fleur et du fruit de l'hélianthe (ou d'autres plantes) et si cela peut influer sur la disposition de la mosaïque ou même la déterminer."

According to the volume before us* it seems that there is no doubt about the logarithmic spiral arrangement in the sun-flower, or indeed that we have systems intersecting isogonally. Reference is made to a careful and elaborate study by H. H. Church,† which has been adopted by T. A. Cook in his Curves of Life. But of Thompson's comment in this connection I shall not do more than quote a single sentence: "On the analogy of the hydrodynamic lines of force in certain vortex movements, and of similar lines of force in certain magnetic phenomena, Mr. Church proceeds to argue that the energies of life follow lines comparable to those of electric energy, and that the logarithmic spirals of the sunflower are, so to speak, lines of equipotential."

Professor Thompson's work is recommended as one of the most notable and most readable of scientific books appearing in the past decade.

R. C. ARCHIBALD.

Hvorledes Mathematiken I Tiden Fra Platon Til Euklid Blev Rationel Videnskab. By H. G. ZEUTHEN. Reprinted from the D. Kgl. Danske Vidensk. Selsk. Skrifter, Naturvidensk. og Mathem. Afd., 8. Række, I. 5. Copenhagen, 1917. 183 pp.

ANY work by Professor Zeuthen on the history of mathe-matics, even though it be a reprint from the memoirs of an academy, deserves to be brought to the attention of other scholars than those who may chance to see the original publication. This is especially true when the memoirs of the academy are printed in a language not generally familiar to scholars and therefore are not as frequently consulted as those which appear in languages more nearly international.

In this particular case there is the more reason for calling attention to the memoir because a summary is given in the French language so that all scholars may have easy access to the argument and, with this as a guide and with a knowledge of German, may follow the more important details in the text itself.

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* Pp. 639–640.

† Relation of Phyllotaxis to Mechanical Laws, Oxford, 1901–1903; cf., *Ann. of Botany*, vol. 15 (1901), p. 481.

It is only a commonplace truism that the mission of the historian is quite as much the interpretation of facts as the mere writing of chronicles. It is not the facts of the present war but the interpretation of these facts and the relation of their influence upon the world that will tax the powers of the future historian. It is this feeling that will strike the reader of Professor Zeuthen's memoir. What has been done is not to call attention to newly discovered materials but to study again the significance of certain important contributions to Greek mathematics in one of the most remarkable periods of the early growth of the science. Probably only a few years intervened between the death of Plato and the birth of Euclid; certainly less than half a century elapsed from the period of the former's activity to that of the rise of the Alexandrian school; and yet it is in this period that Professor Zeuthen finds the recognition of mathematics as a logical science.

Chapter I considers the period in general, characterized as it is by the transition from an intuitive geometry to the demonstrative form in which it has come down to us.

Chapter II discusses those features which characterize a "science raisonnée" such as Euclid sought to include in his Elements. These features include the definition, the postulate, and those "common notions" which we call the axioms. The importance of all of these was fully understood by Plato, and the influence of this master inspired his pupils to undertake those investigations that finally took scientific form in the work of Euclid.

Chapter III sets forth the demands made by Plato upon mathematics in its quality of a "science raisonnée." The master seems not to have been particularly dissatisfied with the progress of plane geometry, possibly under his own influence; but he felt that stereometry was not yet upon a scientific basis.

Chapter IV discusses the rise of the analytic method. The positive facts of elementary geometry were already fairly well known, but it was apparently Plato who suggested the analytic method, with the inverse synthetic form of proof, and it was the development of this method that made possible a work like Euclid's.

Chapter V records the names of some of those who appreciated the reform instituted by Plato and carried it on to fruition. These names include not only those whose major

interest was mathematics, but, it need hardly be said, the name of Aristotle whose contributions to the study of logic assisted in the efforts of the geometer to attain the ideals which Plato had set forth.

Chapter VI returns to the conception of geometry before the reform of Plato, or rather, to the pre-Platonic psychology of form. The problem is to set forth the primitive and intuitive images of people, the early apperception of similarity, of the relation of one form to another, and of the possibility of the displacement of figures without alteration.

Chapter VII enlarges upon the study of displacements as mentioned in the preceding chapter; for example, as shown in the earlier work of Pythagoras and in the much later work of the Indian scholar Bhāskara.

Chapter VIII brings the theory of elementary displacements to a climax in the Elements.

Chapter IX summarizes the growth of the idea of similarity, tracing it to its culmination in Euclid's work.

Chapter X is devoted to a consideration of the notion of angle. Professor Zeuthen shows that the general idea of angle, as distinct from the idea of perpendicularity, arose from the study of similar figures, which of course included congruence as a special case. The rise and use of the horn-shaped angle (keratoeides) is also mentioned.

Chapter XI considers the generalization of demonstrations, including the nature of incommensurables and the use of the idea of the infinitesimal. The influence of Zeno and Eudoxus upon Euclid's treatment of the incommensurable case and upon the work of Archimedes is shown. The influence of Aristotle upon Eudoxus and Euclid is compared with that of Dedekind upon Weierstrass.

Chapter XII relates to the generalization of propositions by Euclid to meet the demands imposed by Aristotle, and shows that his postponement of the geometric treatment of the quadratic was due to the desire to give the most general form possible.

Chapter XIII deals with the question of the ideality of geometric figures, a question by no means new when Plato called it to the attention of his pupils.

Chapter XIV discusses Euclid's treatment of stereometry, particularly with reference to the distinction between congruence and symmetry in a space of three dimensions.

Chapters XV and XVI treat of the Elements, the appreciation accorded to it as a scientific work during two thousand years, and its standing as a scientific work to-day. The influence of Euclid upon the work of Apollonius is set forth in terms of appreciation that it would be well for all teachers of mathematics to consider.

The work is of the scholarly character that one would expect from a man of Professor Zeuthen's exceptional attainments, and it is earnestly to be hoped that he will publish the entire memoir in the French language. Indeed, it should not be too much to hope that Professor Zeuthen may revise all of his historical works and publish them in a uniform French edition before he is compelled to relinquish his writing and to take the scholarly ease that he has so well earned.

DAVID EUGENE SMITH.

A Manual of Mathematics. By R. G. HUDSON and J. LIPKA. New York, Wiley, 1917. 132 pp. Price $1.00.
A Table of Integrals. By R. G. HUDSON and J. LIPKA. New York, Wiley, 1917. 25 pp. Price 15 cents.

THIS manual is taken from the mathematical section of the authors' manual for engineers. It contains the formulas of algebra, trigonometry, mensuration, plane and solid analytic geometry, differential and integral calculus, ordinary and partial differential equations, complex quantities and vectors. In addition to the usual tables—four-place—there is a table of conversion factors for the various scientific units. The formulas are systematically arranged and the section headings are printed in heavy type so that it is easy to locate any formula, a very desirable feature in such a book. The table of integrals is taken from the manual. The integrals are expressed in terms of the coefficients used in the integrand. While this makes the table more difficult for the printer than if substitutions and abbreviations had been made, it is much more convenient for the student.

THOS. E. MASON.