

well true elliptic motion can be simulated by an eccentric circle and Ptolemy's equant. The equant is a point about which motion in the circle appears uniform. In elliptic motion it may be easily seen that the empty focus is approximately such a point. Using the equant, the maximum error in longitude is only one quarter the square of the eccentricity—8' only for Mars, and for the other planets, except Mercury, less than 2'. But if any reader wants to know all the equant can possibly be made to do before it must be condemned, let him read this account of Kepler's efforts.

#### OUR BOOK SHELF.

*The Fourth Dimension.* By C. Howard Hinton, M.A. Pp. viii+247; with coloured frontispiece. (London: Swan Sonnenschein and Co., Ltd., 1904.) Price 4s. 6d.

A BOOK bearing the present title may be reasonably expected to contain certain things. In the first place it should have a clear exposition of Descartes's applications of algebra to geometry, and conversely of geometry to algebra, the logical conclusion of which consists in the removal of all restrictions as to the conceivable number of dimensions of space. In the second place it should contain clear, concise, and exactly worded statements of the peculiar and distinctive geometrical properties which are characteristic of spaces of two, three, four, or more dimensions respectively. Among these peculiarities might be cited, as examples, the number of possible regular figures corresponding to the five regular polyhedra of three-dimensional space, the number of independent motions of a rigid body, the properties analogous to those of the shortest distance between two lines, the symmetry of crystals, and, in short, any results calculated to convince the reader that the study of space not only of four, but of *five, six,* and generally *n* dimensions leads to the discovery of geometrical theorems no less interesting than those of ordinary plane and solid geometry.

Now such things as these are either entirely absent from the book or else they are mixed up with such a mass of irrelevant and discursive matter as to render it often quite impossible to make out what the author is driving at. The notion of a fourth dimension is associated with the belief in a higher world with electricity and magnetism, with organic life, with logic and philosophy, with the nature of the human soul, and with a variety of other ideas only calculated to mislead the reader as to the real use of such inquiries. It is doubtful whether any tangible idea of the "eight cell" or any other four-dimensional figure can be gained by mere playing with coloured squares or cubes. The proper way to realise the nature of such figures is by studying their projections on pairs of coordinate planes, and four-dimensional space has the great advantage over three-dimensional in that any figure formed of points can be completely represented by projections on two sheets of paper, whereas for a three-dimensional figure one sheet is insufficient and two sheets are too much.

There is a certain class of individual, far too common in this country, who busies himself in pestering his mathematical friends with long and rambling letters on such questions as "What is the fourth dimension?" or "What is the ether?" Such people very rarely know anything about the three dimensions of the space they live in, but Mr. Hinton's book will, it is to be

hoped, give them something to think about which will at least amuse them and keep them occupied. The great misfortune is that such books are believed by the general public to be descriptions by a mathematician of the work of other mathematicians. Consequently, mathematicians obtain a reputation for being unpractical which they certainly do not deserve.

*The Hill Towns of Italy.* By Egerton J. Williams, jun. Pp. xiv+398; with illustrations from photographs and map. (London: Smith, Elder and Co., 1904.) Price 10s. 6d. net.

THE majority of English people who visit Italy confine their attention to large towns such as Florence, Rome, Naples and Venice. The mediæval towns of Etruria and Umbria constitute practically a *terra incognita* to the ordinary tourist. The author has done useful work in directing attention to a district full of historic associations, and the picturesque glimpses which he has given us both of towns and country may well tempt those who have the time and opportunity to go and visit the district themselves.

If there is one feature which lends itself to criticism, it is that a perusal of the book does not give one a mental picture so much of the towns themselves as of an American *traveler's* impressions of them. It is probably very hard for any writer to describe Italian life who has not spent several of his early years in Italy. So long as the writer confines himself to purely descriptive matter the facts are Italian enough, but where he endeavours to give colour to the scene, that colour hardly feels right. We may cite such sentences as "The exquisite grace and sweetness of the madonna hold the onlooker like a vise" (query *vice*); "One more ancient madonna greeted me as I passed out by the left aisle." It would also be interesting to know the author's authority for such spelling as Velathri and Thrasymene. Velitæ and Trasimene are certainly usual. Seeing, however, that the book was written as the result of only a sojourn of a spring and summer among the hill towns, we can but be surprised at the amount of interesting matter which it contains.

*Our Mountain Garden.* By Mrs. Theodore Thomas. Pp. 212. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1904.) Price 6s. 6d. net.

SUBURBAN gardeners sometimes attempt, with less or more success, generally less, to establish a mountain in the back garden. The author of this book has adopted the converse plan of establishing a garden on a New Hampshire mountain side. In this little book she tells us how she did it, what patience she exercised, what disappointments she experienced, what ultimate success she achieved.

The story is well told, and it is obvious that the gardener was not only successful, but that she deserved to be.

Nevertheless, her sympathies seem rather to be with the birds and wild animals to which she acted as hostess than with the plants she used for decoration. She seems to have looked on the plants as so many cakes of colour, useful for producing effect, but to have ignored the mental refreshment which a more thorough study of their peculiarities and of their manners and customs would have afforded.

Her "practical hints" are excellent, and will be serviceable to those disposed to follow her example and make a garden for themselves according to their own notions.