

it on his shelf. We would be glad to see the day when every candidate for the doctorate would be subject to examination on such a text. We will welcome the day when one course at least is given in every university, and required of all graduate students, in this survey of all the sciences, their history, progress, and present state as to methods, principles, and correlations.

A word as to the contents of the book is all that is necessary, as no briefer account of it can be given than the text itself. The opening chapter is on the development of mathematics and its relation to the other sciences. This is followed by chapters on Mathematics and astronomy, Mechanics and energetics, The physics of the ether, The physics of matter and chemistry, Mineralogy and geology, Physiology and biological chemistry, Botany and zoology, Medicine and bacteriology. Explanatory notes by the translator close the book, and these will be welcomed by the careful student.

Anything from the pen of Professor Picard will bear the mark of that perspicuous thinker, and this difficult piece of work is no exception. Moreover the style is so charming that one finishes reading it with satisfaction that scientific exposition can still be done so perfectly.

JAMES BYRNIE SHAW.

Maxima und Minima in der elementaren Geometrie. Von
RUDOLF STURM. Leipzig and Berlin, B. G. Teubner, 1910.
v+138 pp.

IN this book, the author makes use of nothing but elementary geometry and trigonometry, the latter being used in proving a few of the theorems. The first two theorems in the book are arithmetical, namely:

- (1) Of n positive numbers whose product is given, the sum is smallest when the numbers are equal.
- (2) If the sum of n positive numbers is given, the product is greatest when the numbers are equal.

These two theorems are the basis of quite a number of proofs on areas and perimeters of polygons. When the problem under consideration can be reduced to a sum or product with the necessary restrictions, the maximum or minimum values follow readily from (1) or (2). With all the possible combinations of restrictions on the sides and angles of a triangle, the author has dealt in detail. Polygons both regular and

irregular, polygons circumscribed about a circle or inscribed in a circle, also figures bounded by straight lines and arcs of circles, all are examined in regard to their forms when their areas or perimeters have maximum or minimum values. Pairs of right triangles are also treated in a few special cases. The sum of the distances and the sum of the squares of the distances of a point from n points in a plane is minimized and some interesting conclusions are drawn. The theorem is given for the sum of the h th powers of the distances when $n = 3$. The minimum perimeter is found for a triangle inscribed in a given triangle and for a quadrilateral inscribed in a quadrilateral that is inscribed in a circle. There are several quite unexpected results in connection with this problem.

Part two treats of solid geometry. Prisms and tetrahedrons are studied in the same detail as the triangles in part one.

In most respects the book reads very smoothly. The number of very slightly different cases treated makes some parts of it almost tiresome, but the detail is no doubt justifiable. On the other hand, one finds a severe brevity of statement in some places, but these are rather few. Typographical errors are not many, but the following may be noted: near the bottom of page 15, read $U - 2c$ for $U - 2C$. In line 4 from the bottom of page 18, read "innerem" for "äusserem." Just below theorem 57, page 41, read $\rho > \rho'$. In the middle of page 47, read 60 for 69. In the first line of § 6, page 51, read 43 for 41. The value of $ABCD$ on page 73 is incorrect. In the value of $\angle O_1B_1O_2$, page 75, read $C_2B_1O_2$ for $B_1C_1O_2$ and CBO for BCO . In the value for A_1B_1' , page 86, β_1 and β_1' are somewhat confused. On page 114, opposite figure 30, read B for B_1 . On page 30, the author seems not to notice the possibility of $C + D$ being equal to 180° but this does not vitiate his conclusions.

J. V. McKELVEY.

Advanced Shop Mathematics. By EARLE B. NORRIS and RALPH T. CRAIGO. New York, McGraw-Hill Book Company, 1913. xi+214 pp.

THIS volume presents the second half of the instruction papers in shop mathematics as developed and used in the extension division of the University of Wisconsin. The intention of the authors as stated in the preface is "to present such of the principles of algebra, geometry, trigonometry and