in observation), make the transformation \( x = \pm \frac{s}{\sqrt{2}} (1 + i) \), where \( i = \sqrt{-1} \), and it is readily found that

\[
\int_0^\infty e^{-s^2} ds = \int_0^\infty \sin s^2 ds = \int_0^\infty \cos s^2 ds = \pm \frac{1}{2} \sqrt{\frac{\pi}{2}},
\]

integrals studied by Euler as early as 1781.* Now if we consider Jacob Bernoulli's problem,† to determine the curve whose curvature is proportional to its arc, we are led (on taking the constant of proportionality) to the equations

\[
x = \int_0^s \sin s^2 ds, \quad y = \int_0^s \cos s^2 ds
\]

which define a double spiral curve,‡ turning about the asymptotic points, determined by the Euler integrals above, and hence named by Cesàro the Clothoïde.§ It would also be interesting to remark that the curve is associated with the name of Fresnel, who was led to it in discussing the diffraction of light.||

R. C. ARCHIBALD.

Brown University,
December, 1913.

SHORTER NOTICES.

Archimedis Opera Omnia. Volume II. By J. L. HEIBERG.
Leipzig, B. G. Teubner, 1912. xviii + 554 pp. 8 Marks.

It may seem strange that a new Latin-Greek edition of the works of Archimedes should be deemed necessary, the first one under the editorship of Professor Heiberg having appeared as late as 1880–1881. We expect new translations into modern

* "De valoribus integralium variabilis \( x = 0 \) usque \( x = \infty \) extensorum."
‡ Cf. Picard, Traité d'Analyse, tome 1, 2nd ed., 1901, p. 357.
languages, and new interpretations of classical treatises from
time to time, but new editions of the text alone, when the
work has so recently been done by a scholar of such ability as
Professor Heiberg, are cause for some surprise.

It is, however, a pleasant indication of the steady advance
in the history of mathematics that such a state of affairs should
exist. For the first Heiberg edition was a work of the highest
order of critical scholarship, so that the present edition means
that later discoveries have been drawn upon for the new ma-
terial which is here given.

It was four years after the publication of Volume I of the
first Heiberg edition that Rose discovered the Latin translation
of Archimedes made by the "notorious William Flemming,"
as Roger Bacon designates William of Moerbecke, or Guilielmus
Brabantinus, the chaplain to Clement IV. Cantor thought
that Tartaglia (1543) took the translation of Archimedes, of
which he so boastfully speaks, entirely from this work.* This
manuscript dates from the thirteenth century, and was faith­
fully made from a Greek codex older than any now extant.
Its importance, therefore, in restoring lost or imperfect
passages is quite apparent.

The second noteworthy discovery which makes this edition
necessary is the one made by Professor Heiberg in 1906, the
Method of Archimedes† found in a manuscript of the tenth
century in a monastery at Constantinople. Until the time of
this discovery the work was known to the world only through
brief extracts in the works of Heron and Suidas, and while
it is now familiar through various publications,‡ its great
importance added to the necessity for this present edition.§
The manuscript is also important because it contains parts of
the work on Floating Bodies (Ὁχομετών) || of which no Greek
copy had been supposed to be extant, and also certain passages
from the Stomachion (Στομάχιον).¶ Still more material from
this manuscript is promised for Volume III.

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* Cantor, Geschichte, vol. II, p. 514. The question is, however, fully
discussed in Heath's Works of Archimedes, p. xxvii, and in the Kliem

† De Mechanicis propositionibus ad Eratosthenem Methodus.

‡ Hermes, 1907, vol. XLII, p. 285; Revue générale des Sciences, 1907;
The Monist, vol. XIX, p. 202, 1909; and in pamphlet form by Sir Thomas
Heath (1912) to accompany his work on Archimedes.


¶ Vol. II, pp. 318-413.

It is unnecessary to say that Professor Heiberg was the first to give a critical and modern study to the works of Archimedes, and that, with the exception of Sir Thomas Heath, there is no one now living who combines such a perfect knowledge of Greek, Latin, and the mathematics of the classical period.

David Eugene Smith.


As stated in the preceding review, there was abundant reason to justify Professor Heiberg in preparing a new edition of the works of Archimedes, and the same may of course be said concerning a work like that of Sir Thomas Heath. In the case of the latter's well-known treatise the lack of reference to the Methodus in the first edition has been overcome in part by the publication* of a pamphlet giving an English translation from the original Greek text. There is, however, good reason for a second edition of the work by Sir Thomas Heath, and it is to be hoped that he will find time to supply this need. Meanwhile the German edition by Dr. Kliem is most welcome. While the translator, in preparing this edition, has, in the main, followed the English text with fidelity, he has not hesitated to amplify it, with the author's permission and assistance, so as to include all the recent discoveries, and to add a number of footnotes which are calculated to assist the student. Thus in Chapter I we have a reference to Förster's article on Pheidias the astronomer, and some mention of the Stomachion as in the Heath supplement of 1912; in Chapter II, a reference to the codices used by Heiberg in his second edition, with information concerning the finding of the Codex rescriptus Metochii Constantinopolitani and the nature of the text, and reference to the recent literature on el-Biruni's knowledge of the work of Archimedes on the circle; and in the following chapters the same policy has been pursued.

In Chapter VII, for example, Dr. Kliem has amplified the treatment somewhat, particularly with reference (page 149) to the new matter found in the Methodus. He has, however, omitted Chapter VIII, on the terminology of Archimedes. This is perhaps justifiable from one point of view,

* Cambridge, 1912.