THE UNIVERSAL SOLUTION FOR NUMERICAL AND LITERAL EQUATIONS; BY WHICH THE ROOTS OF EQUATIONS OF ALL DEGREES CAN BE EXPRESSED IN TERMS OF THEIR COEFFICIENTS

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649207251

The universal solution for numerical and literal equations; by which the roots of equations of all degrees can be expressed in terms of their coefficients by M. A. McGinnis

Edited by Trieste Publishing Pty Ltd.
Cover @ 2017

www.triestepublishing.com

M. A. MCGINNIS

THE UNIVERSAL SOLUTION FOR NUMERICAL AND LITERAL EQUATIONS; BY WHICH THE ROOTS OF EQUATIONS OF ALL DEGREES CAN BE EXPRESSED IN TERMS OF THEIR COEFFICIENTS

Trieste

THE UNIVERSAL SOLUTION

FOR NUMERICAL AND LITERAL EQUATIONS

BY WHICH

THE ROOTS OF EQUATIONS OF ALL DEGREES CAN BE EXPRESSED IN TERMS OF THEIR COEFFICIENTS

BY

M. A. McGINNIS

LONDON
SWAN SONNENSCHEIN & CO., LIM.
1900

PREFACE.

THIS volume of the author's mathematical discoveries makes its appearance at the request of many able mathematicians, teachers, and scholars throughout the United States, among a few of whom are: J. M. Greenwood, Superintendent of Kansas City Schools and President of the National Association of Education; N. B. Newsom, Professor of Mathematics and Languages at the Kansas State University, Lawrence; R. P. Baker, Professor of Mathematics and Languages, Lamar, and J. C. Shelton, President of Scarritt College, Neosho, Missouri; F. C. Colburn, Principal of High School, Texarkana, Texas; and L. D. Harvey, State Superintendent of Wisconsin.

We feel confident that these discoveries and new methods for the solution of numerical equations will meet with the approval of all teachers and pupils; and especially do we feel that this volume will be food for new thought by all true students of mathematics, — at whose hands we expect a just criticism.

The symbols are such as have been used in prior mathematical works. The definitions are limited, and a few of them new and original.

The theorems are taken up in their order, and their application in the solution of numerical equations fully illustrated and demonstrated.

The formation of equations is fully treated, and the binomial theorem briefly stated.

The Absolute Theorems are of a nature so simple that any pupil who understands the formation of equations and the nature of imaginaries will have no difficulty in grasping their full meaning.

The roots of quadratics are placed in a new light.

The General Theorem of Imaginary Quantities, in its demonstration and illustrations, fully accounts for such quantities, and gives them a true place and meaning (for the first time) in the history of mathematics,—thus demonstrating that imaginaries are intelligible expressions of quantity. We feel confident that the true student of mathematics will admit that we have forever settled the question of the interpretation of imaginary quantities by placing upon them the only true and correct interpretation.

Theorem 2 is the combined results of Theorems 1 and D, and its universal application in the solution of equations of all degrees is fully illustrated by numerous examples.

Theorems 3, 4, and 5 are taken up in their order, and their applications fully illustrated in the solution of equations of their class.

The application of the several theorems in determining the location, character (real or imaginary), and signs of the roots of an equation is fully illustrated; and the method is such that it will convince any impartial student that it is a great step beyond the Sturm Theorem; and that in the solution of equations of all degrees it greatly excels, in brevity, that of any known method.

Cubic equations are thoroughly treated, and all kinds and classes of such equations are given and solved by the new method.

Biquadratics are more thoroughly treated than in any prior work of this kind; and all kinds and classes of such equations are given and solved by the new method without removing the second term; and in the universal solution for biquadratics will be found the *first true general solution ever* offered for such equations. The mathematical world during a period of over two centuries has been struggling to offer a true general solution of the Fourth degree. Many able mathematicians laid claim to such discovery; and while it has been generally, if not universally, conceded that a general solution had been accomplished, the *New World* now challenges the *Old* in the birth of the *universal solution for biquadratics.*

Of Fifth degree equations all kinds and classes of such equations are given and solved by the new method; and for the first time in the history of mathematics is an algebraic solution given to equations of this class whose roots are all real: and for a further discussion of the Fifth, the reader is referred to the universal solution.

By application of the theorems, if an equation of the Fifth contains all real roots, but approximate, the sum of the plus roots and the sum of the minus roots in the formation of the equation can be determined; and when this is obtained, an algebraic solution lies, because the equation can then be separated into a quadratic and cubic, or the method reduces the Fifth to an equation of the Fourth. When all the roots of the Fifth are real, but have the same sign, the roots are determined without separating the equation. When the Fifth contains only one real root, but approximate, if its Natural cannot be discovered, we give a method for changing the Fifth to an equation of the Tenth. This method of changing the Fifth into an equation of the Tenth is worthy the attention and study of all students of mathematics, *for in this alone lies a solution of the Fifth by quadratics.* If the Fifth contains but one real root, the Tenth will contain two real roots, which will be the separate products of the imaginary roots. The Tenth will separate into two biquadratics whose roots are all imaginary and a quadratic whose roots are real; and the solution of the quadratic is the solution of the Fifth from which it is derived.

These discoveries open up a new field for thought and investigation in the solution of numerical equations; and, in the opinion of an able teacher, scholar, and mathematician, should be thoroughly mastered by every pupil who studies algebra or geometry.

The application of these theorems is almost limitless in the investigation of simple methods for the solution of numerical equations. The theorems are suggestive; that is, they call up in the mind new thoughts, which will be the thoughts of the student, *and this is the only true secret to a proper study of mathematics from the lower to the higher branches.*

Fifth degree equations are followed by W. M. H. Woodward's able discussion of the celebrated Wantzel Theorem. Mr. Woodward fully sets forth the fallacies of the Wantzel Theorem, which has, we believe, taken the place of Abel's demonstration of the impossibility of the solution by radicals of equations higher than the Fourth degree.

The universal solution offers a method by which general solutions can be obtained for equations as high as the Twelfth degree.

The general solutions offered here will be found to be great helps in the solution of equations of their class; and many equations requiring two or three days' labor to find the roots by the Horner method, can be solved in as many hours by the methods and general solutions which this volume contains.

In conclusion, we are deeply grateful to the many teachers and scholars, and especially to Professor J. M. Greenwood, for timely criticism and words of encouragement; and to W. H. Fleming and John V. Fleming for many acts of kindness, and for such valuable assistance that they have become interested in the publication of this volume. And while the work is entirely our own, we are thankful to those who lent assistance in whatever form.

M. A. McGINNIS.

NEOSHO, MISSOURI,
May 1, 1900.

CONTENTS.