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Review

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at the disposal of the editor to enable him to borrow two precious manuscripts from the National Library at Paris.

The brief biography of Plato of Tivoli, quoted from Wüstenfeld, tells us that he was "born at Tivoli, lived in Spain, there learned Hebrew and Arabic, and translated from both languages works on mathematics and astronomy, *but very badly.*" We hasten to add that the last assertion the editor nails to the counter as a base calumny. One would also gather that the task of translation was no more financially successful in those days in Spain than it is in the present century in Great Britain. Plato omits the introduction and the epilogue to Savasorda's work. The missing portions would seem to reproach the Jews for their ignorance of the rules of geometry, and for their inexcusable blunders in elementary calculation. Evidently our friend Plato had personal experience of the children of Israel, and was so far in their hands that the offending passages were excised. The task of Savasorda was to teach his erring brethren the elements of mensuration. The following is a type of the question he sets his readers: *Given the area of a square (or rectangle) minus (or plus) the sum of its sides, find the sides and area.* This is worth knowing, for it involves the solution of a quadratic. Now the algebra of Muhamed ben Musa Alkarismi, translated by Gerard of Cremona, is supposed to have introduced the western world to that mystery. But Savasorda lived at the end of the eleventh and the beginning of the twelfth centuries, which dislodges Gerard from his lofty pre-eminence (Rouse Ball, p. 171). If you would know the diameter of a circle, this is how you set about it: *Cumque circuli embadam sciveris et ejus diametri longitudinem nosse volueris, tres partes de 11 embado superaddas, et diametri multiplicationem invenies, cuius summae radix diametri longitudinem continebit.* At the request of the publishers the Latin appears on one side of the page with the German on the other. This arrangement, as the editor slyly observes, will be found useful to many.

The second part of the volume deals with the correspondence of Regiomontanus, Giovanni Bianchini, Jacob von Speier, and Christian Roder. It forms quite an E.T. reprint. Their artless confidences have reference to the secrets and mysteries of spherical geometry, astronomy, etc. Some of Jacob's answers read very quaintly: *Velatas aviculas Pannum, quo cenam nostram ornari voluisti, mensuravi, et proportione bona 64 brachia cum reperi, cuius pretium 35 ducatorum et unius recte duaxi.* Regiomontanus is occasionally didactic, as when he proves that "it is not necessary" that a quadrilateral be inscriptible in a circle. He will then rattle off at a sitting some sixteen conundrums to his faithful friends. Then he ends his letter: *Sed quo ruit calamus! Nimum forsitan fatigaberis, vir optime, eligendo tantas litteras.* Truly, those were the days of "the grand style"! We must heartily thank Herr Curtze for a most entertaining volume, and look forward to the second part with great expectations.

General Investigations of Curved Surfaces of 1827 and 1825. By K. F. GAUSS. Translated with notes and a Bibliography by J. C. Morehead and A. M. Hildebrandt. Pp. viii, 127. 1½ dollars. 1902. (The Princeton University Library.)

We owe a debt of gratitude to the Princeton University authorities for providing the funds necessary for the production of this translation. This handsome volume is a worthy tribute to what Darboux has called one of the chief titles of Gauss to fame, the *Disquisitiones generales circa superficies curvas* of 1827, which is still the most finished and useful introduction to the study of infinitesimal geometry. It is a matter of regret that financial considerations have so far prevented our great publishing houses from embarking upon such a venture as the issue of a series of translations of the great mathematical classics. The Germans have realised to the full the stimulus to the student and the teacher afforded by the study of such a paper as the above as compared with that derived from the ordinary text-book summary. In physical science good work has been done in the republication of original papers by the Alembic Society. The American Book Company has even improved on the idea by issuing volumes containing papers on a subject in their historical order; e.g. "The Wave Theory of Light," Huygens, Young, & Fresnel; "The Second Law of Thermodynamics," Carnot, Clausius, & Thomson. In mathematics the Open Court Company (Chicago) has published De Morgan's *Elementary Illustrations of the Differential and Integral Calculus*, and his *Study and Difficulties of Mathematics*; Lagrange's

lectures on *Elementary Mathematics*; Dedekind's papers on *Continuity and Irrational Numbers*, and on the *Nature and Meaning of Numbers*, and so on. It is not improbable that a translation of Gauss's *Disquisitiones Arithmeticae* will be one of the next books to be added to this list. It is a disgrace to the English-speaking mathematical world (or the subtlest of compliments to their Latinity) that no English translation of this masterpiece exists. The most complete series of classical memoirs that has yet appeared is Ostwald's *Klassiker der exacten Wissenschaften*. The paper of Gauss under notice was translated into German by Wangerin, and forms the fifth volume of this really excellent series of mathematical, physical, and chemical memoirs; each volume contains between 50 to 100 pages, and costs but a few pence. They are as cheap as the Open Court volumes are dear.

Messrs. Morehead and Hildebeiter have translated the abstract of the *Disquisitiones* presented to the Royal Society of Göttingen in 1827, and the paper of 1825 on which the abstract was based. The papers of 1825 and 1827 show, as they point out, the manner in which the ideas developed in the mind of the author. Both papers contain the fundamental properties of what is called Gauss's measure of curvature. Geodesic coordinates in 1825 are replaced by the general coordinates p, q in 1827, thus introducing a new method, and employing Monge's principles. This paper was published by Monge in his *Application de l'Analyse à la Géométrie* (1850). The translators supply twenty-eight pages of notes on the 1827 paper, and the bibliography contains a list of 343 papers dating from "the thirties" to 1901.

Lehrbuch der Combinatorik. By DR. EUGEN NETTO (Pp. 260). 1901. (Teubner.)

One of the latest additions to the excellent series of monographs published in the *Sammlung von Lehrbücher auf dem Gebiete der mathematischen Wissenschaften* is from the pen of Professor Netto of the University of Giessen, whose name is familiar in connection with the substitution theory. It is a common complaint among students that in questions on what Prebendary Whitworth so aptly called "Choice and Chance," that they never know exactly where they are. Although much of the glorious uncertainty which lingers in their minds after attempting the solution of a problem may be almost entirely due to careless or ambiguous wording, one cannot help feeling that if the student is left in the air with regard to these and kindred problems it is because of the cursory treatment which this branch of mathematics receives. The interest of the subject is practically inexhaustible. Such a volume as this draws on arithmetic, algebra, analysis, and probabilities for its material; the questions which are set are some of great historical interest; some are as amusing as they are exasperating, and almost all of them require a clear brain and a judicial temperament. For instance, the number of ways of writing the words in the line

Tot tibi sunt dotes, Virgo, quot sidera coelo,

without disobeying the laws of metre (caesura excepted), were given at various dates as 1022, 2196, 3276, 2580, 3096, and 3312. Which is correct we leave our readers to determine. Among the more familiar of the problems treated by Professor Netto is that of the fifteen school-girls, and that of the eight queens none of which are *en prise*. The pretty solution given in *Nature*, p. 427 (1899), has evidently escaped the author. A series of questions is given leading up to the theory of the partition of numbers, and an account follows of Sylvester's determination of the coefficient of x in the development according to ascending powers of x of the expression $(1-x^a)^{-1}(1-x^b)^{-1}(1-x^c)^{-1} \dots$

Two chapters are devoted to "combinations of the third class," which the French call *ternes*, and which were first suggested by Steiner, who applied them in his theory of the double tangents of quartics.* If n objects are arranged three by three, so that any two objects appear in one triplet and only one, such an arrangement is called a system of ternes. For example, of the numbers 1, 2, 3, 4, 5, 6, 7, the triplets in question are 123, 145, 167, 246, 257, 347, 356; there remain 28 "dreier" of the system, which are called "freie," free ternes or triplets. But when we proceed to the quarternes or "vierer," which are in the above case,

* *Journ. f. Math.* 1853, p. 181.