dates are generally stated as if they were known with certainty, as that Euclid was born in 330 B.C., and Fibonacci in 1175 A.D., while in reality many of these statements are very doubtful and are liable to be put to unfortunate use by the novice. Among the probable errors of statement are the assertion that Heron was a contemporary of Hipparchus, and that Jordanus Nemorarius was the Jordanus who was general of the Dominicans. Among the certain errors are the assertions that Alcuin was abbot of Canterbury, and that Omar Khayyám was of Arab rather than Persian stock; and among the typographical errors are the printing of Gunther for Günther (page 26), Muller for Müller (page 30), Harriott for the preferred form of Harriot (page 34), and Plucker for Plücker in the index (with a wrong reference). But in spite of these little blemishes the book will serve a good purpose, particularly among the students of the secondary schools of the French-speaking countries. DAVID EUGENE SMITH.

Solid Geometry. By SOPHIA FOSTER RICHARDSON. Boston, Ginn and Company, 1914. iv + 209 pp.

As the author states in the preface, she gives in this book the "usual course in solid geometry more complete in logical structure than that of the text-books commonly used." Definitions and axioms are quite numerous and prominent and it is by carefully stating these that many difficulties are avoided. For instance there is no difficulty nor incompleteness in the proofs of the theorems about the intersection of a cylinder or cone with a plane through an element and another point of the surface because the theorems are explicitly limited to convex surfaces. We find here also the practice, too rare in American texts, of establishing the existence of a geometric object before defining it. Thus the theorem that a straight line perpendicular to each of two intersecting straight lines at their point of intersection is perpendicular to every straight line in their plane passing through their point of intersection, is given before the definition of a perpendicular to a plane. Similarly the theorem "Any tangent line to a convex cylindrical surface and the element through its point of contact determine a plane which contains no other point of the surface" leads to the definition of a tangent plane to a convex cylindrical surface. As in most texts, geometric locus is defined and the two parts of a locus problem are pointed out, but the notable fact is that the author practices what she preaches, not only in showing that the intersection of two planes is a straight line but also in various other theorems in which too many authors are satisfied with half proofs.

Several theorems on parallel lines and planes are given before theorems on perpendicular lines and planes, an arrangement which would seem to offer less resistance to the beginning student. The exercises throughout the book demand thought, most of them being theorems rather than numerical problems.

The last chapter of the book on "Symmetry and similarity" and the Appendix on "Irrational numbers, variables and limits" offer an elementary treatment of topics to which the student of solid geometry does not usually have access.

RAINARD B. ROBBINS.

A Geometrical Vector Algebra. By T. PROCTOR HALL. Western Specialty, Vancouver, B. C. 30 pp.

HALL'S Geometric Vector Algebra is hardly what its name implies, since trigonometry and determinants are constantly needed to help out the computations of the vector algebra. We fail to attain the promise of the introduction, where we are led to expect a calculus of the space elements themselves. The exposition of principles in the first nine pages is fairly sound, although fragmentary. The word "tensor" is not defined, but means "length of a vector." S_{ab} and V_{ab} mean, substantially, the dot and cross products of Gibbs. But the product of two vectors is defined as a new vector, which turns out to consist of the usual vector product plus another vector term having the direction of the multiplying vector and the length S_{ab}. Evidently with this multiplication not much progress can be made toward a working system. The author himself proves that multiplication is not commutative, associative, nor, in general, distributive. The square of a unit vector, by the definition, is equal to the vector itself, but as a perpendicular operator the square is negative unity; whence equals cannot be put for equals.

Trouble comes in the attempt to show that quaternions are special cases of these operations. The first three fundamental characters of a quaternion on page 10 are correctly stated, but the fourth does not hold, for it contradicts the proof on page 6 that an operator is not distributive. We may indeed resolve the vector into components, but to say that, as an operator,