MATHEMATICAL KEY: NEW COMBINATIONS IN RESPECT TO THE BINOMIAL THEOREM AND LOGARITHMS

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Mathematical Key: New Combinations in Respect to the Binomial Theorem and Logarithms by Joseph B. Mott

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JOSEPH B. MOTT

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Trieste

MATHEMATICAL KEY.

NEW COMBINATIONS

IN RESPECT TO THE

Binomial Theorem and Logarithms;

AND A

NEW DISCOVERY OF ONE GENERAL ROOT THEOREM FOR THE SOLUTION OF EQUATIONS OF ALL DEGREES:

THE EQUATION, $X^x=A$, OR ANY SIMILAR ONE NOT EXCEPTED.

BY JOSEPH B. MOTT.

DESIGNED FOR SUCH AS HAVE FIRST STUDIED SOME SIMPLE WORK ON ALGEBRA, AND DESIRE TO HAVE A MORE PERFECT KNOWLEDGE OF THAT USEFUL BRANCH OF MATHEMATICS.

DETROIT:
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PREFACE.

THE discovery of a general theorem which will develop the roots of equations of all degrees, has seemed to the author to be sufficient apology for offering the subsequent pages to the world. They might have been much extended : many new facts might have been presented, and various examples introduced, which would have greatly enhanced their utility. Indeed the more simple parts of algebra should be so connected with the results here given, as to form one complete chain of reasoning from beginning to end ; but the author's health and personal circumstances would not permit him to devote a sufficient portion of time to the accomplishment of such an object. And as an undue extension of plan is often a cause of failure in the undertaking to carry it out, whereby many useful discoveries may be long hindered from seeing the light, I have thought it best to present these researches as they are, without any modification or enlargement, and run the risk as to what I may be able to do hereafter.

Few know or can realize the difficulties that must be encountered by one who undertakes to get up anything original: first, the great variety of experiments that must be made, take up a great deal of time, often bewilder the mind, and frequently amount to nothing but to show what cannot be done in that way; then again the mental faculties are apt to be so intensely occupied, that the loss of health is a common result. Those who spend a large portion of their time in this way, have just so much less left to devote to the acquirement of property, or the means of living, for the want of a sufficiency of which they often fail of accomplishing their object at last; or if a partial success attends their efforts, yet what is brought to view is new and unpopular, and perhaps but little noticed during the life of the discoverer. On the other hand, however, inventions and improvements follow each other so rapidly at the present day, and so many things have been brought to light that were scarcely dreamed of a short time ago, that public expectation seems more than formerly to be on the lookout for new discoveries and developments. Perhaps, then, among the denizens of this busy and curious world, some may be found to take an interest in the examination of the following pages.

The method of developing the coefficients in the binomial theorem, and finding the logarithmic series, etc., I think will be acknowledged as more simple than any hitherto in use; and the application of the theorems given to the finding of converging series, as often as desired, will serve more fully to exhibit their facility and usefulness.

As it respects *the general root theorem*, I claim both the discovery and invention of it as my own. If any other person has made a similar discovery, it must be a late occurrence, and is wholly unknown to me. DAVIES and other late authors say expressly that no direct formula has appeared for the solution of equations of a degree higher than the fourth, except when the roots are part or all of them rational; but it will be seen in the following pages that equations of all degrees, even many cases of infinity, have a direct solution by one general rule, that is less tedious when applied to numerical equations than any rule of approximation, as well as more perfect.

One great obstacle to the successful prosecution of algebraical researches heretofore has been the tedious methods of resolving the higher equations : the design of this work is to obviate that difficulty, and bring all equations nearly on a level. The reason why mathematicians have not long ago discovered a general theorem for this purpose, is because they have generally commenced their investigations by placing the terms of the highest powers of the unknown quantity first at the left hand; in which position, no direct formula could ever possibly be discovered for cases of infinity. Indeed all that has ever been done in this way consists merely in proposing a new formula (if not more than one) for every different degree of equation, until arriving at those of the fourth degree, where all perfect rules have hitherto suddenly stopped; and even the formulas which have been used for cubic and biquadratic equations are so tedious in most cases, when numerically applied, that the less perfect rules of approximation are generally preferred.

It is easy for a mere tyro in algebra to propose equations that will puzzle an adept to solve by former rules, but will not be so easy after these researches shall become known. There are various forms to which equations may be reduced before applying the root theorem, that will much simplify the result in many cases: these forms are not all presented, but only those which are of the highest importance in respect to solution, though many others might have been added with propriety.

My main object has been to present something new and useful: how far I have succeeded, I leave for the competent to judge. The methods given for the resolution of quadratics in the popular works on algebra are not to be overlooked, although not introduced here; but all the methods for solving the higher equations may be dispensed with beside the root theorem, except cases in which some of the roots are rational, or where the equation is solvable by the binomial or logarithmic theorem. The particular utility of the root theorem consists in the determination of the irrational roots of degrees higher than the second. JOSEPH B. MOTT.

DOWAGIAC, CASS CO. MICH.

March, 1855.

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