

**A TREATISE OF
ANALYTICAL
GEOMETRY**

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A Treatise of Analytical Geometry by Benedict Sestini

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BENEDICT SESTINI

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TREATISE

OF

ANALYTICAL GEOMETRY,

PROPOSED

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PREFACE.

This treatise of Analytical Geometry, which in progress of time may form a part of a complete course of mathematics, although destined at present for a class in Georgetown College, is offered also to those students who cultivate this branch of science in other public institutions. To all these the present introduction is addressed, together with the following treatise, divided into four parts or books: the first of which treats of *co-ordinates*, and *geometrical loci on a plane*; the second of *co-ordinates*, and *geometrical loci in space*; the third treats of *lines of the second order*; and the fourth of *surfaces* of the same order. The first and second are nothing more than an introduction to the principal object of this part of analysis which is exclusively treated of in the third and fourth books. The learner will probably find in our method something not entirely conformable to that usually adopted in other similar works; thus, for instance, in the third and fourth books he will easily remark that the questions are reduced to some principal heads, from which, as from a nucleus, we derive the theory of the lines and surfaces of the second order. Nay, more, all the properties of the lines, as well as of the surfaces, are altogether derived from the discussion of the simple quadrinomial formula $mx^2 + nx + p = q$ (*); or from the trinomial $mx^2 + nx$

(*) Book III, § 44, (1₂). Book IV, § 111, final remark.

= *d*. For this ingenious simplification we are indebted to Baron A. L. Cauchy, who is deservedly considered not only as one of the best mathematicians of the present time, but not inferior to any of those who flourished in preceding ages. The compendious style used by this celebrated author would probably not be intelligible to the incipient learner ; our endeavors, therefore, were especially devoted to develop and explain, in a manner suitable to students, the analysis which the French author first offered to the scientific world ;(*) yet, notwithstanding this labor, some perhaps will object that the present treatise still requires, on the part of the student, a certain penetration of mind. This we readily admit ; but nobody, we trust, will condemn us for supposing some penetration of mind in those who give themselves to the study of the sciences ; and if, in some instances, notwithstanding this supposed aptitude, the student could not overcome by himself some difficult point, we take it for granted that works of this character are not only to be studied in private, but are also to be explained by the teacher. This necessarily supposes the students in general not to be able to overcome all the difficulties by themselves, even in the most elementary treatise, unless the school be considered as a mere formality. Let us even remark, that difficulties in some cases are not inherent in the method but in the object, and to diminish them nothing contributes more than simplicity and order. Order, moreover, excludes all the difficulties which are not inherent in the matter, diminishes the

(*) Exercices de Mat., par M. A. Cauchy, (troisième année.)

labor of the teacher as well as of the student, and is the only means by which the mind can be enriched by a really scientific knowledge and comprehension of the subject. After this, to exclude order from geometry, and in general from mathematical works, is to expel the owner from his own house. Another observation, probably, might be made, namely, that the present treatise is rather defective in point of familiar examples. We neither deny nor grant it; allow us only to remark, that we may here suppose two species of applications or examples, those taken from analytical geometry itself, or those taken from branches of natural philosophy to which this analysis is applicable. The second class is evidently extraneous to our subject; and as to the former, we thought it enough to give only a few of them, which, affording the illustration of some peculiar point, could be at once a model for many others which the teacher and even the student can form for himself illustrative of the same or of other points.

The index which we subjoin, especially the part which belongs to the third and fourth books, may perhaps give to the reader, who should desire it, a more complete idea of the plan and character of the treatise. The parts of this treatise having such connexion and dependence upon each other, we have been compelled to make use of frequent references. We know well that some writers of works of this kind avoid as much as possible such references, and some also, even eminent, exclude them altogether; the reader being, as they allege, thus stopped and disturbed on his way. Consulting, however, our own experience, and the assistance frequently offered by these

references, although accompanied with some trouble, we preferred to follow the example of many others likewise eminent and equally experienced in teaching. And for the sake of some of our friends, to whom we are indebted for the remarks made on the treatise before its publication, and who incline to the exclusion, or at least diminution, of the references, we observe, that although such references are not all and at all times profitable for each reader in particular, the book being written for a great variety of readers, it is not improbable that the number of references be rather deficient than too copious. And, finally, whenever recourse to some of the preceding questions is indispensable, (and they must necessarily form part of the demonstration at hand,) in such cases, and even generally, a reference is either useful to the reader or not; if it is useful, there is no reason of complaint; if not useful, the reader can easily go on without noticing it, not being compelled by a mere reference to interrupt his course.