

They will represent the sheaf of Sturm, consisting of all the cubics having the same osculating tetrahedron, if

$$\alpha'_x \equiv b_x \quad \alpha''_x \equiv b'_x.$$

Surfaces generated by ∞^1 of these cubics, *e. g.*, all those cutting a fixed line, touching a plane, etc., are discussed at some length. The plane depiction of these surfaces is also taken up. This chapter takes up nearly half the paper. Many interesting theorems concerning this sheaf are proved, also the corresponding ones for the sheaf of Reye and of Sturm are given. Several problems are suggested in the course of the discussion, some of which the author states he expects to solve.

C. L. E. MOORE.

Das Erdsphäroid und seine Abbildung. Von Dr. EMIL HAENTZSCHEL, Professor an der kgl. technischen Hochschule und am köllnischen Gymnasium zu Berlin. Leipzig, Teubner. 1903. viii + 140 pp., 16 figures.

THE purpose of this book is to discuss the practical problems of map drawing. It differs from many other works on the subject by leaving aside all those problems which are only of theoretical interest, and by including most of the numerical calculation of those considered. The author makes no claim for completeness, but still he presents enough of the subject to make his problem of the actual construction of geographical maps entirely intelligible. The book is very full of references to more extensive treatments of each particular problem discussed. A knowledge of the relations between exponential and trigonometric functions and of the elements of analytic geometry and the calculus is presupposed, although most of the formulas are derived with great detail. An introduction presents the evidence for the spheroidal form of the earth; it is assumed to be of revolution and Bessel's constants are used. The author mentions that probably Clarke's determination is more accurate than Bessel's.

The first chapter discusses the relations between the various kinds of latitude, geographic, geocentric and reduced (eccentric angle), and the determination of the maximum difference between them. The length of a degree along a meridian is fully discussed and it is clearly shown why a knowledge of its length is valuable. The area of a zone defined by two parallels of latitude is shown not to depict on the concentric sphere in

such a way as to preserve a constant ratio between-corresponding areas. The theory of the large Prussian maps (Messtischblätter) with linear scale of 1 to 25,000 units is discussed, and elaborate calculations are given to show the variation between the lengths of north and of south boundaries between two common meridians.

The second chapter begins with a much more theoretical discussion of two spherical representations, that in which areas are preserved, and the conformal. The maximum difference between the spherical and the geographic latitude is determined. About forty pages are then devoted to the double conformal representation, first of the spheroid upon the gaussian sphere, then the latter upon the plane by Mercator's projection, the curve of contact of the sphere and cylinder being the principal meridian. The process is illustrated by actually determining four points upon the plane when their spheroidal coördinates are known by triangulation and astronomical observation. The calculation covers ten pages, every detail being given and all the numerical work being done with 7-place logarithms.

The book is almost free from typographical errors. On page 50 is a slip; an elementary integral is there called elliptic. The sections are marked by bold-faced type, but only named in the table of contents. The book is provided with an index.

VIRGIL SNYDER.

Die Horopterkurve, mit einer Einleitung in die Theorie der kubischen Raumkurve. Von Dr. WALTHER LUDWIG. Halle, Schilling, 1902. 36 pp.

THIS monograph was prepared to explain the new models of twisted cubic curves (Schilling's catalogue, series XXVII, number 6). Until recently the only models of these curves in the Schilling collection were those on plaster cylinders, which on account of the opaqueness of the material and the smallness of the scale conveyed but little information.

The present series consists of six pieces; four represent the standard forms of the curve traced on celluloid cylinders about twenty inches high, the fifth is the developable of class three made of silk threads and the sixth is a heavy wire model of the horopter.

The memoir is divided into two parts, the general discussion of the cubic curve, and the particular discussion of the horopter. The first part is very elementary. It begins with a dis-