of booklets published in Russia between 1951 and 1959. They are quite short, from 65 pages to 91 pages in length, and have been translated by Mrs. Halina Moss. All of them can be recommended for school libraries.

(i) The book on *Mathematical Induction* provides a very clear exposition of the induction method. There are many examples, some with full solutions in the text. For the other examples solutions are given in a last chapter. The book can be strongly recommended to pupils in sixth forms at school and to students in the first year at the university.

(ii) This is a well written booklet on the elementary properties of the *Fibonacci Numbers*, which should prove interesting and instructive to senior pupils in schools. After proving the simplest properties, Binet's formula for the general Fibonacci Number is derived and divisibility properties of the numbers are obtained. This latter treatment is preceded by an introduction to Euclid's algorithm with simple properties of the greatest common divisor of two numbers. The relations of continued fractions and of the golden section in geometry with Fibonacci numbers are discussed. The book is readable and the exposition detailed and clear.

(iii) *Some Applications of Mechanics to Mathematics* is based on a lecture given to seventh year secondary school pupils at Moscow. The principle of least potential energy is used to obtain tangents to circles and conics and the position of the centre of gravity of point loads is used to prove Ceva's theorem and to solve a problem in the theory of numbers. This would be quite a good book to have in a school library as light reading for senior pupils of mathematics.

(iv) *Geometrical Constructions Using Compasses Only* begins with a historical introduction and then various geometrical problems are solved using compasses only. The fact that the inverse of a straight line is a circle is used to give a general method of construction based on the method of inversion. In the second part of the book constructions are discussed where restrictions are put on the size of the angle made by the legs of the compasses. A sixth form pupil with an interest in geometry would find this book most interesting, although, considering the trend away from geometry in school mathematics, it may well be that the book would have had more value for an earlier generation of school mathematicians.

(v) The first part (38 pages) of *The Ruler in Geometrical Constructions* is devoted to standard work on inverse points, harmonic ranges, etc. The second part (48 pages) gives an account of ruler constructions based on the ideas developed in the first part. It is shown that any construction which can be performed using ruler and compasses can be performed with a ruler only, if the centre and an arc of a circle are given. It is also shown that it is impossible by means of a ruler alone to find the centre of a given circle.

(vi) *Inequalities* is really a collection of problems involving important inequalities. More than half of these are solved in the text and solutions of the rest are given in the last chapter. None of the theorems on operations with inequalities is proved; in fact they are not even stated and a knowledge of them is assumed. All teachers who have taught inequalities to sixth form pupils or first year students know how difficult they are found to be. This book, used along with a standard text, should be a considerable help.

R. P. GILLESPIE

ROBERTS, J. B., *The Real Number System in an Algebraic Setting* (W. H. Freeman and Company, San Francisco and London, 1962), 145 pp., 10s.

This book contains a definition of the real numbers starting with the natural numbers. The first chapter gives a survey of the properties of sets, mappings, relations. operations and algebraic systems, which are used throughout the book. The pictorial mixing boxes, on page 22, illustrating operations on a set $S$ that are commutative or associative are not particularly convincing and would probably be better omitted.

The set of natural numbers is defined as an algebraic system $(Z; +, .; <)$ with two operations and a relation. The main defect in this approach, from the point of view of beginners, is that the reader is subjected immediately to a formidable list of axioms. Some properties of the natural numbers, including prime factorisation, are developed.

The number system is then extended through the following sets:

(1) the positive rationals (by ordered pairs of natural numbers),

(2) the non-negative real numbers (using Cauchy sequences of positive rational numbers),

(3) the real numbers (by ordered pairs of non-negative real numbers).

In the introduction of (2), the familiar modulus notation $| a-b |$ is not available because of the approach through the positive rational numbers rather than through the set of all rational numbers. The collection of symbols $| a, b | < c$ is used to stand for the assertion

$$a < b+c \text{ and } b < a+c,$$

and is read " $a$ and $b$ are within $c$ of each other ". Students may find difficulty in mastering this situation.

There are sections on least upper bounds and greatest lower bounds and the decimal representation of real numbers. Four appendixes, A, B, C and D, contain, respectively, work on cardinal numbers, an introduction to the complex numbers, a statement of the alternative introduction by Peano's axioms to the natural numbers, and a brief note on continued fractions.

The book is well written with good collections of stimulating examples in the exercises. The printing and layout are excellent.

J. HUNTER

TODD, J., *A Survey of Numerical Analysis* (McGraw-Hill, New York, 1962), 589 pp., 97s.

This excellent book arose from a series of lectures and discussions organised by the National Bureau of Standards to attract experienced mathematicians into the field of numerical analysis. The editor has succeeded in preserving a continuity of material throughout the volume which is unusual in a work where practically every chapter has been written by a different author. Although the book is in the main most suitable for post-graduate students, the reviewer feels that its principal function may well be to make the subject of numerical analysis more respectable in the eyes of many mature applied mathematicians.

After an introduction in which the editor outlines the branches of mathematics which have contributed significantly to the development of numerical analysis, there is an adequate chapter on classical numerical analysis including interpolation, numerical differentiation and integration, and the numerical solution of ordinary differential equations of simple type. This is followed by the constructive theory of functions in which the existence of finite polynomials of best approximation to given continuous functions is shown.

The aim of the next chapter is to introduce the reader to the actual use of automatic computers. A hypothetical computer is constructed and programmes written for it. Then follows a section on computer logic, a topic as yet unconnected with numerical analysis, the subject which has done most to motivate the design of high speed computers.

The chapter on matrix computations is concerned with the solution of linear equations and the inversion of matrices together with the determination of eigenvalues