dent patriot, this independent and indomitable worker, this genuine democrat—Pasteur: "The true democracy is that which permits each individual to put forth his maximum of effort."

CHARLES W. ELIOT.

SCIENTIFIC BOOKS.

A College Algebra. By HENRY BURCHARD FINE. Ginn & Company. 1905.

The present day is remarkable for its production of large numbers of mathematical text-books. In most cases the aim of the writers of these books seems to be to convince the student that the subject treated is devoid of any element of interest, that it possesses no logical sequence, and that memory of a large assortment of unconnected facts is the only requisite for a sound mathematical training. One meets with proofs of theorems divided into first, second, etc., steps—an obvious attempt to burden the memory at the expense of the reasoning faculty, and stress is laid on the fact that all problems are 'easy,' in fact on examination they appear scarcely worth the name of problems. There is not the slightest doubt that these harmful books are one of the causes of the decrease in mathematical students at our colleges and universities. The books are, unfortunately, given a trial somewhere, no matter how bad they may be, and one can conceive of no surer way of destroying the interest of the young student in the subject. For those who are merely general students they are equally defective. In the forefront of an author's mind should be a desire to develop the reasoning faculties. Let us have easy exercises by all means, but let us also have exercises which will make students think for themselves. Let us develop our subject along the easiest sequence, but let us develop it logically.

Professor Fine's 'College Algebra' is in refreshing contrast to such books as I have mentioned. He aims at giving an exposition at once logical and easy to understand. The result is a book that must make the subject interesting to the ordinary college student. The work is divided into two parts. The first consists of 78 pages devoted to the ideas at the base of the notion of number, a development of those ideas which are associated with the names of Cantor, Dedekind and others. This difficult subject has been handled by the author with conspicuous clearness, and every student of it should make himself familiar with these first 78 pages. It is questionable, however, whether, even with Professor Fine's exposition, it is possible to make this subject really understood by a student who is just beginning his college algebra course, and possibly the author in later editions may decide to present this section as a separate book, under a separate title.

The second part, some 500 pages, is concerned with algebra proper. It is 'meant to contain everything relating to algebra that a student is likely to need during his school and college course.' Even this wide ideal is given a wide interpretation, and the last chapter, Properties of Continuous Functions, is a fitting introduction to the calculus. The chapters on the solution of equations are of special interest. The author makes much use of graphs, the only way to make clear to the student what is implied by the solution of a set of equations. It would have been of advantage to give a brief account of the generalization of the use of graphs to the case of three variables, and thus to prepare the mind for the idea of a space of more than three dimensions. Particularly noteworthy in connection with graphs is the discussion of inequalities. The idea of a graph as dividing the plane into two regions, in one of which $f(x, y) > 0$ in the other < 0, should certainly be emphasized in ordinary algebra, before the introduction of analytic geometry, as algebraic questions, otherwise unintelligible to the learner, become almost intuitive. Observe, for instance, the illuminating example on page 341.

The general theory of the solution of equations is developed in very effective form; in particular the treatment of symmetric equations. The important idea is the taking of the various simple symmetric functions as new auxiliary variables and, after solving for these, finding the solutions of a set such as, for example, $x + y = a$, $xy = b$. Here it would be of use to point out that x and y are the roots of the quadratic $X^2 - aX + b = o$, and similarly in the more general case. The chapter on convergence of infinite series leaves little to be desired. But the author might have given Cauchy's condensation theorem that under certain conditions

$$\sum_{n=1}^{\infty} f(n) \quad \text{and} \quad \sum_{n=1}^{\infty} a^n f(a^n)$$

converge or diverge together. This has been used to discuss the well-known case

$$\sum_{n=1}^{\infty} \frac{1}{n^k},$$

and is fundamental in the construction of the De Morgan criteria. The result of § 953 may well be obtained by comparison with the series

$$\Sigma \frac{1}{n^k}$$

and a more useful form is: The series converges or diverges according as

$$\underset{n=\infty}{\mathrm{L}}\; n\left(\frac{u_n}{u_{n+1}} - 1\right) \gtrless 0.$$

Dr. Fine has, unfortunately, been compelled to leave the exponential theorem to the last few pages of the book, and it would be an advantage if more space could be given to it in a later edition. Also the more logical development in the indicial, binomial and exponential theorems, and that of De Moivre would be to first prove that if $f(x)$ is any function of x which satisfies $f(x) \times f(y) = f(x + y)$, for all values of x and y, then $f(x) = [f(1)]^x$ for all values of x; and then to apply this in turn to each of the particular theorems.

The book as a whole is admirably complete, and for this reason many parts might with advantage be omitted on a first reading. These parts could be indicated in some manner, for example by means of asterisks.

J. EDMUND WRIGHT.

SOCIETIES AND ACADEMIES.

THE AMERICAN CHEMICAL SOCIETY. NEW YORK SECTION.

THE last regular meeting of the New York Section of the American Chemical Society was held at the Chemists' Club, 108 West Fifty-fifth Street, on Friday, June 8. The chairman, Dr. F. D. Dodge, presided. The following papers were read:

The Chemical Work of the Bureau of Standards: W. A. NOYES.

The chemical laboratories of the bureau of standards were ready for the beginning of work in March, 1905. There are at present five chemists working in these laboratories.

Dr. Stokes and Mr. Cain have been working upon the standards of purity for chemical reagents. Good progress has been made in securing cooperation of the chemical manufacturers in this work, and some progress has been made in the laboratory in the development of methods for testing for impurities in reagents, especially work of this character has been done with methods for determining traces of iron and work is being conducted upon the common acids and alkalies.

Dr. Waters has worked chiefly with Dr. Wolff upon the purification and testing of materials for the preparation of standard electrical cells. He also carried out last year the analysis of the argillaceous limestone which was distributed for the purpose of improving the analytical methods taught in our colleges and universities.

Dr. Weber has analyzed a sample of sulphide ore, a zinc ore, some agricultural samples for sulphur and some samples of white metal. These have been distributed chiefly among technical or agricultural chemists by different societies.

The bureau has taken over the standard samples of iron which heretofore have been distributed by the American Foundrymen's Association, and very careful analyses of these samples were made at the bureau by Mr. Cain.

Arrangements have been partially completed with the American Steel Manufacturers' Association for the preparation of a series of samples of standard steels of the three types, Bessemer, basic open hearth and acid open hearth.

Dr. Noyes has been working on the ratio between the atomic weights of oxygen and hydrogen, and recently he has taken up, in