

struction even in modern times. Another writer on the same subject is Menelaus, who lived somewhat later, and whose Three Books on Spherics still remain.

One of the most important kinds of deduction from a geometrical theory, such as that of the doctrine of the sphere, or that of epicycles, is the calculation of its numerical results in particular cases. With regard to the latter theory, this was done in the construction of Solar and Lunar Tables, as we have already seen; and this process required the formation of a *Trigonometry*, or system of rules for calculating the relations between the sides and angles of triangles. Such a science had been formed by Hipparchus, who appears to be the author of every great step in ancient astronomy.²¹ He wrote a work in twelve books, "On the Construction of the Tables of Chords of Arcs;" such a table being the means by which the Greeks solved their triangles. The Doctrine of the Sphere required, in like manner, a *Spherical Trigonometry*, in order to enable mathematicians to calculate its results; and this branch of science also appears to have been formed by Hipparchus,²² who gives results that imply the possession of such a method. Hypsicles, who was a contemporary of Ptolemy, also made some attempts at the solution of such problems: but it is extraordinary that the writers whom we have mentioned as coming after Hipparchus, namely, Theodosius, Cleomedes, and Menelaus, do not even mention the calculation of triangles,²³ either plain or spherical; though the latter writer²⁴ is said to have written on "the Table of Chords," a work which is now lost.

We shall see, hereafter, how prevalent a disposition in literary ages is that which induces authors to become commentators. This tendency showed itself at an early period in the school of Alexandria. Aratus,²⁵ who lived 270 B. C. at the court of Antigonus, king of Macedonia, described the celestial constellations in two poems, entitled "Phænomena," and "Prognostics." These poems were little more than a versification of the treatise of Eudoxus on the acronycal and heliacal risings and settings of the stars. The work was the subject of a comment by Hipparchus, who perhaps found this the easiest way of giving connection and circulation to his knowledge. Three Latin translations of this poem gave the Romans the means of becoming acquainted with it: the first is by Cicero, of which we have numerous fragments ex-

²¹ Delamb. *A. A.* ii. 37.

²² *A. A.* i. 117.

²³ *A. A.* i. 249.

²⁴ *A. A.* ii. 37.

²⁵ *A. A.* i. 74.