10. Prove that cos 29° is not a rational number.

11. Form a nine digit number using each of the digits 1, 2, 3, 4, 5, 6, 7, 8, 9, once and only once so that the number formed by the nine digits is a multiple of nine, the number formed by the first eight digits is a multiple of eight, the number formed by the first seven digits is a multiple of seven, and so on, i.e. the number formed by the first n digits is a multiple of n, for $1 \leq n \leq 9$.

LETTER TO THE EDITOR

December 1983

Dear Editor,

The National Committee for Mathematics received the following letter from the International Mathematical Union appealing for financial support for the Special Development Fund, and would appreciate your bringing it to the notice of your readers in the belief that many of them would wish to contribute to the fund. Donations can be sent anytime either directly to the banks mentioned in Professor Lehto's letter or to the undersigned, marked "I.M.U. Special Development Fund".

Yours sincerely,

Secretary,
National Committee for Mathematics,
Royal Irish Academy,
19 Dawson Street,
Dublin 2.

May 4, 1983

TO ALL NATIONAL COMMITTEES FOR MATHEMATICS

The Special Development Fund aids IMU to fulfill the important obligation of helping developing countries within the framework of mathematical research. The means of the Fund, which go unreduced to mathematicians from developing countries, are used primarily for travel grants to young mathematicians, to make them possible to participate in International Congresses of Mathematicians. The Executive Committee of IMU elects an international committee to distribute the grants.

Means to the Special Development Fund come from private donations. This letter is addressed to you in the hope that you could make a contribution to the Fund, either directly or by making an appeal among the mathematical community of your country. Donations can be sent at any time and in any convertible currency, to the following accounts:

Schweizerische Kreditanstalt
Stadtfiliale Zurich-Rigiplatz
Universitätstrasse 105
CH-8033 Zürich, Switzerland
Account Number 0862-656208-21

Kansallis-Osake-Pankki
Aleksanterkatu 42
SF-00100 Helsinki 10, Finland
Account Number 100020-411-USD-5705 FR.

The next goal is to collect money for travel grants for the 1986 International Congress of Mathematicians in Berkeley.

With best thanks for your cooperation,

Yours sincerely,

Ollie Lehto

THE EVOLUTION OF RESONANT OSCILLATIONS IN CLOSED TUBES

E.A. Cox[1] *and M.P. Mortell*[2]

1. INTRODUCTION

This paper discusses the formulation and solution of a nonlinear initial value, boundary value problem that arises from a simple experiment in gas dynamics. A tube which is closed at one end, contains a gas. The gas in the tube is driven by an oscillating piston. It is observed that when the frequency of the piston is near to a natural frequency of the tube the resulting gas motion is periodic and characterised by a shock wave travelling over and back along the tube. The theoretical work to explain the final periodic motion goes back to Betchov [2] and Chester [3]. The reader should consult Seymour and Mortell [9] for more recent work on the problem. However, the problem of the evolution of the periodic motion of the gas from an initial state has not until now [4] been solved.

It is worthwhile noting, at this juncture, that nonlinear effects, such as shocks, can occur without any dramatically large input into the system. For example, in the present case when the piston is operating at the fundamental frequency of the tube, a shock has been observed even though the ratio of piston displacement to tube length is of the order 10^{-2} [8].

Before giving the details of the particular problem, the broader background in which it is set will be sketched. The study of nonlinear waves began with the pioneering work of Stokes [10] and Riemann [7]. Whitham [11] distinguishes two main classes of waves, hyperbolic and dispersive waves. Hyperbolic waves are solutions of a set of hyperbolic partial differential equations and our problem fits into this class. The intersection of characteristics for a nonlinear hyperbolic equation gives rise to the physical phenomenon of a shock.