Chapter 1 : TraitÃ© des substitutions et des Ã©quations algebriques | work by Jordan | blog.quintoapp.com

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Augustus Edward Hough Love Preface to the 1st edition [edit] The present treatise is the outcome of a suggestion made to me some years ago by Mr R. Webb that I should assist him in the preparation of a work on Elasticity. He has unfortunately found himself unable to proceed I wish to acknowledge The division of the subject adopted is that The present volume contains the general mathematical theory of the elastic properties of the first class of bodies, and I propose to treat the second class in another volume. Anything like an exhaustive history has been rendered unnecessary by the work of the late Dr Todhunter as edited by Prof. Karl Pearson , but it is hoped that the brief account given will at once facilitate the comprehension of the theory and add to its interest. The theory of elastic crystals adopted is that which has been elaborated by the researches of F. The conditions of rupture or rather of safety of materials are as yet so little under stood that it seemed best to give a statement of the various theories that have been advanced without definitely adopting any of them. In connexion with this theory I have endeavoured to give precision to the term " factor of safety ". This is rendered necessary partly by the controversy that has raged round the number of independent elastic constants, and partly by the fact that there exists no single investigation of the deduction in question which could now be accepted by mathematicians. In spite of the work of Prof. Pearson it seems not yet to be understood by English mathematicians that the cross-sections of a bent beam do not remain plane. The old-fashioned notion of a bending moment proportional to the curvature resulting from the extensions and contractions of the fibres is still current. Against the venerable bending moment the modern theory has nothing to say, but it is quite time that it should be generally known that it is not the whole stress, and that the strain does not consist simply of extensions and contractions of the fibres. The theory leads in every special case to a system of partial differential equations, and the solution of these subject to conditions given at certain bounding surfaces is required. The general problem is that of solving the general equations with arbitrary conditions at any given boundaries. In discussing this problem I have made extensive use of the researches of Prof. Betti of Pisa, whose investigations are the most general that have yet been given The case of a solid bounded by an infinite plane and otherwise unlimited is investigated on the lines laid down by Signor Valentino Cerruti, whose analysis is founded on Prof. It is hoped that he will not then fail to understand the subject for lack of examples, nor waste his time in mere problem grinding. Historical Introduction[edit] The Mathematical Theory of Elasticity is occupied with an attempt to reduce to calculation the state of strain , or relative displacement, within a solid body which is subject to the action of an equilibrating system of forces, or is in a state of slight internal relative motion, and with endeavours to obtain results which shall be practically important in applications to architecture, engineering, and all other useful arts in which the material of construction is solid. Alike in the experimental knowledge obtained, and in the analytical methods and results, nothing that has once been discovered ever loses its value or has to be discarded; but the physical principles come to be reduced to fewer and more general ones, so that the theory is brought more into accord with that of other branches of physics, the same general dynamical principles being ultimately requisite and sufficient to serve as a basis for them all. The first mathematician to consider the nature of the resistance of solids to rupture was Galileo. Although he treated solids as inelastic, not being in possession of any law connecting the displacements produced with the forces producing them, or of any physical hypothesis capable of yielding such a law, yet his enquiries gave the direction which was subsequently followed by many investigators. When the general equations had been obtained, all questions of the small strain of elastic bodies were reduced to a matter of mathematical calculation. Hooke and Mariotte occupied themselves with the experimental discovery of what we now term stress-strain relations. Hooke gave in the famous law of proportionality of stress and strain which bears his name, in the words "Ut tensio sic vis; that is, the Power of any spring is in the same proportion with the Tension thereof. This law forms the basis of the mathematical theory of Elasticity. This application was made by Mariotte , who in enunciated the same law independently. He remarked that the resistance of a beam to flexure arises from the extension and contraction of its parts, some of its longitudinal filaments being extended, and others contracted. He assumed that half are extended, and half contracted. The first investigation of any importance is that of the elastic line or elastica by James Bernoulli in , in which the resistance of a bent rod is assumed to arise from the extension and contraction of its longitudinal filaments, and the equation of the curve assumed by the axis is formed. This equation practically involves the result that the resistance to bending is a couple proportional to the curvature of the rod when bent, a result which was assumed by Euler in his later treatment of the problems of the elastica, and of the vibrations of thin rods. As soon as the notion of a flexural couple proportional to the curvature was established it could be noted that the work done in bending a rod is proportional to the square of the curvature. Daniel Bernoulli suggested to Euler that the differential equation of the elastica could be found by making the integral of the square of the curvature taken along the rod a minimum Euler, acting on this Lagrange followed and used his theory to determine the strongest form of column. These researches are the earliest in The theory of the flexure of beams of finite section was considered by Coulomb His theory of beams is the most exact of those [that assume] the stress in a bent beam arises wholly from the extension and contraction of its longitudinal filaments, and Coulomb was also the first to consider the resistance [although considered as nonelastic] of thin fibres to torsion Coulomb was [also] first to [consider] strain we now call shear , though he considered it in connexion with rupture only He called it "detrusion," and noticed that the elastic resistance of a body to shear , [as opposed to] its resistance to extension or contraction, are in general different; but he did not introduce a distinct modulus of rigidity to express resistance to shear. He defined "the modulus of elasticity of a substance" as "a column of the same substance capable of producing a pressure on its base which is to the weight causing a certain degree of compression, as the length of the substance is to the diminution of its length. This introduction of a definite physical concept, associated with the coefficient of elasticity which descends, as it were from a clear sky, on the reader of mathematical memoirs, marks an epoch in the history of the science. During the first period in the history of our science â€" while these various investigations of special problems were being made, there was a cause at work which was to lead to wide generalizations. This cause was physical speculation concerning the constitution of bodies. In the eighteenth century the Newtonian conception of material bodies, as made up of small parts which act upon each other by means of central forces, displaced the Cartesian conception of a plenum pervaded by "vortices. The most definite speculation of this kind is that of Boscovich , for whom the material points were nothing but persistent centres of force. But such an estimate would give a very wrong impression of the value of the older researches. Physical Science had emerged from its incipient stages with definite methods of hypothesis and induction and of observation and deduction, with the clear aim to discover the laws by which phenomena are connected with each other, and with a fund of analytical processes of investigation. This was the hour for the production of general theories, and the men were not wanting. Fresnel announced his conclusion that the observed facts in regard to the interference of polarised light could be explained only by the hypothesis of transverse vibrations. He showed how a medium consisting of "molecules " connected by central forces might be expected to execute such vibrations and to transmit waves of the required type. Before the time of Young and Fresnel such examples of transverse waves as were knownâ€"waves on water, transverse vibrations of strings, bars, membranes and platesâ€"were in no case examples of waves transmitted through a medium; and neither the supporters nor the opponents of the undulatory theory of light appear to have conceived of light waves otherwise than as "longitudinal " waves of condensation and rarefaction, of the type rendered familiar by the transmission of sound. The theory of elasticity, and, in particular, the problem of the transmission of waves through an elastic medium now attracted the attention of In the future the developments of the theory of elasticity were to be closely associated with the question of the propagation of light, and these developments arose in great part from the labours of these two savants. By the Autumn of Cauchy had discovered most of the elements of the pure theory of elasticity. By means of relations between stress-components and strain-components, he had eliminated the stress-components from the equations of motion and equilibrium, and had arrived at equations in terms of the displacements. Cauchy obtained his stress-strain relations for isotropic materials by means of two assumptions, viz. The methods used in these investigations are quite different from At a later date Cauchy extended his theory to the case of crystalline bodies, and he then made use of the hypothesis of material points between which there are forces of attraction or repulsion. The equations of equilibrium and motion of isotropic elastic solids Poisson assumed that the irregular action of the nearer molecules may be neglected, in comparison with the action of the remoter ones, which is regular. This assumption is the text upon which Stokes afterwards founded his criticism of Poisson. Starting from what is now called the Principle of the Conservation of Energy he propounded a new method of obtaining these equations. One of the advantages of this method, of great importance, is that we are necessarily led by the mere process of the calculation, and with little care on our part, to all the equations and conditions which are requisite and sufficient for the complete solution of any problem to which it may be applied. Green supposed the function to be capable of being expanded in powers and products of the components of strain. He therefore arranged it as a sum of homogeneous functions of these quantities of the first, second and higher degrees. Of these terms, the first must be absent, as the potential energy must be a true minimum when the body is unstrained; and, as the strains are all small, the second term alone will be of importance. From this principle Green deduced the equations of Elasticity, containing in the general case 21 constants. From these laws he deduced the result that, when a solid body is strained without alteration of temperature, the components of stress are the differential coefficients of a function of the components of strain with respect to these components severally. The same result can be proved to hold when the strain is effected so quickly that no heat is gained or lost by any part of the body. He noted a result equivalent to the first of these, and the second is virtually contained in his theory of the torsional vibrations of a bar. The observation that resistance to compression and resistance to shearing are the two fundamental kinds of elastic resistance in isotropic bodies was made by Stokes , and he introduced definitely the two principal moduluses of elasticity He pointed out that, if the ratio of these moduluses could be regarded as infinite, the ratio of the velocities of "longitudinal " and " transverse " waves would also be infinite, and then, as Green had already shown, the application of the theory to optics would be facilitated. The hypothesis of material points and central forces does not now hold the field. Of much greater importance have been the development of the atomic theory in Chemistry and of statistical molecular theories in Physics, the growth of the doctrine of energy, the discovery of electric radiation. The problem of curved plates or shells was first attacked from the point of view of the general equations of Elasticity by H. He expressed the geometry of the middle-surface by means of two parameters after the manner of Gauss , and he adapted to the problem the method which Clebsch had used for plates. He arrived at an expression for the potential energy of the strained shell which is of the same form as that obtained by Kirchhoff for plates, but the quantities that define the curvature of the middle-surface were replaced by the differences of their values in the strained and unstrained states. Math also see Crelle, Journ Math 78 pp. Mathieu adapted to the problem [of curved plates or shells] the method which Poisson had used for plates. Whenever very thin rods or plates are employed in constructions it becomes necessary to consider the possibility of buckling , and thus there arises the general problem of elastic stability. In all [isolated problems] two modes of equilibrium with the same type of external forces are possible, and the ordinary proof of the determinacy of the solution of the equations of Elasticity is defective. A general theory of elastic stability has been proposed by G. He arrived at the result that the theorem of determinacy cannot fail except in cases where large relative displacements can be accompanied by very small strains, as in thin rods and plates, and in cases where displacements differing but slightly from such as are possible in a rigid body can take place, as when a sphere is compressed within a circular ring of slightly smaller diameter. In all cases where two modes of equilibrium are possible the criterion for determining the mode that will be adopted is given by the condition that the energy must be a minimum. The history of the mathematical theory of Elasticity shows clearly that the development of the theory has not been guided exclusively by considerations of its utility for technical Mechanics. Most of the men by whose researches it has been founded and shaped have been more interested in Natural Philosophy than in material progress, in trying to understand the world than in trying to make it more comfortable. Even in the more technical problems, such as the transmission of force and the resistance of bars and plates, attention has been directed, for the most part, rather to theoretical than to practical aspects of the questions. To get insight into what goes on in impact, to bring the theory of the behaviour of thin bars and plates into accord with the general equationsâ€"these and such-like aims have been more attractive Analysis of Strain[edit] Whenever, owing to any cause, changes take place in the relative positions of the parts of a body the body is said to be "strained.

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A Treatise on the Theory of Algebraical Equations by Robert Rev. Robert Murphy An Elementary Treatise On the Theory of Equations; With a Collection of Examples by I. Todhunter Winstowe A Novel by Bertha Jame Laffan.

It is taught to students who are presumed to have no knowledge of mathematics beyond the basic principles of arithmetic. In algebra, numbers are often represented by symbols called variables such as a, n, x, y or z. This is useful because: It allows the reference to "unknown" numbers, the formulation of equations and the study of how to solve these. This step leads to the conclusion that it is not the nature of the specific numbers that allows us to solve it, but that of the operations involved. It allows the formulation of functional relationships. Polynomial A polynomial is an expression that is the sum of a finite number of non-zero terms , each term consisting of the product of a constant and a finite number of variables raised to whole number powers. A polynomial expression is an expression that may be rewritten as a polynomial, by using commutativity, associativity and distributivity of addition and multiplication. A polynomial function is a function that is defined by a polynomial, or, equivalently, by a polynomial expression. The two preceding examples define the same polynomial function. Two important and related problems in algebra are the factorization of polynomials , that is, expressing a given polynomial as a product of other polynomials that can not be factored any further, and the computation of polynomial greatest common divisors. A related class of problems is finding algebraic expressions for the roots of a polynomial in a single variable. Abstract algebra Main articles: Abstract algebra and Algebraic structure Abstract algebra extends the familiar concepts found in elementary algebra and arithmetic of numbers to more general concepts. Here are listed fundamental concepts in abstract algebra. Rather than just considering the different types of numbers , abstract algebra deals with the more general concept of sets: All collections of the familiar types of numbers are sets. Set theory is a branch of logic and not technically a branch of algebra. The notion of binary operation is meaningless without the set on which the operation is defined. The numbers zero and one are abstracted to give the notion of an identity element for an operation. Zero is the identity element for addition and one is the identity element for multiplication. Not all sets and operator combinations have an identity element; for example, the set of positive natural numbers 1, 2, 3, The negative numbers give rise to the concept of inverse elements. Addition of integers has a property called associativity. That is, the grouping of the numbers to be added does not affect the sum. This property is shared by most binary operations, but not subtraction or division or octonion multiplication. Addition and multiplication of real numbers are both commutative. That is, the order of the numbers does not affect the result. This property does not hold for all binary operations. For example, matrix multiplication and quaternion multiplication are both non-commutative. Group theory and Examples of groups Combining the above concepts gives one of the most important structures in mathematics: Every element has an inverse: The operation is associative: For example, the set of integers under the operation of addition is a group. The integers under the multiplication operation, however, do not form a group. This is because, in general, the multiplicative inverse of an integer is not an integer. The theory of groups is studied in group theory. A major result in this theory is the classification of finite simple groups , mostly published between about and , which separates the finite simple groups into roughly 30 basic types. Semigroups , quasigroups , and monoids are structures similar to groups, but more general. They comprise a set and a closed binary operation, but do not necessarily satisfy the other conditions. A semigroup has an associative binary operation, but might not have an identity element. A monoid is a semigroup which does have an identity but might not have an inverse for every element. A quasigroup satisfies a requirement that any element can be turned into any other by either a unique left-multiplication or right-multiplication; however the binary operation might not be associative. All groups are monoids, and all monoids are semigroups.

Chapter 3 : Smith: Chapter XXXII: Theory of equations

A treatise on the theory and solution of algebraical equations Item Preview A treatise on the theory and solution of algebraical equations. by Macnie, John.

A - C[edit] All the modern higher mathematics is based on a calculus of operations, on laws of thought. All mathematics, from the first, was so in reality; but the evolvers of the modern higher calculus have known that it is so. Therefore elementary teachers who, at the present day, persist in thinking about algebra and arithmetic as dealing with laws of number, and about geometry as dealing with laws of surface and solid content, are doing the best that in them lies to put their pupils on the wrong track for reaching in the future any true understanding of the higher algebras. Algebras deal not with laws of number, but with such laws of the human thinking machinery as have been discovered in the course of investigations on numbers. Plane geometry deals with such laws of thought as were discovered by men intent on finding out how to measure surface; and solid geometry with such additional laws of thought as were discovered when men began to extend geometry into three dimensions. The precision of statement and the facility of application which the rules of the calculus early afforded were in a measure responsible for the fact that mathematicians were insensible to the delicate subtleties required in the logical development They sought to establish calculus in terms of the conceptions found in traditional geometry and algebra which had been developed from spatial intuition. Boyer , The History of the Calculus and Its Conceptual Development The most influential mathematics textbook of ancient times is easily named, for the Elements of Euclid has set the pattern in elementary geometry ever since. The most effective textbook of the medieval age is less easily designated; but a good case can be made out for the Al-jabr of Al-Khwarizmi , from which algebra arose and took its name. Is it possible to indicate a modern textbook of comparable influence and prestige? We think only through the medium of words. D - E[edit] My specific A learner who has a good knowledge of the subjects just named, and who can master the present treatise, taking up elementary works on conic sections, application of algebra to geometry, and the theory of equations, as he wants them, will, I am perfectly sure, find himself able to conquer the difficulties of anything he may meet with; and need not close any book of Laplace , Lagrange , Legendre , Poisson , Fourier , Cauchy , Gauss , Abel , Hindenburgh and his followers. I am not aware that any work exists in which this has been avowedly attempted, and I have been the more encouraged to make the trial from observing that the objections to the theory of limits have usually been founded either upon the difficulty of the notion itself, or its unalgebraical character, and seldom or never upon anything not to be defined or not to be received in the conception of a limit Augustus De Morgan , The Differential and Integral Calculus Abel did not deny that we might solve quintics using techniques other than algebraic ones of adding, subtracting, multiplying, dividing, and extracting roots. What Abel did do was prove that there exists no algebraic formula This situation is reminiscent of that encountered when trying to square the circle , for in both cases mathematicians are limited by the tools they can employ. William Dunham , Journey Through Genius: The Great Theorems of Mathematics The principal object of Algebra, as well as of all the other branches of the Mathematics, is to determine the value of quantities which were before unknown; and this is obtained by considering attentively the conditions given, which are always expressed in known numbers: Leonhard Euler , Elements of Algebra Vol. It appears, that all magnitudes may be expressed by numbers; and that the foundation of all the Mathematical Sciences must be laid in a complete treatise on the science of Numbers, and in an accurate examination of the different possible methods of calculation. The fundamental part of mathematics is called Analysis, or Algebra. In Algebra then we consider only numbers, which represent quantities, without regarding the different kinds of quantity. These are the subjects of other branches of mathematics. Perhaps in ten years society may derive advantage from the curves which these visionary algebraists will have laboriously squared. I congratulate posterity beforehand. But to tell you the truth I see nothing but a scientific extravagance in all these calculations. That which is neither useful nor agreeable is worthless. And as for useful things, they have all been discovered; and to those which are agreeable, I hope that good taste will not admit algebra among them. Richard Aldington, letter 93 from Frederick to Voltaire May 16, In general the position as regards all such new calculi is this â€" That one cannot accomplish by them anything that could not be accomplished without them. However, the advantage is, that, provided such a calculus corresponds to the inmost nature of frequent needs, anyone who masters it thoroughly is able â€" without the unconscious inspiration of genius which no one can command â€" to solve the respective problems, yea to solve them mechanically in complicated cases in which, without such aid, even genius becomes powerless. Such conceptions unite, as it were, into an organic whole countless problems which otherwise would remain isolated and require for their separate solution more or less application of inventive genius. And while agreeing with those who had contended that negatives and imaginaries were not properly quantities at all, I still felt dissatisfied with any view which should not give to them, from the outset, a clear interpretation and meaning It early appeared to me that these ends might be attained by our consenting to regard Algebra as being no mere Art, nor Language, nor primarily a Science of Quantity; but rather as the Science of Order in Progression. It was, however, a part of this conception, that the progression here spoken of was understood to be continuous and unidimensional: And although the successive states of such a progression might no doubt be represented by points upon a line, yet I thought that their simple successiveness was better conceived by comparing them with moments of time, divested, however, of all reference to cause and effect; so that the "time" here considered might be said to be abstract, ideal, or pure, like that "space" which is the object of geometry. It corresponded to the conception of simultaneity or synchronism; or, in simpler words, it represented the thought of the present in time. Of all possible answers to the general question, "When," the simplest is the answer, "Now: Wallis did not become interested in mathematics till the age of thirty-one, but devoted himself to the subject for the rest of his life. One of the earliest and most important books on algebra ever written in English was his treatise published in It contains a brief historical sketch of the subject which is unfortunately not entirely accurate, but his treatment of the theory and practice of arithmetic and algebra has made the book a standard work for reference ever since. Herbert Edwin Hawkes, William Arthur Luby, Frank Charles Touton, First Course in Algebra With the help of books only he [Wilhelm Xylander] studied the subject of Algebra, as far as was possible from what men like Cardan had written and by his own reflection, with such success that not only did he fall into what Herakleitos called But when he first became acquainted with the problems of Diophantos his pride had a fall so sudden and so humiliating that he might reasonably doubt whether he ought previously to have bewailed, or laughed at himself. He considers it therefore worth while to confess publicly in how disgraceful a condition of ignorance he had previously been content to live, and to do something to make known the work of Diophantos, which had so opened his eyes. Rhetoric Algebra, or "reckoning by complete words. Neither is it the Europeans posterior to the middle of the seventeenth century who were the first to use Symbolic forms of Algebra. In this they were anticipated many centuries by the Indians. A Study in the History of Greek Algebra pp. The geometrical algebra of the Greeks has been in evidence all through our history from Pythagoras downwards, and no more need be said of it here except that its arithmetical application was no new thing to Diophantus. It is probable, for example, that the solution of the quadratic equation, discovered first by geometry, was applied for the purpose of finding numerical values for the unknown as early as Euclid , if not earlier still. In Heron the numerical solution of equations is well established, so that Diophantus was not the first to treat equations algebraically. What he did was to take a step forward towards an algebraic notation. Reported in Moritz The objects with which it deals are absolute numbers and measurable quantities which, though themselves unknown, are related to "things" which are known, whereby the determination of the unknown quantities is possible. Such a thing is either a quantity or a unique relation, which is only determined by careful examination. What one searches for in the algebraic art are the relations which lead from the known to the unknown, to discover which is the object of Algebra as stated above. The perfection of this art consists in knowledge of the scientific method by which one determines numerical and geometric unknowns. No attention should be paid to the fact that algebra and geometry are different in appearance. Algebras jabbre and maqabeleh are geometric facts which are proved by propositions five and six of Book two of Elements. Amir-Moez in Scripta Mathematica 26 This quotation has often been abridged in various ways, usually ending with "Algebras are geometric facts which are proved", thus altering the context significantly. The history of arithmetic and algebra illustrates one of the striking and curious features of the history of mathematics. Ideas that seem remarkably simple once explained were thousands of years in the making. Morris Kline, Mathematics for the Nonmathematician p. Each theorem required a new kind of proof What impressed Descartes especially was that algebra enables man to reason efficiently. It mechanizes thought, and hence produces almost automatically results that may otherwise be difficult to establish. Whereas geometry contained the truth about the universe, algebra offered the science of method. Of course, their goal is to get at more difficult problems, as indeed they do. Morris Kline , Mathematics for the Nonmathematician pp. Another feature of Alexandrian algebra is the absence of any explicit deductive structure. The various types of numbers Nor was there any axiomatic basis on which a deductive structure could be erected. The work of Heron , Nichomachus , and Diophantus , and of Archimedes as far as his arithmetic is concerned, reads like the procedural texts of the Egyptians and Babylonians The problems are inductive in spirit, in that they show methods for concrete problems that presumably apply to general classes whose extent is not specified. In view of the fact that as a consequence of the work of the classical Greeks mathematical results were supposed to be derived deductively from an explicit axiomatic basis, the emergence of an independent arithmetic and algebra with no logical structure of its own raised what became one of the great problems of the history of mathematics. This approach to arithmetic and algebra is the clearest indication of the Egyptian and Babylonian influences Though the Alexandrian Greek algebraists did not seem to be concerned about this deficiency But the invention of analytic geometry in the seventeenth century made the study of geometric objects, and curves in particular, increasingly part of algebra. Instead of the curve itself, one considered the equation relating the x and y coordinates of a point on the curve. Eli Maor , e: The Story of a Number In England, where it originated, the calculus fared less well. As a result, over the next hundred years, while mathematics fluorished in Europe as never before, England did not produce a single first-rate mathematician. When the period of stagnation finally ended around , it was not in analysis but in algebra that the new generation of English mathematicians made their greatest mark. The Story of a Number It may fairly be said that the germs of the modern algebra of linear substitutions and concomitants are to be found in the fifth section of the Disquisitiones Arithmeticae ; and inversely, every advance in the algebraic theory of forms is an acquisition to the arithmetical theory. Theory of Numbers, Cambridge, , Part 1, sect. The first and typical example of the application of mathematics to the indirect investigation of truth, is within the limits of the pure science itself; the application of algebra to geometry, the introduction of which, far more than any of his metaphysical speculations, has immortalized the name of Descartes , and constitutes the greatest single step ever made in the progress of the exact sciences. Its rationale is simple. It is grounded on the general truth, that the position of every point, the direction of every line, and consequently the shape and magnitude of every enclosed space, may be fixed by the length of perpendiculars thrown down upon two straight lines, or when the third dimension of space is taken into account upon three plane surfaces, meeting one another at right angles in the same point. A consequence or rather a part of this general truth is that, curve lines and surfaces may be determined by their equations. It is not taught either in foreign or American colleges, and is now become obsolete. This is the common algebraical method , which is concise, simple, and perspicuous ; and is sufficient for all useful purposes in practical mathematics. The method is clear and intelligible to all persons who know the first principles of algebra. The rudiments of algebra ought to be taught before geometry, because algebra may be applied to geometry in certain cases, and facilitates the study of it. Although the Arabs did not contribute much original matter to algebra they vitalized it and enriched its contents by applying algebraic operations to the problems of Greek geometry and to their own problems in astronomy and trigonometry. This led them directly to numerical higher equations. The solution of numerical cubic equations by intersecting conics was the greatest original contribution to algebra made by the Arabs.

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These solutions remained unknown to the Western world, and were rediscovered in the seventeenth century by Descartes , Thomas Baker , and Edmund Halley.

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Excerpt. Art. -the signification of the derived function from any given function Â¢(a) which is an aggregate of any powers of a, and the mode of successive derivation in such case.

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