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THIS IS A SMALL BUT SELECT PRIVATE COLLECTION OF BOOKS ON MATHEMATICS, formed from about 1995 to 2005. Many of the books come from the renowned library of Haskell F. Norman. The principal dealers who furnished books are Roger Gaskell, W.P. Watson, and myself. The client was always quite fastidious about condition.

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Catalogue 210

*D'Alembert's Masterpiece on Dynamics;
A Very Fine Copy*

1. **ALEMBERT, Jean Le Rond d'**. *Traité de Dynamique, dans lequel les Loix de l'Equilibre & du mouvement des Corps sont réduites au plus petit nombre possible, & démontrées d'une manière nouvelle, & où l'on donne un Principe général pour trouver le Mouvement de plusieurs Corps qui agissent les uns sur les autres, d'une manière quelconque.* Engraved vignette on title & four folding engraved plates. 2 p.l., xxvi, [2], 186, [2] pp. 4to, cont. marbled calf, spine gilt, red morocco lettering piece on spine. Paris: David l'aîné, 1743. \$27,500.00

First edition, and a wonderfully fine and fresh copy, of d'Alembert's masterpiece on dynamics; this has become a scarce book on the market. The

present copy is the finest to appear in many many years.

“The *Traité de dynamique*, which has become the most famous of his scientific works, is significant in many ways. First, it is clear that d’Alembert recognized that a scientific revolution had occurred, and he thought that he was doing the job of formalizing the new science of mechanics...The *Traité* also contained the first statement of what is known as d’Alembert’s principle. D’Alembert was, furthermore, in the tradition that attempted to develop mechanics without using the notion of force. Finally, it was long afterward said (rather simplistically) that in this work he resolved the famous *vis viva* controversy, a statement with just enough truth in it to be plausible.”—*D.S.B.*, I, p. 111—(& see pp. 111-13 for a full account of the work).

Ex Bibliotheca Mechanica. Preserved in a box.

• *En Français dans le Texte* 147. *Printing & the Mind of Man* 195. Roberts & Trent, *Bibliotheca Mechanica*, p. 7—“A landmark in the history of mechanics.”

2. ALEMBERT, Jean Le Rond d’. *Traité de l’Équilibre et du Mouvement des Fluides. Pour servir de suite au Traité de Dynamique.* Engraved vignette on title & ten folding engraved plates. xxxii, [8], 458 pp., one leaf of errata. Small 4to, cont. pink half-sheep & decorated boards (one corner worn, first & last few leaves with relatively minor worming in the gutter), flat spine gilt (spine with some wormholes), contrasting leather lettering piece on spine. Paris: David, 1744. \$8500.00

First edition of the sequel to d’Alembert’s masterpiece — the *Traité de Dynamique* (1743). “In this [the present] work d’Alembert used his principle to describe fluid motion, treating the major problems of fluid mechanics that were current. The sources of his interest in fluids were many. First, Newton had attempted a treatment of fluid motion in his *Principia*, primarily to refute Descartes’s *tourbillon* theory of planetary motion. Second, there was a lively interest in fluids by the experimental physicists in the eighteenth century...Finally, of course, there was the inherent interest in fluids themselves. D’Alembert’s first treatise had been devoted to the study of rigid bodies; now he was giving attention to the other class of matter, the fluids. He was actually giving an alternative treatment to one already published by Daniel Bernoulli, and he commented that both he and Bernoulli usually arrived at the same conclusions. He felt that his own method was superior. Bernoulli did not agree.”—*D.S.B.*, I, p. 113.

Very good copy from the library of Haskell F. Norman with bookplate.

• Roberts & Trent, *Bibliotheca Mechanica*, pp. 7-8. Rouse & Ince, pp. 101-106.

The True First Edition

3. **ALEMBERT, Jean Le Rond d'.** *Reflexions sur la Cause generale des Vents. Pièce qui a remporté le Prix proposé par l'Académie Royale des Sciences de Berlin, pour l'Année 1746.* Fine engraved vignette on title; one engraved headpiece with a port. of Frederick the Great, to whom the book is dedicated; & two folding engraved plates. 4 p.l., 194 pp.; 138 pp. 4to, cont. vellum over boards (one corner a little jammed), spine gilt. Paris: David l'aîné, 1747 [but 1746]. \$4500.00

First edition of this important work. "In 1747 d'Alembert published two more important works, one of which, the *Réflexions sur la cause générale des vents*, won a prize from the Prussian Academy. In it appeared the first general use of partial differential equations in mathematical physics. Euler later perfected the techniques of using these equations...As a work on atmospheric tides it was successful, and Lagrange continued to praise d'Alembert's efforts many years later."—*D.S.B.*, I, p. 113.

This and the Berlin edition of the same year are both variously claimed as the true first edition and it is perhaps logical to suppose that a prize-winning essay should first appear under the imprint of the prize giver. However, the imprimatur of the French Académie was granted on 6th September 1746 and the book was on sale in November of that year (see d'Alembert's letter of 6th January 1747 to Euler).

Fine copy of a very rare edition. Contemporary signature of "Castiglioni" on title. From the library of Haskell F. Norman with bookplate.

☛ See Roberts & Trent, *Bibliotheca Mechanica*, p. 8 for the Berlin edition.

His Major Contribution to Fluid Dynamics

4. **ALEMBERT, Jean Le Rond d'.** *Essai d'une Nouvelle Theorie de la Résistance des Fluides.* Two folding engraved plates. xlvii, 212 pp. 4to, cont. mottled calf (portion of upper cover somewhat abraded, head & foot of spine carefully repaired), spine gilt, contrasting leather lettering piece on spine. Paris: David, 1752. \$3750.00

First edition of d'Alembert's major contribution to fluid dynamics, in which "the differential hydrodynamic equations were first expressed in terms of a field and the hydrodynamic paradox was put forth...the essay was an important contribution. Hunter Rouse and Simon Ince have said that d'Alembert was the first 'to introduce such concepts as the components of fluid velocity and acceleration, the differential requirements of continuity, and even the complex

numbers essential to modern analysis of the same problem.'—*D.S.B.*, I, p. 115.

Nice copy from the library of Haskell F. Norman with bookplate..

• Roberts & Trent, *Bibliotheca Mechanica*, p. 8. Rouse & Ince, *History of Hydraulics*, pp. 101-03.

“The Greatest Geometer of the Sixteenth Century”—Cajori

5. APOLLONIUS, of Perga. *Francisci Maurolyci Messanensis Emendatio, et Restitutio Conicorum Apollonii Pergaei. Nunc primum typis excusae, ubi primi quatuor eiusdem Apollonij libri mendis, quibus foedè scatebant, expurgantur, novisque interdum demonstrationibus illustrantur...* Woodcut arms on title & numerous woodcut diagrams in the text. 4 p.l., 5-192 pp. Folio, cont. vellum over boards (binding a little soiled, first eight leaves with some light & mostly marginal dampstaining), spine gilt, green morocco lettering piece on spine. Messina: Heirs of P. Brea, 1654.

\$16,500.00

First edition of an extremely rare book; WorldCat locates only one copy in an American library. This is Maurolico’s attempt “to reconstruct books V and VI of the *Conics* from the brief references to them that Apollonius provided in his preface to the entire work. In Maurolico’s time, only the first four books were known in the Greek original; he completed his restoration in 1547... (Although Maurolico’s work is less famous than Viviani’s, both Libri and Gino Loria cite it as an example of his genius).”—*D.S.B.*, IX, p. 191. Maurolico also here re-worked books I-IV.

Cajori, in his *History of Mathematics* (pp. 141-42), called Maurolico “the greatest geometer of the sixteenth century” and describes the present book as his “chief work... [it] is his masterly and original treatment of the conic sections, wherein he discusses tangents and asymptotes more fully than Apollonius had done, and applied them to various physical and astronomical problems.”

A native of Sicily, Maurolico (1494-1575), was raised in an intellectual environment dominated by Greek humanism. “During the 1530’s Maurolico pursued his elucidations of classical mathematical texts... By 1540 Maurolico was ready to lay out a full scale programme for the renaissance of mathematics... It is important to remember that to Maurolico’s mind even Greek mathematicians could err... Maurolico was certainly the most radical of Renaissance mathematicians in this respect. Whereas Commandino might emend Apollonius in odd passages, Maurolico undertook a full-scale reorganisation of the works of both Apollonius and Archimedes. The result, in the case of the Apollonius, was the first advance in the theory of conic sections since antiquity.”—Rose, *The Italian Renaissance of Mathematics*, pp. 161-66—(and see Chapter 8 — “Maurolico and the Renaissance of Greek Mathematics” — for a full account of this book and

Maurolico's achievements).

Fine copy. Old private library stamp on title.

♣ Riccardi, II, 143.

Contains "His Most Important Contributions to Mathematics"

6. **ARCHIMEDES.** *Monumenta Omnia Mathematica, quae extant...ex traditione...Francisci Maurolici.* Woodcut printer's device on title, numerous woodcut illus. in the text, & a woodcut vignette on verso of final leaf. 4 p.l., 296 pp. Folio, cont. English panelled calf (joints very carefully repaired, first leaf & final leaf with some light browning around edges), spine richly gilt. Palermo: C. Hesperii, 1685. \$14,500.00

First edition of Maurolico's important edition of Archimedes' works, based upon an earlier partial edition by Borelli (Messina: 1670-72), which was almost completely lost. Maurolico's edition was largely prepared in 1534 and 1547-50 and remained in manuscript for many years after his death.

Maurolico's "method of redaction is suggested in the preface. After enumerating and summarising Archimedes' works, Maurolico states that he has tried to make the works more easily intelligible by adding many lemmas, by demonstrating many things omitted by Archimedes, and by treating of the centres of gravity of solids...Maurolico does not hesitate to re-arrange Archimedes' master work, the *De Sphaera et Cylindro*, often substituting what he claims to be a better proof or enunciation for that of the original...It is, however, in the *De Aequponderantibus* that Maurolico makes his most drastic re-arrangement of the Archimedean material and also his most important contributions to mathematics...

"Maurolico organises the treatise (which he calls *De Momentis Aequalibus*) and his own additions into four books. The first deals with general principles relating to centres of gravity and equilibrium. The following three books concern the determination of centres of gravity in plane figures; paraboloids; and spheres, pyramids, prisms, conoids and other solids. Although Archimedes had apparently known how to find the centres of gravity in various solids, none of his proofs was extant in the sixteenth century. Maurolico sought to remedy this deficiency by applying the Archimedean method of moments to the problem. This he did with considerable success...

"Although the long delay in publishing the Maurolico Archimedes precluded its entry to the mainstream of mathematical development, the importance of its author's studies was acknowledged by Federico Commandino."—Rose, *The Italian Renaissance of Mathematics*, p. 167.

A really nice copy. Two faintly bleached out library stamps in blank portions of title. Two bookplates removed.

♣ Riccardi, I, 43-44—(with a list of the contents).

*“Established the Fundamental Principles of the
Calculus of Probabilities”—Evans*

7. **BERNOULLI, Jacob.** *Ars Conjectandi, Opus Posthumum. Accedit Tractatus De Seriebus Infinitis, et Epistola Gallicè scripta de Ludo Pilae Reticularis.* Woodcut device on title, two folding printed tables, & one folding woodcut plate. 2 p.l., 306, 35, [1] pp. 4to, fine cont. vellum over boards (slightly warped). Basel: impensis Thurnisiorum, Fratrum, 1713.
\$40,000.00

First edition of “the first systematic attempt to place the theory of probability on a firm basis and is still the foundation of much modern practice in all fields where probability is concerned — insurance, statistics and mathematical heredity tables.”—*Printing & the Mind of Man* 179.

A very fine and large copy preserved in a box.

♣ Dibner, *Heralds of Science*, 110. *D.S.B.*, II, pp. 46-51. Evans, *Epochal Achievements*, 8. Horblit 12.

His Collected Works

8. **BERNOULLI, Johann.** *Opera Omnia, tam antea sparsim edita, quam hactenus inedita.* Engraved frontis. port. of the author, another of Frederick III of Prussia, engraved vignettes on titles, & 91 engraved plates. Titles printed in red & black. Four vols. Large 4to, a handsome prize binding of mid-19th cent. blind-stamped black morocco, finely stamped arms in gilt of the “Académie de Paris, Prix du Concours Général,” spines gilt, dentelles gilt, a.e.g. Lausanne & Geneva: M.M. Bousquet, 1742.
\$9500.00

First collected edition; a fine and handsome set in an attractive prize binding with an appealing provenance (see below). After Newton’s death in 1727, Bernoulli was unchallenged as the leading mathematical preceptor to all Europe. Most of Bernoulli’s writings appeared in various journals and remained uncollected until the present edition.

“His chief discoveries are the exponential calculus, the treatment of trigonometry as a branch of analysis, the conditions for a geodesic, the determination of orthogonal trajectories, the solution of the brachistochrone, the statement that a ray of light traversed such a path that *Smds* [in Greek] is a minimum, and the enunciation of the principle of virtual work...The general adoption on the continent of the differential rather than the fluxional notation was largely due to his influence.”—Ball, *A Short Account of the History of Mathematics*, p. 368.

The recipient of this prize book was Adolphe Carnot (1839-1920), son of

Hippolyte Carnot. Adolphe entered the École Polytechnique in 1858 and, upon completion, joined the École des Mines where he was a professor for more than thirty years. The book label in the first volume states that this set was awarded to Carnot for “Mathématiques Spéciales, Physique, 2e Prix.”

• Roberts & Trent, *Bibliotheca Mechanica*, pp. 36-37—“the first edition of Jean Bernoulli’s collected works brings together 189 of his papers and 59 of his lectures. The first volume is primarily devoted to problems in geometry and the early calculus, but also contains papers on muscular mechanics, the resistance of solids, and a geometrical demonstration of the motion of pendulums and projectiles in resisting and unresisting media. Volumes two and three are almost totally devoted to problems of mechanics, the first of these containing his theoretical essay on the maneuvering of vessels and related papers, as well as numerous contributions on the analysis of trajectories. His discourse on the laws governing the communication of movement opens volume three, which also contains his essay on celestial mechanics. The last volume contains contributions on the curvature of elastic plates, his mecanico-dynamical propositions, and problems in dynamics. Most important, its appearance in this volume represents the first printing of the *Hydraulica*, which was written in competition with his son, Daniel.”

9. CANTOR, Georg. [From upper wrapper]: “Sur la Théorie des Ensembles,” an offprint from *Acta Mathematica* (ed. by G. Mittag-Leffler), Vol. 2:4, pp. [305]-414. Large 4to, orig. printed wrappers (a few unimportant chips to wrappers). Stockholm & al.: F. & G. Beijer, 1883.

\$1250.00

A collection of Cantor’s articles, including: “Sur une Propriété du Système de Tous les Nombres algébriques réels,” “Une contribution à la théorie des ensembles,” “Sur les séries trigonométriques,” “Extension d’un théorème de la théorie des séries trigonométriques,” “Sur les ensembles infinis et linéaires de points I-IV,” “Fondements d’une théorie générale des ensembles,” and “Sur divers théorèmes de la théorie des ensembles de points situés dans un espace continu à n dimensions. Première communication.”

Cantor (1845-1918), “has gone down in history as the founder of set theory, but the science of mathematics is equally indebted to him for important contributions in classical analysis.”—*D.S.B.*, III, p. 53.

Fine copy. “Offert par l’auteur” printed on upper wrapper.

*A Foundation Work of Modern Calculus;
"Classic"—D.S.B.*

10. CAUCHY, Augustin Louis, Baron. *Cours d'Analyse de l'École Royale Polytechnique...1.re Partie. Analyse Algébrique* [all published]. Woodcut royal arms on title. 2 p.l., xiv, [2], 576 pp. 8vo, cont. calf-backed marbled boards, spine gilt, orange leather lettering piece on spine. [Paris]: de l'Imprimerie Royale, 1821. \$5000.00

First edition and most uncommon, especially in this attractive state. "The first comprehensive theory of complex numbers is found in [the present work]. There he justified the algebraic and limit operations on complex numbers, considered absolute values, and defined continuity for complex functions."—*D.S.B.*, III, p. 137.

Cauchy (1789-1857), "was a prolific and profound mathematician. By a prompt publication of his results, and the preparation of standard text-books, he exercised a more immediate and beneficial influence upon the great mass of mathematicians than any contemporary writers. He was one of the leaders in infusing rigor into analysis. His researches extended over the field of series, of imaginaries, theory of numbers, differential equations, theory of substitutions, theory of functions, determinants, mathematical astronomy, light, elasticity, etc., — covering pretty much the whole realm of mathematics, pure and applied . . .

"Encouraged by P.S. Laplace and S.D. Poisson, Cauchy published in 1821 his *Cours d'Analyse*...a work of great merit. Had it been studied more diligently by writers of textbooks, many a lax and loose method of analysis long prevalent in elementary text-books would have been discarded half a century earlier."—Cajori, *A History of Mathematics*, pp. 368-69.

Fine and attractive copy.

☛ *En Français dans le Texte* 231.

One of "His Greatest Contributions"—Boyer

11. CAUCHY, Augustin Louis, Baron. *Résumé des Leçons données à l'École royale polytechnique sur le Calcul infinitésimal...Tome premier* [all published]. xii, 172 pp. Large 4to, cont. wrappers (a bit frayed), uncut. Paris: de l'Imprimerie Royale, 1823. \$2750.00

First edition of the rarest of Cauchy's three great textbooks, it is one of the author's most important achievements. With this book Cauchy placed "the fundamental principle of the calculus on a satisfactory foundation."—Smith, *History of Mathematics*, II, p. 700.

"Cauchy rivaled Euler in mathematical productivity, contributing some 800 books and articles on almost all branches of the subject. Among his greatest contributions are the rigorous methods which he introduced into the calculus

in his three great treatises: the *Cours d'analyse de l'École Polytechnique* (1821), *Résumé des leçons sur le calcul infinitésimal* (1823), and *Leçons sur le calcul différentiel* (1829). Through these works Cauchy did more than anyone else to impress upon the subject the character which it bears at the present time."—Boyer, *The History of the Calculus*, p. 271.

Very good copy, entirely uncut, with the bookplate and stamp of the Jesuit College St. Joseph, Poitiers.

*The Culmination of His Work on Definite Integrals;
"Important"*

12. CAUCHY, Augustin Louis, Baron. *Mémoire sur les Intégrales définies, prises entre des Limites imaginaires.* 1 p.l., 68 pp., one leaf of errata. Large 4to, cont. blue morocco-backed marbled boards, spine lettered in gilt. Paris: De Bure Frères, August 1825. \$3750.00

First edition of one of Cauchy's most important papers, the culmination of his work on definite integrals, begun with a *mémoire* in 1814. "Genuine complex integration is still lacking in the 1814 *mémoire*...In a *mémoire détaché* of 1825 [Cauchy] took a long step toward what is now call Cauchy's integral theorem...The important 1825 *mémoire* was neither used nor quoted until 1851, a circumstance utterly strange and hard to explain."—D.S.B., III, p. 139.

Very good and large copy with the discrete stamp of Julian R. Nava on the first leaf of text.

♣ Bell, *Men of Mathematics*, p. 250—"a landmark in the history of mathematical analysis."

13. CAUCHY, Augustin Louis, Baron. *Résumés analytiques.* 166 pp., one blank leaf. Large 4to, orig. printed front & back wrappers for all five *livraisons* bound-in cont. half-calf & marbled boards (well-rebacked, corners a little worn), flat spine gilt, green morocco lettering piece on spine. Torino: de l'Imprimerie Royale, 1833. \$2950.00

First edition and a remarkable survival which provides important evidence regarding the publication history of this work on algebraic analysis. This is the private journal kept by Cauchy which he published during his brief time as a professor at the University of Torino, while in exile following the July Revolution of 1830.

Fine copy. The upper wrapper of the first part is a little rubbed.

In the Original Wrappers

14. CAUCHY, Augustin Louis, Baron. *Nouveaux Exercices de Mathématiques* [& title to Part 8]: *Mémoire sur la Dispersion de la Lumière*. iv, 24 pp.; 25-56 pp.; 57-116 pp.; 117-180 pp.; 181-204 pp.; , iv, 205-236 pp. Eight parts in six *livraisons*. Large 4to, orig. pink printed wrappers (two spines a bit defective, upper wrapper of the final *livraison* detached), uncut. Prague: 1835 [Parts 1-7] & J.F. Calve, 1836 [Part 8]. \$4250.00

First edition of this important memoir in which Cauchy explains the dispersion of light on the basis of the undulatory theory. It completes Fresnel's researches on the subject. Cauchy was the first to attempt to work out a mathematical basis for the properties of ether.

This book was written and printed in Prague where Cauchy resided as tutor to the Duc de Bordeaux after the abdication of his father, King Charles X.

The publication of this work is somewhat complicated and has been well-explained by Roger Gaskell in his *Catalogue 17* (1996), item 7 (this set): "The original parts are important for understanding how the work was originally published. *The Mémoire* occupies the first 8 'livraisons' (in 6 separately wrapped parts, *livraisons* 1, 2, 3-4, 5-6, 7, 8) of a series entitled *Nouveaux exercices de mathématiques* of which no more was published. The first *livraison* contains a title-page for *Nouveaux exercices* and a foreword in which Cauchy explains that it is a sequel to his *Exercices de mathématiques* published in Paris, and *Résumés analytiques* published in Turin: the title-page for the *Mémoire* itself appears in the 8th *livraison* with a foreword signed by the Société Royale des Sciences de Prague, claiming full credit for publishing 'une édition aussi élégante et correcte que possible.' Cauchy himself initially undertook the publication of the series and the *Nouveaux exercices* title gives no publisher's name, but when it was taken over by the Société Royale it was distributed by J.G. Calve whose name appears on the *Mémoires* title-page. The work is sometimes catalogued as *Nouveaux exercices*, sometimes as *Mémoire sur la Dispersion de la Lumière*; the former title-page and Cauchy's foreword as sometimes discarded."

Fine set preserved in a box. Scarce. Minor foxing.

15. CHEBYSHEV, Pafnutii L'vovich. *Oeuvres*... publiées par les soins de MM. A. Markoff & N. Sonin. Three frontis. ports. & diagrams in the text. vi, 714 pp.; iv, xx, 736 pp. Two vols. Large 4to, orig. printed wrappers bound in cont. half-cloth & marbled boards. St. Petersburg: J. Glasounof et al., 1899-1907. \$3250.00

First edition in French of the collected works, issued simultaneously with the Russian edition. Chebyshev (1821-94), professor of mathematics at St. Petersburg University and founder of the Petersburg mathematical school, made important contributions to the theory of numbers, integration of algebraic functions, the

theory of the best approximation of functions, the theory of probability, ballistics, cartography, and theoretical mechanics.

Fine set.

• D.S.B., III, pp. 222-32.

*The Author's Masterpiece;
The Road to a Computer Language*

16. CONDILLAC, Étienne Bonnot, Abbé de. *La Langue des Calculs, Ouvrage Posthume.* 2 p.l., 484 pp., 1 leaf. 8vo, cont. sheep-backed paste-paper boards (small hole in blank gutter portion of title, light foxing at front), flat spine gilt, red morocco lettering piece on spine. Paris: C. Houel, An VI [1798]. \$1950.00

First edition. A work of considerable dual importance, stemming from the opening sentence of the book "toute langue est une méthode analytique, et toute méthode analytique est une langue" and from the emphasis on mathematical formalism and algebraization. On the one hand, the book is a keystone in pioneering linguistics and the analytical theory of language as developed by Carnap and the Vienna logicians in the late twenties and early thirties.

On the other hand, the book stands in the road which, from Lull and Leibniz through Gödel, Herbrand, and Turing, led to the art and science of computing. Programming is a language and the book is quite close to formulating things in a modern way, nearer to the 20th century than to Leibniz's era.

Very good copy with half-title.

• D.S.B., III, pp. 380-83. Tomash C166-Condillac "viewed mathematics as the paradigm of knowledge. Algebra, for example, is both a language and a method of analysis while spoken language is vague, imprecise and encrusted by centuries of inexact usage...The work deals with numbers, their names and meanings, as well as the arithmetic operations, and all topics up to algebra, logarithms and geometric sequences."

"Immensely Wise"

17. COURNOT, Antoine Augustin. *Exposition de la Théorie des Chances et des Probabilités.* One folding engraved plate (foxed). 2 p.l., viii, 448 pp. 8vo, a prize binding of cont. green sheep (some foxing), upper cover stamped in gilt "College Royal de Bordeaux" within a gilt wreath, double gilt fillets round sides, flat spine decorated in the Romantic style. Paris: L. Hachette, 1843. \$2950.00

First edition. Cournot's *Exposition* "was immensely wise without being profoundly original. He was proudest of the contribution the book made to the

philosophical understanding of probability, and indeed he did achieve a much higher level of clarity than did any of his predecessors in his discussions of distinctions between subjective and objective probability."—Stigler, *The History of Statistics*, p. 196.

Cournot (1801-77), is considered to be the true founder of mathematical economics.

Apart from the foxing, a very handsome copy.

✦ *D.S.B.*, III, p. 451—"It is important in the history of the calculus of probability, since it examines in an original way the interpretation and foundations of this calculus and its applications." Keynes, "Bibliography" in *A Treatise on Probability*, p. 439.

"This Monumental System of the World"

18. DESCARTES, René. *Principia Philosophiae*. Woodcut printer's vignette on title & numerous woodcut diagrams in the text. 12 p.l. (the last a blank), 310 pp. 4to, cont. vellum over boards, ties gone, spine lettered in ink at head. Amsterdam: L. Elzevir, 1644.

[bound after]:

—, *Specimina Philosophiae: seu Dissertatio de Methodo Recte regendae rationis, et veritatis in scientiis investigandae: Dioptrice, et Meteora*. Ex Gallico translata, & ab Auctore perlecta, variisque in locis emendata. Woodcut printer's device on title & numerous woodcuts in the text. 8 p.l., 331 pp. 4to. Amsterdam: L. Elzevir, 1644. \$12,500.00

Very attractive copies from the library of Hermann Conring (1606-81), professor of natural history at Helmstädt who made important contributions to medicine (he was an early convert to Harvey's ideas), law, and politics. With his 19-line epigraph on Descartes on the free front endpaper and signature dated 1645.

I. First edition "of this monumental system of the world, the most comprehensive of all of Descartes' works. Dedicated to his friend, Princess Elizabeth, daughter of the Elector Palatine, Frederick V, its three treatises embrace the whole of his philosophy, with the exception of the moral...

"In Part I, Descartes sets out the basic principles of his investigation pursuing the methods developed in his *Discourse on Method*...

"Part II is devoted to the nature of the physical world and the means by which we may comprehend it. Fundamental to Descartes' physical theories was his conviction that all space was occupied, space was identified with matter, all matter was infinitely extensible and infinitely divisible; within the context of this theory a vacuum was impossible as was the existence of atoms...

"Also presented in Part II are Descartes' three laws of motion: the first is the

conventional statement that a body at rest remains at rest until set in motion by some outside agency, and, concomitantly, that a body in motion remains so until met with resistance. His second law states that moving bodies tend to continue in a straight line; consequently, for a body to move in a circle or an arc it must be subjected to forces other than those which initially set it in motion. His third law and the seven secondary rules which he derived from it are more controversial...

"Part III not only presents Descartes' conception of the structure of the world, but represents the first serious attempt at a mechanical explanation of the solar system. The Vortex Theory boldly attempted to reduce the phenomena of the universe to a single mechanical principle. 'Even after Newton had shown that the Cartesian system was impossible as a dynamical system, the theory lingered on, and for more than a generation efforts were continually being made to patch up the fabric before it finally collapsed.'—Scott, 167-168."—Roberts & Trent, *Bibliotheca Mechanica*, pp. 91-92.

II. First Latin edition of Descartes' *Discours de la Méthode*; this edition contains important revisions by the author. The first edition, published in 1637, marks the starting point of the Cartesian system of natural philosophy, which stands in time between Bacon and Newton. His famous "Cogito, ergo sum" first appeared in this form in this edition. The book includes important observations on optics in the *Dioptrice*.

Fine crisp copies.

☛ See *Printing and the Mind of Man* 129 and *Horblit* 24 for the first edition.

"Of Epoch-Making Importance"—Cajori

19. DESCARTES, René. *Geometria, à Renato Des Cartes Anno 1637 Gallicè edita; nunc autem cum Notis Florimondi de Beaune... in linguam Latinam versa, & commentariis illustrata, Operâ atque studio Francisci à Schooten...* Numerous woodcut diagrams in the text. Title printed in red & black. 6 p.l., 336 pp., one leaf of errata. Small 4to, cont. limp vellum (binding a little worn). Leyden, J. Maire, 1649. \$3950.00

First edition in Latin of Descartes's magnum opus. It first appeared in French as the third part of the *Discours de la Méthode* (1637); our edition is the text's first separate appearance. This is one of the key texts in the history of mathematics and prepared the way for the later mathematical achievements of 17th-century.

The *Geometria* is divided into three books. The first deals with problems which can be constructed by the aid of the circle and straight line only. The second book is on the nature of curved lines. The third book treats of the construction of problems solid and more than solid.

Analytic geometry first appeared in this work. "The fundamental idea in Descartes's mind was not the revolutionizing of geometry so much as it was the

elucidating of algebra by means of geometric intuition and concepts; in a word, the graphic treatment of the equation. His imagination extended far beyond this, however, to the establishing of a universal mathematics in which algebra, geometry and arithmetic should be closely related members.”—Smith, *History of Mathematics*, I, pp. 375-76.

The original text is famously obscure. This edition, with notes by Beaune and a commentary by Schooten, enabled the book to be widely read. It was through this Latin translation that Newton and the other contemporary mathematicians acquired an understanding of Descartes’s work.

A very good copy.

♣ Cajori, *A History of Mathematics*, p. 174—“Of epoch-making importance.” *D.S.B.*, IV, pp. 55-58.

*The First Printing of Fermat’s Last Theorem;
With the Very Rare Errata Leaf*

20. DIOPHANTUS, of Alexandria. *Arithmeticonum Libri Sex, et De Numeris multangulis Liber Unus.* Cum Commentariis C.G. Bacheti...& observationibus D.P. de Fermat...Accessit Doctrinae Analyticae inventum novum, collectum ex variis eiusdem D. de Fermat Epistolis. Large engraved vignette on title, several finely engraved headpieces & initials, & a few woodcut diagrams in the text. 6 p.l., 64, 341, 48 pp., one leaf of errata. Folio, cont. speckled calf (carefully rebacked with the orig. spine laid-down, light browning as usual, two corners discretely repaired), spine richly gilt. Toulouse: B. Bosc, 1670. \$65,000.00

First edition, and a very fine and fresh copy. This edition is the first to contain Fermat’s observations on the *Arithmetica* of Diophantus, the first systematic treatise on algebra; it also contains (on H3r) the first statement of the celebrated “Last Theorem” which Fermat originally wrote by hand in the margins of his copy of Bachet’s edition of Diophantus (1620). This theorem is the most famous problem in mathematics and remained unsolved for over 325 years until its recent solution by Andrew Wiles. But it should be remembered that Wiles was able to resort to sophisticated 20th-century techniques not available to Fermat. The exact form of Fermat’s proof, if indeed he had a genuine one, thus remains one of the great unsolved puzzles of mathematics.

The 1670 edition was published posthumously by Fermat’s son Clement Samuel. It is based on his father’s annotated copy of the Bachet edition of 1621 and contains a major part of Fermat’s work on number theory, a branch of mathematics that he virtually created.

A nice copy with the extremely rare errata leaf.

♣ Smith, *Rara Arithmetica*, p. 348.

Tiling: Probability and Art

21. DOÛAT, Dominique. *Methode pour faire une infinité de desseins differents Avec des Carreaux mi-partis de deux couleurs par une Ligne diagonale ou observations du P. Dominique Doüat...sur un memoire inseré dans l'histoire de l'Academie Royale des Sciences de Paris l'année 1704. Présenté par le R.P. Sebastien Truchet...* Engraved title within decoratively tiled border & 28 engraved plates (with 72 different designs). 8 p.l. (incl. engraved title), 189 pp. Large 4to, cont. speckled calf (head of spine a bit chipped), spine richly gilt. Paris: J. Quillau, 1722. \$12,500.00

First edition of this remarkably illustrated book, which is important both in mathematical probability and art history. "There are few places where the approaches of the artist and the scientist intersect more intimately than in the production and analysis of tiling patterns. In *The Sense of Order: A Study of the Psychology of Decorative Art*, Ernst Gombrich reproduces some figures from a book by a Dominican priest named Douat, which was published in Paris in 1722 and is now very rare. Douat's book contains 72 engraved designs...and nearly 190 pages of tables listing all the possible permutations and combinations of the four letters A, B, C and D (arranged in different sequences to represent the orientation of the unit tiles juxtaposed horizontally, diagonally and vertically, concluding with the 256 possibilities of arrangement of a 4 x 4 array). The book had some influence on European decorative art in the eighteenth century and inspired illustrations in such works as Jeurat's *Traité de perspective* (Paris: 1750) and Diderot's *Encyclopédie*...

"Though Douat's book provided a fine source of patterns for the use of craftsmen, the intellectual inspiration behind it was entirely that of a fellow Dominican priest, Sebastien Truchet, an engineer with an interest in mathematics and art...Truchet had published a short paper "Memoir sur les Combinaisons" in the *Memoires de l'Académie Royale des Sciences* in 1704...

"Truchet's treatise is of considerable importance for it is in essence a graphical treatment of combinatorics, a subject that, under the influence of Pascal, Fermat and Leibniz, was at the forefront of mathematics at the time. Truchet says that he got the idea when he saw a supply of tiles for paving apartments in a château near Orléans."—Smith, Cyril Stanley, "The Tiling Patterns of Sebastien Truchet and the Topology of Structural Hierarchy" in *Leonardo*, Vol. 20, Issue 4(1987), pp. 373-85.

Fine copy and rare. Armorial bookplate of Pierre Pecquot, Seigneur de Saint Maurice (1658-1735), secretary to the king of France. A WorldCat entry calls for 30 plates (including the engraved title); this is wrong.

22. [EMERSON, William]. *The Method of Increments. Wherein the Principles are demonstrated; and the Practice thereof shewn in the Solution of Problems.* viii, 147 pp. 4to, orig. blue boards (spine defective, title dusty), uncut. London: J. Nourse, 1763. \$950.00

First edition. "Chiefly based on Taylor's 'Methodus Incrementorum,' and Stirling's 'Differential Method,' and valuable as an early treatise on the calculus of finite differences."—Sotheran 1170.

Emerson (1701-82), mathematician, published a long series of introductory works on various aspects of mathematics. When invited to become a member of the Royal Society, he declined, saying "it was a damned hard thing that a man should burn so many farthing candles as he had done, then have to pay so much a year for the honour of F.R.S. after his name."

Good uncut copy preserved in a box.

*His First Major Publication;
Large Paper Set*

23. EULER, Leonhard. *Mechanica sive Motus Scientia Analytice exposita...* Thirty-two folding engraved plates. 8 p.l., 480 pp.; 4 p.l., 500 pp. Two vols. Large 4to, orig. boards (minor wear & foxing), entirely uncut. St. Petersburg: ex Typographia Academiae Scientiarum, 1736. \$15,000.00

First edition, and a fine set in original state, of Euler's first major publication and the first work to apply analysis to the study of mechanics.

"In an introduction of the *Mechanica* (1736) Euler outlined a large program of studies embracing every branch of the science. The distinguishing feature of Euler's investigations in mechanics as compared to those of his predecessors is the systematic and successful application of analysis. Previously the methods of mechanics had been mostly synthetic and geometrical; they demanded too individual an approach to separate problems. Euler was the first to appreciate the importance of introducing uniform analytic methods into mechanics, thus enabling its problems to be solved in a clear and direct way..."

"This first large work on mechanics was devoted to the kinematics and dynamics of a point-mass. The first volume deals with the free motion of a point-mass in a vacuum and in a resisting medium; the section on the motion of a point-mass under a force directed to a fixed center is a brilliant analytical reformulation of the corresponding section of Newton's *Principia*; it was sort of an introduction to Euler's further works on celestial mechanics. In the second volume, Euler studied the constrained motion of a point-mass...In the chapter on the motion of a point on a given surface, Euler solved a number of problems of the differential geometry of surfaces and of the theory of geodesics."—D.S.B., IV, pp. 479-80.

♣ Roberts & Trent, *Bibliotheca Mechanica*, pp. 103-04.

A New Branch of Mathematics

- 24. EULER, Leonhard.** *Methodus Inveniendi Lineas Curvas Maximi Minimive proprietate gaudentes, sive Solutio Problematis Isoperimetrici Latissimo sensu accepti.* Engraved vignette on title & five folding engraved plates. Title in red & black. 1 p.l., 322 pp., 1 leaf of instructions to binder. Large 4to, cont. mottled calf (foot of upper joint carefully repaired), spine richly gilt, red morocco lettering piece on spine. Lausanne & Geneva: M.M. Bousquet, 1744. \$12,500.00

First edition of the work which created the calculus of variations. This book, which displayed "an amount of mathematical genius seldom rivalled, contained his researches on the calculus of variation to the invention of which Euler was led by the study of the researches of Johann and Jakob Bernoulli... The study of isoperimetrical curves, the brachistochrone in a resisting medium and the theory of geodesics, previously treated by the elder Bernoullis and others, led to the creation of this new branch of mathematics, the Calculus of Variations. His method was essentially geometrical, which makes the solution of the simpler problems very clear."—Cajori, *A History of Mathematics*, p. 234.

Fine large copy from the library of Haskell F. Norman with bookplate.

• Dibner 111. *D.S.B.*, IV, p. 479. Evans, *First Editions of Epochal Achievements in the History of Science* (1934), 9. Horblit 28. Roberts & Trent, *Bibliotheca Mechanica*, p. 104—"For the purposes of mechanics, the significance of this work lies in the appendix, which deals with geometrical forms of elastic curves... The present work illustrates the first solution to the problem of the buckling of a column." Sparrow 60.

The First in His Great Trilogy

- 25. EULER, Leonhard.** *Introductio in Analysin Infinitorum.* Engraved vignette on each title, engraved frontis., engraved port. of Mairan, one folding printed table, & 40 folding engraved plates. Titles in red & black. 1 p.l., xvi, 320 pp.; 1 p.l., 398 pp., 1 unnumbered leaf. Two vols. Large 4to, orig. semi-stiff boards (covers a little soiled), uncut. Lausanne: M.M. Bousquet, 1748. \$20,000.00

First edition, and a lovely set in the original bindings, of the first of Euler's great trilogy on analytical mathematics, the others being *Institutiones Calculi Differentialis* (1755) and *Institutionum Calculi Integralis* (1768-70). The *Introductio* presents the first clear statement of the idea that mathematical analysis is a science of functions and offers a more thorough investigation of the very concept of function.

"In his 'Introduction to Mathematical Analysis' Euler did for modern analysis

what Euclid had done for ancient geometry. It contains an exposition of algebra, trigonometry and analytical geometry, both plane and solid, a definition of logarithms as exponents, and important contributions to the theory of equations. He evolved the modern exponential treatment of logarithms, including the fact that each number has an infinity of natural logarithms. In the early chapters there appears for the first time the definition of mathematical function, one of the fundamental concepts of modern mathematics."—*Printing & the Mind of Man* 196.

A remarkable set in original state, entirely uncut and in the original boards, from the library of Haskell F. Norman with bookplate. Minor browning.

*The Second in his Trilogy;
The Norman Copy*

26. EULER, Leonhard. *Institutiones Calculi Differentialis cum eius Usu in Analyysi Finitorum ac Doctrina Serierum.* xxiv, 880 pp. Large 4to, antique half-calf & marbled boards, spine gilt. St. Petersburg: Academiae Imperialis Scientiarum, 1755. \$12,500.00

First edition of Euler's second great contribution to analytical mathematics. "This is the first text-book on the differential calculus which has any claim to be regarded as complete, and it may be said that until recently many modern treatises on the subject are based on it."—Ball, *A Short Account of the History of Mathematics*, p. 396.

"Euler developed the calculus of finite differences in the first chapters of his *Institutiones calculi differentialis*, and then deduced the differential calculus from it. He established a theorem on homogeneous functions, known by his name, and contributed largely to the theory of differential equations, a subject which had received the attention of I. Newton, G.W. Leibniz, and the Bernoullis, but was still undeveloped."—Cajori, *A History of Mathematics*, pp. 238-39.

Very good copy from the library of Haskell F. Norman with bookplate. Old stamp of the London Institution on title and verso of last leaf.

Abraham Gotthelf Kaestner's Annotated Copy

27. EULER, Leonhard. *Theoria Motus Corporum Solidorum seu Rigidorum ex Primis Nostrae Cognitionis Principiis Stabilita et ad Omnes Motus, qui in huiusmodi Corpora cadere possunt, accommodata.* Fifteen engraved plates. 16 p.l., 520 pp. 4to, cont. paste-paper boards (some browning), rebacked in antique style by Aquarius, spine gilt, red morocco lettering piece on spine. Rostock & Greifswald: A.F. Röse, 1765. \$15,000.00

First edition and a highly important copy, having belonged to one of the leading mathematicians of the 18th century, Abraham Gotthelf Kaestner (1719-

1800). Professor of mathematics at the University of Göttingen, Kaestner “owes his place in the history of mathematics to his great success as an expositor and to the seminal character of his thought. From today’s point of view Kaestner’s historical significance lies mostly in the interest he promoted in the foundation of parallel theory.”—*D.S.B.*, VII, p. 206.

Kaestner has signed this copy and written extensive annotations on the front endpapers and some marginalia and corrections on approximately ten leaves.

“The *Theoria motus corporum solidorum*...is related to the *Mechanica*. In the introduction to this work, Euler gave a new exposition of punctual mechanics and followed Maclaurin’s example (1742) in projecting the forces onto the axes of a fixed orthogonal rectilinear system. Establishing that the instantaneous motion of a solid body might be regarded as composed of rectilinear translation and instant rotation, Euler devoted special attention to the study of rotatory motion...Euler thus laid the mathematical foundation of the numerous studies on variational principles of mechanics and physics which are still being carried out.”—*D.S.B.*, IV, p. 480.

Nice copy. Old stamp on title of “Steuermans Schule, Bremen.”

• Roberts & Trent, *Bibliotheca Mechanica*, pp. 105-06.

*His Third & Final Contribution to Analytical Mathematics;
Large Paper Set*

28. EULER, Leonhard. *Institutionum Calculi Integralis*. One folding engraved plate. 2 p.l., 542 pp.; 2 p.l., 526, [8] pp.; 4 p.l., 639 pp. Three vols. Large 4to, cont. half-calf & paste-paper boards, green & red morocco lettering pieces on spines. St. Petersburg: Impensis Academia Imperialis Scientiarum, 1768-69-70. \$22,500.00

First edition, and an uncommonly handsome set printed on large paper, of the third and final classic contribution by Euler to analytical mathematics. “This series of works was completed by the publication in three volumes in 1768 to 1770 of the *Institutiones Calculi Integralis*, in which the results of several of Euler’s earlier memoirs on the same subject and on differential equations are included. This, like the similar treatise on the differential calculus, summed up what was then known on the subject, but many of the theorems were recast and the proofs improved. The Beta and Gamma functions were invented by Euler and are discussed here...”—Ball, *A Short Account of the History of Mathematics*, p. 396.

This work “exhibits Euler’s numerous discoveries in the theory of both ordinary and partial differential equations, which were especially useful in mechanics.”—*D.S.B.*, IV, p. 478.

The second edition of this work appeared posthumously between 1792 and 1794 with a fourth volume of unpublished material. This fourth volume is sometimes mistakenly described as belonging to the first edition.

A fine and extremely large set, from the library of Haskell F. Norman with

bookplate. Small oval red ink stamp (a shield resting against a tree) on verso of each title. I have seen this stamp on the versos of titles of numerous scientific books over the years. The books are always notable titles and in fine condition; it must have been a wonderful, important, and large private library. Who was the collector?

*One of Euler's Rarer Works;
The Dukes of Anhalt Set*

29. EULER, Leonhard. *Opuscula Analytica*. Two folding engraved plates. 2 p.l., 363 pp.; 2 p.l., 346 pp. Two vols. Large 4to, early 19th-cent. half-sheep & green marbled boards, flat spine gilt, red leather lettering piece on spine. St. Petersburg: Typis Academiae Imperialis Scientiarum, 1783-85. \$9500.00

First edition of this collection of 29 mathematical treatises by Euler; the first volume was published in the year of his death. This is a very uncommon book.

"Containing important papers on the theory of numbers, including his famous 'Observationes circa Divisionem Quadratorum per Numeros primos', also 'de Criteriis Aequationis $fx + gy = hzz$, utrum ea Resolutionem admittat necne? Considerationes super Theoremate Fermatiano,' etc. etc."—Sotheran, 2nd Supp., 1464.

Fine and fresh set from the library of the Dukes of Anhalt with their stamp on verso of each title.

• Keynes, *A Treatise on Probability. Bibliography*, p. 443.

"Marks an Epoch"

30. FOURIER, Jean Baptiste Joseph, Baron. *Théorie Analytique de la Chaleur*. Two engraved plates. 2 p.l., xxii, 639 pp. Large 4to, cont. olive calf (occasional minor foxing), single gilt fillet round sides, central wreath on each cover with the following legend: "Academie de Paris. Prix du Concours Général" by Bradel with his ticket, dentelles gilt, a.e.g.. Paris: Firmin-Didot, 1822. \$37,500.00

First edition, and a large and absolutely superb copy of this celebrated work in a handsome signed prize binding. "This work marks an epoch in the history of both pure and applied mathematics. It is the source of all modern methods in mathematical physics involving the integration of partial differential equations in problems where the boundary values are fixed...The gem of Fourier's great

book is 'Fourier's series.'"—Cajori, *A History of Mathematics*, p. 270.

Fourier's methods find their widest application to problems of vibration in heat, sound, and fluid motion.

A rare book and a nice copy, preserved in a box. Ex Bibliotheca Mechanica.

• Dibner, *Heralds of Science*, 154. *D.S.B.*, V, pp. 93-99. *En Français dans le Texte*

232. Evans, *First Editions of Epochal Achievements in the History of Science* (1934), 37.

Roberts & Trent, *Bibliotheca Mechanica*, p. 118.

"Fourier's Theorem"

31. FOURIER, Jean Baptiste Joseph, Baron. *Analyse des Équations déterminées... Première Partie* [all published]. 2 p.l., xxiv, 258 pp. Large 4to, cont. half-calf & marbled boards (very carefully rebacked with orig. spine laid-down), spine gilt, pale blue lettering piece on spine. Paris: Firmin Didot Frères, 1831. \$3500.00

First edition of the work which first contains "Fourier's theorem" on the number of real roots between two chosen limits.

"At the time of his death, Fourier was trying to prepare these and many other results for a book to be called *Analyse des équations déterminées*; he had almost finished only the first two of its seven *livres*. His friend Navier edited it for publication in 1831 inserting an introduction to establish from attested documents (including the 1789 paper) Fourier's priority on results which had by then become famous. Perhaps Fourier was aware that he would not live to finish the work, for he wrote a synopsis of the complete book which also appeared in the edition. The synopsis indicated his wide interests in the subject, of which the most important not yet mentioned were various means of distinguishing between real and imaginary roots, refinements to the Newton-Raphson method of approximating to the root of an equation, extensions to Daniel Bernoulli's rule for the limiting value of the ratio of successive terms of a recurrent series, and the method of solution and applications of linear inequalities. Fourier's remarkable understanding of the last subject makes him the great anticipator of linear programming."—*D.S.B.*, V, p. 98.

Very nice copy. Old library stamp on title.

• Cajori, *A History of Mathematics*, p. 433—This book "contains much original matter, in particular there is a demonstration of Fourier's theorem on the position of the roots of an algebraical equation."

"The Astonishing Richness"

- 32. GALOIS, Evariste.** *Oeuvres Mathématiques*, publiées sous les Auspices de la Société Mathématique de France, avec une Introduction par M. Émile Picard. Heliogravure frontis. port. of Galois. x, 61 pp., one leaf. 8vo, cont. half-calf & cloth (spine a bit worn), red leather lettering piece on spine. Paris: Gauthier-Villars et fils, 1897. \$1250.00

First book edition of these important texts which enabled Galois' work to become known to the mathematical world; they exerted a profound influence on the development of modern mathematics.

Galois (1811-32), "died at the age of twenty years and seven months from wounds received in a mysterious duel. He left a body of work — for the most part published posthumously — of less than 100 pages, the astonishing richness of which was revealed in the second half of the nineteenth century. Far from being a cloistered scholar, this extraordinarily precocious and exceptionally profound genius had an extremely tormented life...continuing the work of Abel, he produced with the aid of group theory a definitive answer to the problem of the solvability of algebraic equations, a problem that had absorbed the attention of mathematicians since the eighteenth century; he thereby laid one of the foundations of modern algebra. The few sketches remaining of other works that he devoted to the theory of elliptic functions and that of Abelian integrals and his reflections on the philosophy and methodology of mathematics display an uncanny foreknowledge of modern mathematics."—*D.S.B.*, V, pp. 259-60.

These texts were originally published in the *Journal de Mathématiques pures et appliquées* (1846). See *En Français dans le Texte* 246 for the journal appearance. Picard's introduction appears here for the first time.

Very good copy with unimportant foxing. Partially interleaved. Bookplate removed.

"A Landmark in Algebra"—Bell

- 33. GAUSS, Carl Friedrich.** *Demonstratio Nova Theorematis Omnem Functionem Algebraicam Rationalem Integram unius Variabilis in Factores Reales Primi vel Secundi Gradus resolvi posse*. One engraved plate (somewhat browned). 39, [1] pp. 4to, cont. half-calf & marbled boards. Helmstadt: C.G. Fleckeisen, 1799. \$35,000.00

First edition of Gauss's first book for which he received his doctorate degree; in this rare work Gauss gave the first rigorous proof of the fundamental theorem of algebra. This theorem, which states that every algebraic equation in one unknown has a root, was expressed by Albert Girard, Descartes, Newton, and Maclaurin. Attempts at a proof were made by d'Alembert, Euler, and Lagrange, but Gauss was the first to furnish a rigorous demonstration.

This is Gauss's first great work and marks the beginning of an extraordinary

ten years which saw the publication of his *Disquisitiones Arithmeticae* (1801) and his calculation of the orbit of the newly discovered planet Ceres.

"Gauss ranks, together with Archimedes and Newton, as one of the greatest geniuses in the history of mathematics."—*Printing & the Mind of Man*, p. 155.

A very good copy. Library stamp on blank portion of title removed and another stamp on final text leaf with circular piece of paper pasted over. On page 26 there are two corrections, presumably in the Gauss's hand.

Provenance: Absolutely reliable.

• Bell, *Men of Mathematics*, pp. 218-69. *D.S.B.*, V, pp. 298-315. Smith, *History of Mathematics*, II, pp. 473-74.

34. GAUSS, Carl Friedrich. *Theorematis Fundamentalis in Doctrina de Residuis Quadraticis Demonstrationes et Ampliationes Novae.* 20 pp. Large 4to, attractive antique boards.. Göttingen: H. Dieterich, 1818.

\$4950.00

First separate edition, offprint issue with new pagination from the *Comm. Recent. Soc. Gott.*, Vol. IV (1816-18). In this important memoir Gauss provided a fifth and sixth demonstration of his great law of quadratic reciprocity, a "gem" of higher arithmetic. It perfected and completed the work on this subject in his *Disquisitiones Arithmeticae* (1801).

Fine copy.

• Cajori, *A History of Mathematics*, pp. 435-36. Poggendorff, I, 854-57.

"Definitive"

35. GAUSS, Carl Friedrich. *Theoria Combinationis Observationum Erroribus Minimis Obnoxiae.* 1 p.l., 58 pp. Large 4to, attractive modern marbled boards (minor foxing), red morocco lettering piece on spine. Göttingen: H. Dieterich, 1823.

\$3950.00

First separate edition, offprint issue with new pagination from the *Comm. Recent. Soc. Gott.*, Vol. V (1819-22). Geodesy was a preoccupation of Gauss from 1817 to 1825 and a major interest for nearly thirty years. The present work is concerned with minimizing observational errors in statistical analysis. "Surveying problems also motivated Gauss to develop his ideas on least squares and more general problems of what is now called mathematical statistics. The result was the definitive exposition of his mature ideas in the [present work]."—*D.S.B.*, V, p. 304.

Fine copy.

• Poggendorff, I, 854-57.

"The Crowning Contribution of the Period"
The Geometry of Curved Surfaces

- 36. GAUSS, Carl Friedrich.** *Disquisitiones Generales circa Superficies Curvas*. 50 pp. Large 4to, later 19th-century cloth-backed marbled boards, orig. wrappers bound in. Göttingen: Dieterich, 1828. \$9500.00

First separate edition, offprint issue with new pagination from the *Comm. Recent. Soc. Gott.*, Vol. VI (1823-27). "The crowning contribution of the period, and his last breakthrough in a major new direction of mathematical research, was [the present work], which grew out of his geodesic meditations of three decades and was the seed of more than a century of work on differential geometry."—*D.S.B.*, V, p. 304.

This work led directly to the work of Riemann and the mathematical foundations of the general theory of relativity. Implicit in this work is a non-Euclidean geometry, which Bolyai, Lobachevsky, and Riemann formally developed.

Fine copy from the library of Haskell F. Norman with bookplate. Many edges are uncut.

♣ Poggendorff, I, 854-57.

- 37. GAUSS, Carl Friedrich.** *Supplementum Theoriae Combinationis Observationum Erroribus Minimis Obnoxiae*. 44 pp. Large 4to, attractive modern marbled boards, red morocco lettering piece on spine. Göttingen: H. Dieterich, 1828. \$3500.00

First separate edition, offprint issue with new pagination from the *Comm. Recent. Soc. Gott.*, Vol. VI (1823-27). Geodesy was a preoccupation of Gauss from 1817 to 1825 and a major interest for nearly thirty years. "Surveying problems also motivated Gauss to develop his ideas on least squares and more general problems of what is now called mathematical statistics. The result was the definitive exposition of his mature ideas in the *Theoria combinationis observationum erroribus minimis obnoxiae* (1823, with supplement in 1828)."—*D.S.B.*, V, p. 304.

Fine copy and rare.

♣ Poggendorff, I, 854-57.

*"Breaks New Ground with all the Boldness
of the Great Pioneers"*

38. GAUSS, Carl Friedrich. *Theoria Residuorum Biquadraticorum. Commentatio Prima.* 32 pp. Large 4to, attractive modern marbled boards, red morocco lettering piece on spine. Göttingen: Dieterich, 1828.

[bound with]:

— . *Theoria Residuorum Biquadraticorum. Commentatio Secunda.* 24, 33-40, 33-60 pp. Large 4to (minor foxing). Göttingen: Dieterich, 1832.

\$5500.00

First separate edition, offprint issues with new pagination from the *Comm. Recent. Soc. Gött.*, Vol. VI (1823-27) & VII (1828-32). These two memoirs (the first was delivered in 1825) constitute one of Gauss's most important works. "Quadratic reciprocity 'stands out not only for the influence it has exerted in many branches, but also for the number of new methods to which it has given birth' (P. A. MacMahon). The solution of the problem of the representation of numbers by binary quadratic forms is one of the great achievements of Gauss."—Cajori, *A History of Mathematics*, p. 436.

Fine copies.

♣ Bell, *Men of Mathematics*, p. 253—"The memoir of 1825 breaks new ground with all the boldness of the great pioneers." Poggendorff, I, 854-57.

39. GAUSS, Carl Friedrich. *Principia Generalia Theoriae Figurae Fluidorum in Statu Aequilibrii.* 1 p.l., 53 pp. Large 4to, attractive modern marbled boards, red morocco lettering piece on spine. Göttingen: Dieterich, 1830. \$4500.00

First separate edition, originally published in the *Comm. recent. Soc. Gött.*, Vol. VII (1828-32). This is Gauss's "one contribution to capillarity and an important paper in the calculus of variations, since it was the first solution of a variational problem involving double integrals, boundary conditions, and variable limits."—*D.S.B.*, V, p. 305.

Fine copy.

♣ Poggendorff, I, 854-57.

"One of the Great Pioneers in Infinitesimal Analysis"—D.S.B.

40. GREGORIUS a Sancto Vincentio (or Gregorius Saint Vincent). *Problema Austriacum plus ultra Quadratura Circuli* [or, from the half-title: *Opus geometricum*]. Finely engraved title. 26 p.l., 1225, [1] pp., [3] pp. of errata. Two vols in one. Folio, attractive antique calf-backed marbled boards by Trevor Lloyd (lightly browned, first five leaves with minor repairs to upper outer corner), spine richly gilt, red morocco lettering piece on spine. Antwerp: J. & J. Meursius, 1647. \$14,500.00

First edition. This is the major work of the brilliant Jesuit mathematician Gregorius Saint Vincent (1584-1667), "one of the great pioneers in infinitesimal analysis."—*D.S.B.*, XII, p. 76. He studied under Clavius in Rome and when Galileo compared his telescope with those of the Jesuits in 1611, Gregorius hinted that he had doubts about the geocentric system. He finished his studies in Louvain and established himself as a mathematician in that city where he taught and wrote a number of notable mathematical works.

The present work treats four main subjects. "Book I contains various introductory theorems on the circle and on triangles as well as geometrically clothed algebraic transformations. Book II includes the sums of geometric series obtained by means of transformation to the differences of the terms... In book VIII it is shown that if the horn angle is conceived as a quantity, the axiom of the whole and the parts no longer holds..."

"Books III-VI are devoted to the circle, ellipse, parabola, and hyperbola, and to the correspondence between the parabola and the Archimedean spiral... Book VII contains Gregorius' remarkable quadrature method... Book X is devoted to the quadrature of the circle."—*D.S.B.*, XII, p. 75—(and see the extended and detailed discussion of this book on pp. 75-76).

Very good copy with the signature dated 27 August 1774 of Francis Maseres (1731-1824), the mathematician, on the free front endpaper. With the stamp in several places of the Inner Temple Library to which Maseres bequeathed his library. This is a rare book on the market.

♣ Cajori, *A History of Mathematics*, p. 181—"His great book... the *Opus* contains solid achievements, which were the more remarkable, because at that time only four of the seven books of the conics of Apollonius of Perga were known in the Occident." Smith, *History of Mathematics*, I, pp. 424-25.

Quaternions

41. HAMILTON, William Rowan. *Lectures on Quaternions: Containing a Systematic Statement of a New Mathematical Method.* 3 p.l., 64, [ix]-lxxii, 736pp., one leaf of errata. Thick 8vo, orig. blind-stamped pale purple cloth (sides a little faded, the spine more so), spine lettered in gilt.

Dublin: Hodges & Smith; London: Whittaker & Co.; Cambridge: Macmillan, 1853. \$7500.00

First edition of Hamilton's masterpiece and a very nice copy in the original cloth. "The achievement in pure mathematics for which he is now best remembered is the invention of quaternions, a linear algebra of rotations in space of three dimensions. Quaternions were the first non-commutative number system to be investigated in detail, and Hamilton's discovery that a consistent and useful system of algebra could be constructed without obeisance to the commutative law of multiplication was comparable in importance to the invention of non-Euclidean geometry. Quaternions led to vector analysis...which has become of the greatest importance in mathematical physics, and was developed by G. F. B. Riemann and E. B. Christoffel into tensor analysis. This made possible the creation of the general theory of relativity."—*Printing & the Mind of Man* 334.

Fine copy of a book which is now very rare in its original binding.

The First Work in English on Newton's Calculus

42. HAYES, Charles. *A Treatise of Fluxions: or, an Introduction to Mathematical Philosophy. Containing a full Explication of that Method by which the Most Celebrated Geometers of the present Age have made such vast Advances in Mechanical Philosophy.* Numerous woodcut diagrams in the text including one tipped-in on p. ii. 8 p.l., xii, 315, [1] pp. Folio, cont. panelled calf (two corners a bit worn, a few leaves at front & back with minor marginal dampstaining), red leather lettering piece on spine (slightly flaked). London: E. Midwinter for D. Midwinter & T. Leigh, 1704. \$9500.00

First edition of the first work in English on Newton's calculus; this has become a most uncommon book on the market. "This is the first English work explaining Newton's infinitesimals and applying his method to obtain the tangents of curves, then their areas, and lastly the problems of maxima and minima."—Babson 175.

Hayes (1678-1760), was a mathematician, geographer, and chronologer. His greatest work was the unfinished *Chronographia Asiatica et Aegyptiaca*.

Fine, crisp, and fresh copy. Contemporary signatures of "William Whitworth" and "Fra: Hunt" on title-page.

• ODNB—" This was the first English work explaining Newton's method of fluxions — the Newtonian version of the infinitesimal calculus; it covered in more than three hundred pages all the known areas of the early eighteenth-century calculus (finding tangents, areas, maxima and minima, caustics, centres of gravity, percussion, and oscillation, plus a treatment of central forces).

- 43. JACOBI, Carl Gustav Jakob.** *Vorlesungen über Dynamik...nebst fünf hinterlassenen Abhandlungen desselben*, herausgegeben von A. Clebsch. viii, 578 pp. Large 4to, cont. half-calf & cloth sides (leather somewhat defective at corners), spine gilt, green morocco lettering piece on spine. Berlin: G. Reimer, 1866. \$950.00

First edition. "Jacobi's lectures on dynamics delivered at the University at Königsberg in the winter of 1842-1843 appear here as edited by Clebsch. As Jacobi had been prevented by illness from completing the series of lectures, Clebsch has supplied the chapter 'Die Integration der nicht linearen partiellen Differentialgleichungen erster Ordnung' from a paper by Jacobi of 1838. To the lectures have been joined five of Jacobi's papers on related topics."—Roberts & Trent, *Bibliotheca Mechanica*, pp. 172-74.

Very nice copy.

☛ *D.S.B.*, Vol. VII, pp. 50-55—"Most of Jacobi's work is characterized by linkage of different mathematical disciplines. He introduced elliptic functions not only into number theory but also in the theory of integration, which in turn is connected with the theory of differential equations where, among other things, the principle of the last multiplier is due to Jacobi. Most of his investigation on first-order partial differential equations and analytical mechanics were published [in the present work]. Taking W.R. Hamilton's research on the differential equations of motion (canonical equations) as a starting point, Jacobi also carried on the work of the French school (Lagrange, Poisson, and others)."

- 44. LACROIX, Silvestre François.** *An Elementary Treatise on the Differential and Integral Calculus*. Translated from the French [by John F.W. Herschel, Charles Babbage, & George Peacock]. With an Appendix and Notes. Five folding engraved plates. viii, 720 pp. 8vo, attractive antique half-calf & marbled boards (minor foxing & occasional dampstaining), flat spine gilt, red morocco lettering piece on spine, uncut. Cambridge: J. Deighton & Sons, 1816. \$1500.00

First edition in English. It was this work that was largely responsible for the introduction of Continental methods of analysis and notation into English mathematics. Herschel, Babbage and Peacock, who formed the Analytical Society while still undergraduates at Cambridge, translated and edited Lacroix's work and secured its use as a textbook, first in Cambridge and afterwards, country-wide.

Fine uncut copy.

☛ *D.S.B.*, VI, p. 324.

Lagrange's First Book; Of Great Rarity

45. **LAGRANGE, Joseph Louis.** *Lettera...all' illustrissimo Signor Conte Giulio Carlo da Fagnano...Contenente una nuova serie per i differenziali, ed integrali di qualsivoglia grado corrispondente alla Newtoniana per le potestà, e le radici.* Woodcut printer's device on title. 8 pp. Small 4to, fine modern red morocco by Laurenchet, upper cover lettered in gilt. Torino: nella Stamperia Reale, 1754. \$25,000.00

First edition of Lagrange's first book, published when he was 18 years old; this is a very rare book with no copy located in WorldCat. "In 1754 Lagrange had a short essay printed in the form of a letter written in Italian and addressed to the geometer Giulio da Fagnano. In it he developed a formal calculus based on the analogy between Newton's binomial theorem and the successive differentiations of the product of two functions."—*D.S.B.*, VII, p. 560.

A fine copy.

• Riccardi, II, 2—"Questo rarissimo opuscolo interessa assai la storia della scienza, anche perchè è il primo lavoro del nostro a. da lui composto nella tenera età di 18 anni; ed è l'unica memoria matematica da lui pubblicata in lingua italiana."

"Second Only to Newton's Principia"—Wolf

46. **LAGRANGE, Joseph Louis, Comte.** *Méchanique Analitique.* xii, 512 pp. Large 4to, cont. mottled calf (several discrete repairs, minor rubbing & wear), flat spine gilt, red morocco lettering piece on spine. Paris: la Veuve Desaint, 1788. \$16,500.00

First edition of the work which laid the foundations of modern mechanics. This book contains the discovery of the general equations of motions of any system of bodies. "Lagrange proposed to reduce the theory of mechanics and the art of solving problems in that field to general formulas, the mere development of which would yield all the equations necessary for the solution of every problem..."

"The [book] united and presented from a single point of view the various principles of mechanics, demonstrated their connection and mutual dependence, and made it possible to judge their validity and scope. It is divided into two parts, statics and dynamics, each of which treats solid bodies and fluids separately. There are no diagrams. The methods presented require only analytic operations subordinated to a regular and uniform development. Each of the four sections begins with a historical account which is a model of the kind."—*D.S.B.*, VII, pp. 569-70.

A very good and large copy. Early ownership stamp on title and on first leaf of text.

• Dibner, *Heralds of Science*, 112. *En Français dans le Texte* 179. Evans, *First*

Editions of Epochal Achievements in the History of Science (1934), 10—"Perhaps the most beautiful mathematical treatise in existence." Horblit 61. Roberts & Trent, *Bibliotheca Mechanica*, pp. 189-90. Sparrow, *Milestones of Science*, 120. Wolf, II, pp. 69-70.

47. LAGRANGE, Joseph Louis, Comte. *Théorie des Fonctions Analytiques, contenant les Principes du Calcul différentiel, dégagés de Toute considération d'Infiniment Petits ou d'Evanouissans, de Limites ou de Fluxions, et réduits à l'Analyse Algébrique des Quantités finies.* 2 p.l., viii, 277, [1] pp. Large 4to, cont. half-calf & speckled boards (final ten leaves with pale & unimportant dampstaining, occasional minor browning), uncut. Paris: Imprimerie de la République, An V [1797]. \$3000.00

First edition and a lovely copy. In this work, Lagrange "intended to show that power series expansions are sufficient to provide differential calculus with a solid foundation. Today mathematicians are partially returning to this conception in treating the formal calculus of series."—*D.S.B.*, VII, p. 570.

"The year 1797...saw the appearance of the famous work of Lagrange, *Théorie des fonctions analytiques*, ... This book developed with care and completeness the characteristic definition and method in terms of 'fonctions derives,' based upon Taylor's series, which Lagrange had proposed in 1772. In it the author gave not only an attempted proof of the incorrect theorem that every continuous function may be so expanded, but also the determination of the 'fonctions derives' (or derivatives) of the elementary functions, and numerous applications to geometry and mechanics...Lagrange's *Théorie des fonctions* was only one, but by far the most important, of many attempts made about this time to furnish the calculus with a basis which would logically modify or supplant those given in terms of limits and infinitesimals."—Cajori, *The Concepts of the Calculus*, pp. 261-63.

Fine uncut copy.

Fine Uncut Copy

48. LAGRANGE, Joseph Louis, Comte. *De la Résolution des Équations numériques de tous les Degrés.* viii, 268 pp. Large 4to, cont. calf-backed marbled boards (head of spine a trifle worn), flat spine gilt, orange leather lettering piece on spine, uncut. Paris: Duprat, An VI [1798]. \$3250.00

First book edition of these two papers, originally published in 1769 and 1770 in journals, containing for the first time a fine historical introduction and followed by numerous notes. In this work, Lagrange "gives the method of approximating to the real roots of an equation by means of continued fractions, and enunciates several other theorems...He also here explains how the equation

whose roots are the squares of the differences of the roots of the original equation may be used so as to give considerable information as to the position and nature of those roots.”—Ball, *A Short Account of the History of Mathematics*, p. 411.

Lagrange also gives here a proof that every equation must have a root, a theorem which before this usually had been considered self-evident.

An uncommonly attractive copy, entirely uncut.

♣ D.S.B., VII, pp. 559-73.

A Fundamental Work

49. LAPLACE, Pierre Simon, Marquis de. *Traité de Mécanique Céleste.* Folding engraved plate in Vol. IV. Five vols. Large 4to, cont. polished mottled calf (joints & a few corners carefully repaired), spines nicely gilt, red morocco lettering pieces on spines. Paris: J.B.M. Duprat & others, An VII [1798]-1825. \$25,000.00

First edition and a complete set with all the supplements. In this monumental and fundamental astronomical work, Laplace — the “Newton of France” — codified and developed the theories and achievements of Newton, Euler, d’Alembert, and Lagrange. “Laplace maintained that while all planets revolve round the sun their eccentricities and the inclinations of their orbits to each other will always remain small. He also showed that all these irregularities in movements and positions in the heavens were self-correcting, so that the whole solar system appeared to be mechanically stable. He showed that the universe was really a great self-regulating machine and the whole solar system could continue on its existing plan for an immense period of time. This was a long step forward from the Newtonian uncertainties in this respect... Laplace also offered a brilliant explanation of the secular inequalities of the mean motion of the moon about the earth — a problem which Euler and Lagrange had failed to solve... He also investigated the theory of the tides and calculated from them the mass of the moon.”—*Printing & the Mind of Man* 252.

A very nice set. Our set has the first state, with the earlier dates, of the titles of Vols. I and II, all the half-titles, and all the supplements.

♣ Dibner, *Heralds of Science*, 14. D.S.B., XV, pp. 273-403. *En Français dans le Texte* 201. Horblit 63. Roberts & Trent, *Bibliotheca Mechanica*, pp. 197-98.

*One of His Three Greatest Books;
"Seminal"*

- 50. LAPLACE, Pierre Simon.** *Théorie Analytique des Probabilités*. 4 p.l., 464 pp. Large 4to, cont. marbled sheep, flat spine prettily gilt. Paris: Courcier, 1812. \$29,500.00

First edition and a fine, large copy; this book, which is of considerable rarity on the market, is one of Laplace's three most important books, equalled only by his *Exposition du Système du Monde* (1796) and *Mécanique Céleste*. It is the most influential book on probability and statistics ever written.

"Book I is devoted to the mathematical methods. In Book II, occupying two-thirds of the volume, they are applied to the solution of problems in probability...It was the first full-scale study completely devoted to a new specialty, building out from old and often hackneyed problems into areas where quantification had been nonexistent or chimerical...What no one has denied is that it was a seminal if not a fully systematic work."—*D.S.B.*, XV, pp. 367-69.

Fine copy. Bookplate of the Turner Collection.

♣ Evans, *First Editions of Epochal Achievements in the History of Science* (1934), 12. Keynes, *A Treatise on Probability*, p. 447 in the bibliography. Stigler, *The History of Statistics*, pp. 146-48.

- 51. LEBESGUE, Henri Léon.** *Thèses présentées a la Faculté des Sciences de Paris pour obtenir le Grade de Docteur...1re Thèse. Intégrale, Longueur, Aire. 2e Thèse. Propositions données par la Faculté*. 2 p.l., 129, [1] pp. Tall 8vo, orig. printed wrappers (rather chipped) bound in attractive modern cloth-backed marbled boards, spine gilt, green leather lettering piece on spine. Milan: Imprimerie Bernardoni de C. Rebeschini, 1902. \$500.00

First edition. "Lebesgue's outstanding contribution to mathematics was the theory of integration that bears his name and that became the foundation for subsequent work in integration theory and its applications...[In his doctoral thesis — the present work] Lebesgue began to develop his theory of integration which as he showed, includes within its scope all the bounded discontinuous functions introduced by Baire."—*D.S.B.*, VIII, p. 110—(& see the rest of the article for Lebesgue's achievements).

Apart from the chipping to the wrappers, a fine copy.

“A Gem”

52. **LEGENDRE, Adrien Marie.** *Essai sur la Théorie des Nombres...* xxiv, 472, [56] pp. Large 4to, cont. calf (well-rebacked with the orig. spine laid-down), double gilt fillet round sides, spine gilt, red morocco lettering piece on spine. Paris: Duprat, An VI, [1798]. \$4950.00

First edition of one of the fundamental works in the development of number theory; it contains Legendre's discovery of the law of quadratic reciprocity, described by Gauss as a "gem of arithmetic." Although Legendre had first given a demonstration of this law in the *Mémoires* of the Paris Academy of Sciences in 1785, his presentation was incomplete and was only fully developed in the present work.

This book also contains Legendre's researches on Fermat's last theorem and the group of integers which can be represented as sums of three squares.

Legendre (1752-1833), "in both the theory of elliptic function and number theory...raised questions that were fruitful subjects on investigation for mathematicians of the nineteenth century."—*D.S.B.*, VIII, p. 142.

Fine and attractive copy from the library of Haskell F. Norman with bookplate.

• En Français dans le Texte 200.

“Discovery of the Differential Calculus”

53. **LEIBNIZ, Gottfried Wilhelm.** “Nova Methodus pro Maximis et Minimis,” pp. 467-73 & one plate (numbered “Tab. XII”), in *Acta Eruditorum* (1684). 1 p.l., 591, [7] pp. Thick 4to, cont. vellum over boards (foot of spine a little worn, some browning as is usual), single gilt fillet round sides, spine gilt, red morocco lettering piece on spine. Leipzig: C. Günther, 1684. \$25,000.00

First printing of this epochal work which opens the modern period in the history of calculus. “The controversy with Newton on priority of invention of the calculus does not detract from the superiority of Leibniz's method of notation, one retained in modern use. He applied his new method to the solution of the cubic parabola and the inverse methods of tangents and many problems left unsolved by Descartes. Fifteen years after Newton's first work in fluxions and nine after his own independent discovery, Leibniz published the above, his first announcement of the differential calculus.”—Dibner, *Heralds of Science*, 109.

The controversy between Newton and Leibniz over priority of the invention of calculus is one of the most famous in the history of science.

This volume of the *Acta Eruditorum* contains four further first printings of works by Leibniz: “De Dimensionibus Figurarum Inveniendis” (pp. 233-36); “Demonstrationes Novae de Resistentia Solidorum” (pp. 319-25); “Meditationes de Cognitione, Veritate, & Ideis” (pp. 537-42); and “Additio ad Schedam...de

Dimensionibus Curvilinearum" (pp. 585-87).

Nice copy with the early bookplates of the Duque de Hytar and Dr. Federico Gomez de la Mata. From the library of Haskell F. Norman with bookplate.

• Evans, *First Editions of Epochal Achievements in the History of Science* (1934), 7. Horblit 66a. *Printing & the Mind of Man* 160. Sparrow, *Milestones of Science*, 130 & plate.

Leibniz Defended — But Too Late

54. LEIBNIZ, Gottfried Wilhelm & BERNOULLI, Jean. *Commercium Philosophicum et Mathematicum*. 23 folding engraved plates. 2 p.l., xxviii, 484 pp.; 1 p.l., 492 pp. Two vols. Large 4to, cont. vellum over boards, crowns in gilt in center of each cover, brown leather lettering piece on each spine (Vol. II's label is a little chipped). Lausanne & Geneva: M.M. Bousquet, 1745. \$4750.00

First edition. "Important for containing the evidence, as embodied in the correspondence between Leibnitz and Jean Bernoulli, on the question of the rival claims to priority in the invention of the calculus, between Newton and Leibnitz. It was the only serious claim published in Leibnitz's favor and a tardy answer to the *Commercium Epistolicum*, which gave the evidence in Newton's favor."—Babson 196.

Our copy does not contain the portrait of Leibniz (missing in a great many copies).

Fine set. Book label of Sydney Ross.

First Textbook of Differential Calculus

55. [L'HOSPITAL, Guillaume François Antoine de, Marquis de Sainte-Mesme]. *Analyse des Infiniment Petits, pour l'intelligence des lignes courbes*. Fine armorial engraving on title, engraved vignettes, & 11 folding engraved plates. 9 p.l., 181, [1] pp., 1 leaf. Large 4to, cont. speckled calf (upper joint very carefully repaired at head & foot, minor rubbing), spine richly gilt. Paris: Imprimerie Royale, 1696. \$12,500.00

First edition of the first textbook of the differential calculus and a very controversial book. The Marquis de l'Hospital (1661-1704), was among the earliest pupils of Jean Bernoulli who, in 1691, spent some months at his house in Paris for the purpose of teaching him the new calculus, the knowledge of which was then confined to Newton, Leibniz, and the two elder Bernoullis. There was at that time no textbook on the subject and the credit for putting together the first treatise which explained the principles and the use of the method is due to l'Hospital. The book had a wide circulation and went through

many editions; it brought the differential notation into general use in France and helped to make it known throughout Europe.

The preface is of great interest for the history of the calculus and the early phase of the Newton-Leibniz controversy on its invention. This first edition is a very rare book.

Very good copy. Discrete embossed ownership stamp on title.

♣ *D.S.B.*, VIII, pp. 304-05. Smith, *History of Mathematics*, I, p. 384. Babson, *Supp.*, p. 30.

*“The Earliest Logical and Systematic Publication
of the Newtonian Methods”;
Large & Thick Paper Set*

56. MACLAURIN, Colin. *A Treatise of Fluxions. In Two Books.* 41 folding engraved plates. 3 p.l., vi, 412 pp.; 1 p.l., 413-763, [1] pp. Two vols. 4to, cont. calf, spines nicely gilt, red morocco lettering pieces on spines. Edinburgh: T.W. & T. Ruddimans, 1742. \$25,000.00

First edition— and a very handsome set printed on large and thick paper — of the most important early presentation of Newton’s calculus. “Maclaurin’s *Treatise of Fluxions* (1742) has been described as the earliest logical and systematic publication of the Newtonian methods. It stood as a model of rigor until the appearance of Cauchy’s *Cours d’analyse* in 1821...The *Treatise* is otherwise noteworthy for the solution of a great number of problems in geometry, statics, and the theory of attractions. It contains an elaborate discussion of infinite series, including Maclaurin’s text for convergence, as well as a remarkable investigation of curves of quickest descent and various isoperimetrical problems...Maclaurin also elaborated many of the principles enunciated by Newton in the *Principia* in this work, including problems in applied geometry and physics, grounded on the geometry of Euclid.”—*D.S.B.*, VIII, pp. 610-11.

It incorporates in a revised form his *On the Percussion of Bodies*, the memoir published in 1724 which gained Maclaurin the prize of l’Académie Royale des Sciences.

A fine, handsome, and crisp set with the armorial bookplate of Col. George Callander of Craigforth. From the library of Haskell F. Norman with bookplate. This has become a scarce book, especially in such fine condition.

“His Most Important Book”—D.N.B.

57. [MOIVRE, Abraham de]. *Miscellanea Analytica de Seriebus et Quadraturis...* Several woodcut diagrams in the text. 6 p.l., 250 pp., one leaf of errata. Large 4to, cont. calf (two corners carefully repaired), double gilt fillet round sides, spine gilt, morocco lettering piece on spine.

London: J. Tonson & J. Watts, 1730.

[bound with]:

— [Drop-title]: *Miscellaneis Analyticis Supplementum*. 22 pp., one leaf of errata. N.p.: n.d. \$12,500.00

First edition of the de Moivre's "most important book" (D.N.B.), here bound with the rare *Supplementum* which is very often missing. The *Miscellanea Analytica* is the successor to *The Doctrine of Chances* and contains the first formulation of "De Moivre's Theorem," the formula for determining a normal approximation to a binomial distribution. This became "the most fruitful single instrument of discovery used in probability theory and statistics for the next two centuries."—D.S.B., IX, pp. 452-53.

The *Supplementum* was published by de Moivre to answer criticisms made by James Stirling after the appearance of the *Miscellanea*.

A very nice copy from the library of Haskell F. Norman with his bookplate.

♣ Stigler, *The History of Statistics*, pp. 70-77.

An Optical Classic

58. **NEWTON, Isaac.** *Opticks: or, a Treatise of the Reflexions, Refractions, Inflexions and Colours of Light. Also Two Treatises of the Species and Magnitude of Curvilinear Figures*. Nineteen folding engraved plates. Title printed in red & black. 2 p.l., 144, 137 pp., 1 leaf numbered "138" on recto, 139-211, [1] pp. Large 4to, cont. English panelled calf (very beautifully rebacked & recornered by Aquarius, minor dustiness), green morocco lettering piece on spine. London: S. Smith & B. Walford, 1704. \$65,000.00

First edition, and a fine, fresh copy, of one of the great classics in optics. "All previous philosophers and mathematicians had been sure that white light is pure and simple, regarding colours as modifications or qualifications of the white. Newton showed experimentally that the opposite is true: there are pure coloured rays which cannot be analysed by refraction, such as the green of the spectrum; just as there are coloured rays which can be analysed, such as the green formed by mixing blue and yellow light. Natural white light, far from being simple, is a compound of many pure elementary colours which can be separated and recomposed at will."—*Printing & the Mind of Man* 172.

This book is distinguished in two other ways. First, it contains Newton's earliest mathematical papers in print, published here for the first time to assert his priority over Leibniz in the invention of the calculus. Second, it contains his set of sixteen "Queries" on the nature of matter which, in the 18th century, was considered to be the most important feature of the *Opticks* and had a profound

influence on scientific thought.

Very good and crisp copy. With the modern bookplate of Jean Michel Cantacuzène, a member of the princely family of Wallachia, Moldavia, and Russia. They descended from a branch of the Greek Kantakouzenos family, who, in turn, descended from the Byzantine Emperor John VI Cantacuzenus. Small stamp on verso of title "R.H. Inclis."

♣ Babson 132. Dibner, *Heralds of Science*, 148. Horblit 79b. Sparrow, *Milestones of Science*, 150.

59. [NEWTON, Isaac]. *Universal Arithmetick: or, a Treatise of Arithmetical Composition and Resolution. To which is added, Dr. Halley's Method of finding the Roots of Aequations Arithmetically*. Translated from the Latin by the late Mr. Raphson, and revised and corrected by Mr. Cunn. Eight folding engraved plates. 2 p.l., iv, 272 pp. 8vo, cont. panelled calf (corners a bit worn, minor dustiness), red morocco lettering piece on spine. London: J. Senex et al., 1720. \$4250.00

First edition of Newton's most popular mathematical work, originally published in Latin in 1707 and translated into English for the first time with the present edition. It was republished many times, both in Britain and on the Continent. Leibniz reviewed it in the *Acta Eruditorum* in highly laudatory terms.

"The *Universal Arithmetic*, which is on algebra, theory of equations, and miscellaneous problems, contains the substance of Newton's lectures during the years 1673 to 1683. His manuscript of it is still extant; Whiston extracted a somewhat reluctant permission from Newton to print it, and it was published in 1707. Amongst several new theorems on various points in algebra and the theory of equations Newton here enunciates the following important results. He explains that the equation whose roots are the solution of a given problem will have as many roots as there are different possible cases; and he considers how it happens that the equation to which a problem leads may contain roots which do not satisfy the original question. He extends Descartes's rule of signs to give limits to the number of imaginary roots. He uses the principle of continuity to explain how two real and unequal roots may become imaginary in passing through equality, and illustrates this by geometrical considerations; thence he shews that imaginary roots must occur in pairs. Newton also here gives rules to find a superior limit to the positive roots of a numerical equation, and to determine the approximate values of the numerical roots. He further enunciates the theorem known by his name for finding the sum of the *n*th powers of the roots of an equation, and laid the foundation of the theory of symmetrical functions of the roots of an equation."—Ball, *A Short Account of the History of Mathematics*, pp. 330-31.

Fine copy with the early 19th-century signature of "Jas le Couteur" on title.

Short crack at head of lower joint.

♣ Babson 201. Gjertsen, *The Newton Handbook*, pp. 33-36.

*“The Greatest Work in the History of Science”–
Printing & the Mind of Man*

60. NEWTON, Isaac. *Philosophiae Naturalis Principia Mathematica*. Finely engraved frontis. port. of Newton, one engraving on p. 506, & numerous woodcut diagrams in the text. Title in red & black. 18 p.l. (including frontis. port.), 530, [6] pp., one leaf of publisher’s ads. Large 4to, later 18th-cent. calf (joints carefully repaired, some rubbing), double gilt fillet round sides, spine gilt, orange morocco lettering piece on spine. London: G. & J. Innys, 1726. \$25,000.00

Third and definitive edition of the greatest work in the history of science. “This edition was the last published during the author’s lifetime and the basis of all subsequent editions. It was edited by Henry Pemberton, M.D., F.R.S., and contains a new preface by Newton and a large number of alterations, the most important being the scholium on fluxions, in which Leibnitz had been mentioned by name. This had been considered an acknowledgement of Leibnitz’s independent discovery of the calculus. In omitting Leibnitz’s name in this edition, Newton was criticised as taking advantage of an opponent whose death had prevented any reply. Halley’s verses were restored to their original form.”–Babson 13.

A large, clean, and complete copy with the early signature of James Davy (or Darcy) on title. With the imprimatur leaf, half-title, engraved frontispiece portrait, and the leaf of publisher’s ads.

♣ Gjertsen, *The Newton Handbook*, pp. 476-77.

His Masterly Treatise

61. NEWTON, Isaac. *The Method of Fluxions and Infinite Series; with its Applications to the Geometry of Curve-Lines...* translated from the Author’s Latin Original not yet made publick. To which is subjoin’d, a Perpetual Comment upon the whole Work...by John Colson, M.A. and F.R.S. Engraved frontis. plate & numerous woodcut diagrams in the text. iv, ix-xxiv, 339 pp., and one leaf of errata & one leaf of contents (numbered “[143]-[144]”) bound in between pp. 142 & [143]. Large 4to, cont. speckled calf (joints very discretely repaired), double gilt fillet round sides, spine gilt, red morocco lettering piece on spine. London: Printed

by H. Woodfall & sold by J. Nourse, 1736. \$25,000.00

First edition of an immensely important book; it is Newton's most ambitious exposition of his fluxional calculus. It is a key document in the controversy over whether Newton or Leibniz had priority in discovering differential calculus. In virtually every respect, Newton both deepened and expanded his treatment and made his exposition more systematic. Newton began writing his treatise in the winter of 1670-71 but was not in the "humour" to finish it until just before his death.

A fine and crisp copy from the library of Haskell F. Norman, with bookplate.
 ♣ Babson 171. Gjertsen, *The Newton Handbook*, pp. 156-58.

The Mathematical Foundation of Chaos Theory

62. **POINCARÉ, Henri.** *Les Méthodes nouvelles de la Mécanique Celeste.* 2 p.l., 385 pp.; viii, 479, [1] pp.; 2 p.l., 414 pp. Three vols. 8vo, modern bright red morocco-backed red boards, spines lettered in gilt. Paris: Gauthier-Villars, 1892-93-99. \$1950.00

First edition of Poincaré's great work on his new mathematical methods in astronomy, the foundation of the mathematics of chaos theory. "His work on celestial mechanics led to investigations of the behaviour of divergent and non-uniformly convergent series, which in turn led to a foundation of the theory of asymptotic expansions, and to the study of integral invariants, quadratic forms, and double integrals of periodic orbits" —*Biographical Dictionary of Scientists*.

The present work is considered to be the most remarkable work in celestial mechanics after Newton. "Poincaré inaugurated the rigorous treatment of celestial mechanics, in opposition to the semi-empirical computations that had been prevalent before him...Most of his results were developed in his famous three-volume *Les méthodes nouvelles de la mécanique céleste* and later in his *Leçons de mécanique céleste*." —*D.S.B.*, XI, p. 57.

"The development of mathematics in the nineteenth century began under the shadow of a giant, Carl Friedrich Gauss; it ended with the domination by a genius of similar magnitude, Henri Poincaré. Both were universal mathematicians in the supreme sense, and both made important contributions to astronomy and mathematical physics." —*D.S.B.*, XI, p. 51.

Fine set.

Presentation Copy

63. **POISSON, Siméon Denis.** *Théorie Mathématique de la Chaleur.* One folding engraved plate (somewhat spotted). 2 p.l., 532, [2] pp. Large 4to, cont. red boards (corners & ends of spine a little worn, some foxing), flat

spine gilt, uncut. Paris: Bachelier, 1835. \$5000.00

First edition of Poisson's important formulation of equations describing the distribution of heat within bodies. "Poisson scored a point in this work by demonstrating how the conductivity of heat in the interior of bodies, far from being contained in the notion of flux as Fourier had held, must be derived from an absorption coefficient that restores a neglected functional dimension."—*D.S.B.*, XV, p. 488.

A very fine and handsome copy with a presentation inscription by Poisson, inscribed "A Monsieur [recipient's name illegible] de la part de l'auteur." Preserved in a box.

• Roberts & Trent, *Bibliotheca Mechanica*, pp. 260-61—"This is the first edition of an important work in which Poisson formulated equations for the distribution of heat in bodies. As opposed to Fourier, who maintained in his *Mémoire analytique de la chaleur* that the conductivity of heat was contained in the motion of flux, Poisson showed that it must be derived from an absorptive coefficient restoring the neglected functional dimension... One of Poisson's chief treatises."

64. RAMANUJAN, Srinivasa Aaiyengar. *Collected Papers*. Edited by G.H. Hardy, P.V. Seshu Aiyar, and B.M. Wilson. xxxvi, 355, [1] pp. Large 8vo, orig. blue cloth, spine lettered in gilt. Cambridge: at the University Press, 1927. \$1350.00

First edition. "The part of Ramanujan's work that stimulated most contributions from later mathematicians is probably his study of the partition of numbers into summands... Ramanujan's other work comprised a variety of topics, mainly of a combinatorial nature. He wrote on the representation of integers as the sum of squares and on the lattice points inside a circle; in function theory he produced several papers on definite integrals, as well as on elliptic, hypergeometric, and modular functions."—*D.S.B.*, XI, p. 269.

G.H. Hardy called his discovery of Ramanujan the one romantic incident of his life.

Laid-in are two offprints by Ramanujan:

1. "New Expressions for Riemann's Functions (s) and (t)," extracted from *The Quarterly Journal of Pure and Applied Mathematics* (No. 183, 1915), pp. [2], 253-61. 8vo, plain blue wrappers.

2. "Some Definite Integrals Connected with Gauss's Sums," extracted from *The Messenger of Mathematics*, New Series, No. 522, October 1914, pp. [75]-86. 8vo, plain blue wrappers.

Fine copy.

*“Raphson’s Method”; Not “Newton’s Method” or,
Maybe, the “Newton–Raphson Method”*

- 65. RAPHSON, Joseph.** *Analysis Aequationum Universalis, seu ad Aequationes Algebraicas resolvendas Methodus generalis, & expedita, ex nova infinitarum serierum methodo, deducta ac demonstrata. Editio secunda cui accessit Appendix de Infinito Infinitarum Serierum progressu ad Aequationum Algebraicarum Radices eliciendas. Cui etiam Annexum est; De Spatio reali, seu Ente Infinito Conamen Mathematico-Metaphysicum.* Woodcut diagrams in the text. 3 p.l., 5-55, [9], 95, [1] pp. Small 4to, 18th-cent. calf (rebacked & recornered), red morocco lettering piece on spine. London: Typis TB. for A. & I. Churchill et al., 1702. \$4500.00

Third edition; the first edition appeared in 1690 and the second in 1697. Raphson (d. 1715 or 1716), also wrote the important *History of Fluxions* (1715) and translated Newton’s *Arithmetica Universalis* into English (1720). He was a fellow of the Royal Society.

“In 1690, Joseph Raphson...published a tract, *Analysis aequationum universalis*. His method closely resembles that of Newton. The only difference is this, that Newton derives each successive step, p , q , r , of approach to the root, from a *new* equation, while Raphson finds it each time by substitution in the original equation...Raphson does not mention Newton; he evidently considered the difference sufficient for his method to be classed independently. To be emphasized is the fact that the process which in modern texts goes by the name of ‘Newton’s method of approximation,’ is really not Newton’s method, but Raphson’s modification of it...It is doubtful, whether this method should be named after Newton alone...Raphson’s version of the process represents what J. Lagrange recognized as an advance on the scheme of Newton...Perhaps the name ‘Newton-Raphson method’ would be a designation more nearly representing the facts of history.”—Cajori, *A History of Mathematics*, p. 203.

The first edition is very rare. The *Appendix* appears for the first time in the second edition of 1697 along with the separately paginated second part *De Spatio reali*.

Fine fresh copy. 19th-century bookplate of P. Duncan.

- 66. RICCATI, Vincenzo.** *De Usu Motus Tractorii in Constructione Aequationum differentialum Commentarius.* Engraved printer’s vignette on title & three folding engraved plates. 72 pp. 4to, orig. semi-stiff boards (boards a little soiled), uncut. Bologna: ex Typographia Laelii a Vulpe, 1752. \$3750.00

First edition. This book contains the integration of the celebrated equation of

Jacopo Riccati, the author's father. "Riccati's work is significant not only because he treated second order differential equations but because he had the idea of reducing second order equations to first order. This idea of reducing the order of an ordinary differential equation by one device or another will be seen to be a major method in the treatment of higher order ordinary differential equations...D'Alembert was the first to consider the general form of the Riccati equation and to use the term 'Riccati equation' for this form."—Kline, *Mathematical Thought from Ancient to Modern Times*, pp. 483-84.

Riccati (1707-75), a member of the distinguished mathematical family and a Jesuit, was a well-known mathematician and physicist at the College of San Francisco Saverio in Bologna, and worked on the study of differential equations series, quadrature problems, and the hyperbolic functions.

Fine copy in original state.

• *D.S.B.*, XI, pp. 401-02. Riccardi I, 364. Roberts & Trent, *Bibliotheca Mechanica*, pp. 278-79—"This book is an analysis of the resistance to motion in terms of differential equations. In the preface he makes reference to the work of Euler, Jacob Bernoulli, Manfredi and his own father, Jacob Riccati."

"A Man of Undoubted Genius"—Smith

67. SIMPSON, Thomas. *Essays on Several Curious and Useful Subjects, in Speculative and mix'd Mathematicks. Illustrated by a Variety of Examples.* Woodcut diagrams in the text. Title printed in red & black. viii, 142 pp., one leaf of errata. 4to, attractive antique panelled calf by Trevor Lloyd, spine gilt, red morocco lettering piece on spine. London: H. Woodfall for J. Nourse, 1740. \$1750.00

First edition of one of Simpson's most important books. "The first application of the Newton—Raphson process to the solution of transcendental equations was made by Thomas Simpson in his *Essays...on Mathematicks*, London, 1740."—Cajori, *History of Mathematics*, p. 227. One of the essays contains a solution to Kepler's problem of orbits. A number of Newtonian topics are treated in the thirteen essays. Some of the titles include "Of the Apparent Places of the Fixed Stars, arising from the Motion of Light, and the Motion of the Earth in its Orbit," "Of the Motion of Projectiles in resisting Mediums," and "A General Quadrature of Hyperbolic Curves."

Simpson (1710-61), "that strange mathematical genius" (Smith), a self-instructed mathematician, was elected professor of mathematics at the Woolwich Military Academy in 1743 and a fellow of the Royal Society in 1745. He was one of the most important of a small group of mathematicians which included John Landen and Edward Waring, who made significant advances in

Newtonian calculus as an analytical tool.

Minor foxing but a very good copy.

• D.S.B., XII, pp. 443-45. Smith, *History of Mathematics*, I, p. 457. Roberts & Trent, *Bibliotheca Mechanica*, p. 297. Wallis 150.3. Not in Babson Cat.

68. SIMPSON, Thomas. *Mathematical Dissertations on a Variety of Physical and Analytical subjects...* Woodcut diagrams in the text. viii, 168 pp., one leaf of errata. 4to, attractive antique panelled calf by Trevor Lloyd (foxed), spine gilt, red morocco lettering piece on spine. London: T. Woodward, 1743. \$1500.00

First edition of an interesting book by Simpson. In it he discusses the figure of the earth, the force of attraction at the surface of a nearly spherical body, the theory of the tides, and the law of astronomical refraction.

A very good copy.

• D.S.B., XII, pp. 443-45. Smith, *History of Mathematics*, I, p. 457.

69. SIMPSON, Thomas. *Miscellaneous Tracts on Some curious and very interesting Subjects in Mechanics, Physical-Astronomy, and Speculative Mathematics; wherein, The Precession of the Equinox, the Nutation of the Earth's Axis, and the Motion of the Moon in her Orbit, are determined.* Three folding engraved plates. 4 p.l., 179, [1] pp. 4to, attractive antique panelled calf by Trevor Lloyd (occasional foxing), spine gilt, red morocco lettering piece on spine. London: J. Nourse, 1757. \$2500.00

First edition of Simpson's most important book which includes several papers on celestial mechanics. It "consists of eight memoirs, and these contain his best known investigations. The first three papers are on various problems in astronomy; the fourth is on the theory of mean observations; the fifth and sixth on problems in fluxions and algebra; the seventh contains a general solution of the isoperimetrical problem; the eighth contains a discussion of the third and ninth sections of the *Principia*, and their application to the lunar orbit. In this last memoir Simpson obtained a differential equation for the motion of the apse of the lunar orbit similar to that arrived at by Clairaut, but instead of solving it by successive approximations, he deduced a general solution by indeterminate coefficients."—Ball, *A Short Account of the History of Mathematics*, pp. 389-90.

A very good copy.

• D.S.B., XII, pp. 443-45. Smith, *History of Mathematics*, I, p. 457.

An Important Work in the Development of the Calculus

70. **VARIGNON, Pierre.** *Eclaircissemens sur l'Analyse des Infiniment Petits*. Six folding engraved plates. 4 p.l., 118, [2] pp. Large 4to, cont. speckled sheep (spine a little worn, some rubbing), spine gilt, red morocco lettering piece on spine. Paris: Rollin, 1725. \$3500.00

First edition of a very scarce book, published posthumously. Varignon (1654-1722), member of the Académie des Sciences and one of the outstanding scientists of his time, was an intimate friend of Newton, Leibniz, and the Bernoullis. The first French scientist of note to advocate the new differential calculus, he demonstrated the principle of the parallelogram of forces simultaneously with and independently of Newton.

"In working with the model of falling bodies, Varignon encountered difficulties in obtaining acceleration as a second derivative. This problem had the advantage, however, of obliging him to reassess the importance of the new differential and integral calculus...He was among those who gave the most favorable reception to the publication of L'Hospital's *Analyse des infiniment petits* in 1696. The *Eclaircissemens* is composed of critical notes that Varignon, as a professor, considered necessary in presenting L'Hospital's pioneering work to young mathematicians."—*D.S.B.*, XIII, p. 586.

Very good copy. 18th-century ownership stamp on second preliminary leaf of "Dn. [illegible] Nicolas de Azara." This was Don José Nicolás de Azara (1730-1804), Spanish diplomat, collector of Italian antiquities, and patron of the arts.

Highly Selective Index

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