor M.S. Klamkin

12. THE SANDY FOUNDATIONS OF MATHEMATICS by Professor J.W. Macki

Summary: (Math 31 or Math Club Level). The concept of numbers is usually introduced via the notion of set. But intuitive set theory contains paradoxes. When one tries to make set theory precise, problems arise. I discuss recent work in this area which seems to indicate that there are no obvious firm foundations for mathematics.

13. FINDING ROOTS OF POLYNOMIALS AND OTHER SORDID DRAMAS by Professor J.W. Macki

Summary: (Math 30 level). A discussion of techniques for finding roots of polynomials from ancient times through the escapades of Cardano, Tartaglia and Ferraro. Concludes with a discussion of Galois' and Abel's solution of the quintic problem.

14. SOME PROBLEMS ON PAIRINGS by Professor J.W. Moon

Summary: Suppose a class consists of an equal number of boys and girls and that some of the boys and girls like each other and some don't. When is it possible to pair off the boys and girls in such a way that each person is paired with someone he or she likes? This and some related problems and applications will be discussed.