Was ist Mathematik? Unterhaltungen während einer Seereise. By
 Lothar Heffter. Freiburg i. Br., Theodor Fischer, 1922. 160 pp.

Les Mathématiques. By Pierre Boutroux. Paris, Albin Michel, 1922.
 183 pp.

Problems of Modern Science. Edited by Arthur Dendy. *Mathematics.* By
 J. W. Nicholson. New York, Henry Holt and Company, 1922. 237 pp.

Judging by the number of books that are appearing which devote
themselves to the popular exposition of various branches of science, it
would appear that the general public is becoming increasingly interested
in the nature of scientific progress. Or is it only that publishers are
beginning to realize the existence of this interest and are gradually be-
coming bold enough to meet the resulting demand? Of the books listed
above the first two endeavor to give a popular account of mathematics
as a whole; they are attempts to answer for the layman the question
he so often asks: "What is mathematics all about, anyway? I know
a little something about elementary algebra and plane geometry. But
you people (meaning the mathematicians) talk about 'mathematical
research', you use a lot of technical terms and a mass of mysterious
looking symbols that nobody else can understand. Can't you tell some-
thing about it in terms that are intelligible to us?" The two books
referred to offer replies to these questions in very different ways. The
first is by far the less formal and is concerned primarily with ideas;
the second is more formal and is primarily concerned with processes.
The former can be more easily read, the latter is more adapted to study.
Both cover a wide field.

The little book by Heffter is in the form of a dialog between a
mathematician and a merchant, is delightfully written, and admirably
accomplishes its purpose within the limits which the author has imposed
on himself. "In the beginning was number" is the title of the third
chapter (the first two are introductory) and here the author speaks
genially of the concept of whole number (positive and negative), calls
attention to the fact that there exist an infinitude of such numbers
although each one is finite, illustrates the commandment "Thou shalt
not divide by zero," discusses prime and composite numbers, congruence
and quadratic residues and diophantine equations, not neglecting Fermat's
last theorem and the Wolfskehl prize. The next chapter deals with
the successive extensions of the concept of number up to and including
the introduction of complex numbers, not omitting the Dedekind cut,
the concept of transcendental numbers and the squaring of the circle,
the fundamental theorem of algebra and the distinction between the
existence of a root of an algebraic equation and its algebraic solvability.
In Chapter V, the story of Achilles and the tortoise serves to introduce
the notion of infinite series and products and continued fractions.

Chapter VI on "Connected variable numbers" introduces the function concept and the graph (including periodic functions and the depiction of one plane on another) and Chapter VII under the suggestive title of "Snapshot and moving picture" brings the concepts of derivative and integral and the fundamental theorem of the integral calculus, going so far as to introduce the notion of curvature and of differential and integral equations. The next three chapters are devoted to geometry, mainly projective (parallel and central projection, photograph, double ratio, points at infinity, duality, projective transformations and the group concept); but the fundamental notions of analytic geometry, imaginary elements, theory of surfaces (surfaces of constant curvature, non-euclidean geometry, minimal surfaces, lines of curvature and geodesics) are also discussed. In Chapter XI the fairy tale of the king and his five sons serves to introduce a problem in analysis situs and we are give a glimpse of the four-color problem, one-sided surfaces, and of concepts of genus and connectivity. The next chapter treats briefly of the classical mechanics and the last of the theory of relativity. It will be surprising to many that such a wide domain of advanced mathematical doctrine should be capable of informal and yet intelligible exposition to the layman, and yet it has been done and done extremely well. It would be highly desirable if this little book could be made available in an English translation; but would any American publisher be bold enough to publish it?

Boutroux's little book must be treated more briefly, not because it is less meritorious but because it will have a narrower appeal. As has already been suggested, it is more abstract in its treatment and is less easily digested by the lay reader. The author was himself well aware of this characteristic of his work and was apparently quite deliberate in bringing it about. In a ten page preface he discusses at length the difficulties in the way giving a popular exposition of mathematics and reaches the conclusion that in order to give a true picture of mathematics as it is the treatment must necessarily be rather severe. "It is desirable," he says, "that a book treating of mathematics be a bit abstract. If it demands more thought, the impression which it leaves will doubtless be more in conformity with truth." The character of the discussion is foreshadowed by this attitude on the part of the author. The chapter headings are as follows: I, Properties of Numbers; II, Properties of Figures; III, Mathematical Demonstration; IV, Algebraic Computation; V, Analytic Geometry; Functions and Derivatives; VI, Differential Equations; VII, The Theory of Functions. It will be seen that the emphasis is almost exclusively on analysis; there is no treatment of projective geometry or of analysis situs. The book would seem to be admirably adapted to the interested layman, who having read Heffter's little book, desires to go a bit further.

Professor Nicholson's article of thirty-seven pages in the last of the books under review has a different purpose than the other two, although it too is addressed to the layman. It forms one of a series of lectures delivered at King's College of the University of London on problems of modern science and attempts to present to a general audience an account of present activities in mathematical research with special emphasis on those which are related to other sciences. Any one faced with such a task has a perfect right to make his own selection of topics to be presented, and a reviewer has little right to criticise such selection. The present reviewer has no disposition to do so, beyond observing that other men would doubtless have made other selections. As is natural, the problems in vogue in England receive the greater part of the lecturer's attention. We thus hear of the theory of partitions, and of Waring's problem, and of related topics in the theory of numbers. A strange error has crept into the account of Fermat's theorem, when the founding of the Wolfskehl prize is located at Vienna. Dubious also is the statement (p. 19) that Fermat's theorem is one "towards the solution of which an extensive mathematical training is of little help." The last sixteen pages are devoted to some mathematical considerations connected with the theory of relativity and Planck's quantum theory. The lecture is readable throughout. It may be doubted, however, if a general educated audience would carry away more than a very vague notion of what it was all about, especially concerning the latter part of the lecture. More than that ought probably not to be expected from such a lecture, however, and even so, who would be bold enough to deny that the giving of such lectures and their publication is worth while? If they serve to arouse interest and give their audience even a vague notion of the beauty and significance of scientific progress they have accomplished a noble purpose.

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Principes et Premiers Développements de Géométrie Générale Synthétique Moderne. By Emile Bally. Paris, Gauthier-Villars, 1922. VIII + 218 pp.

The preface to this rather ambitious work contains some amusing statements which may be considered as characteristic of the treatise under review. The author says: "This book is dedicated to the friends of geometry. For many among these, simple amateurs as they are, the ingenious geometric deductions are agreeable relishes which they taste without any afterthought and without bothering themselves with the elements of which they may be composed. Others, more distrustful, the *critics,* wish to know what one has put into the relishes; some of these, the *purists,* cannot tolerate certain ingredients, and declare execrable every composition which contains a trace of those ingredients. Although endeavoring to please the first category, (and this book is above all the