

# Quartic Equation

A quartic equation is a fourth-order polynomial equation of the form

$$z^4 + a_3 z^3 + a_2 z^2 + a_1 z + a_0 = 0. \quad (1)$$

While some authors (Beyer 1987b, p. 34) use the term "biquadratic equation" as a synonym for quartic equation, others (Hazewinkel 1988, Gellert et al. 1989) reserve the term for a quartic equation having no cubic term, i.e., a quadratic equation in  $x^2$ .

Ferrari was the first to develop an algebraic technique for solving the general quartic, which was stolen and published in Cardano's *Ars Magna* in 1545 (Boyer and Merzbach 1991, p. 283). The Wolfram Language can solve quartic equations exactly using the built-in command `Solve[a4 x^4 + a3 x^3 + a2 x^2 + a1 x + a0 == 0, x]`. The solution can also be expressed in terms of Wolfram Language algebraic root objects by first issuing `SetOptions[Roots, Quartics -> False]`.

The roots of this equation satisfy Vieta's formulas:

# Beyond The Quartic Equation

**IM Harris**



## **Beyond The Quartic Equation:**

*Beyond the Quartic Equation* R. Bruce King, 2009-01-16 One of the landmarks in the history of mathematics is the proof of the nonexistence of algorithms based solely on radicals and elementary arithmetic operations addition subtraction multiplication and division for solutions of general algebraic equations of degrees higher than four This proof by the French mathematician Evariste Galois in the early nineteenth century used the then novel concept of the permutation symmetry of the roots of algebraic equations and led to the invention of group theory an area of mathematics now nearly two centuries old that has had extensive applications in the physical sciences in recent decades The radical based algorithms for solutions of general algebraic equations of degrees 2 quadratic equations 3 cubic equations and 4 quartic equations have been well known for a number of centuries The quadratic equation algorithm uses a single square root the cubic equation algorithm uses a square root inside a cube root and the quartic equation algorithm combines the cubic and quadratic equation algorithms with no new features The details of the formulas for these equations of degree  $d$   $d = 2, 3, 4$  relate to the properties of the corresponding symmetric groups  $S_d$  which are isomorphic to the symmetries of the equilateral triangle for  $d = 3$  and the regular tetrahedron for  $d = 4$

**Beyond the Quartic Equation** R. Bruce King, 2008-11-01 The objective of this book is to present for the first time the complete algorithm for roots of the general quintic equation with enough background information to make the key ideas accessible to non specialists and even to mathematically oriented readers who are not professional mathematicians The book includes an initial introductory chapter on group theory and symmetry Galois theory and Tschirnhausen transformations and some elementary properties of elliptic function in order to make some of the key ideas more accessible to less sophisticated readers The book also includes a discussion of the much simpler algorithms for roots of the general quadratic cubic and quartic equations before discussing the algorithm for the roots of the general quintic equation A brief discussion of algorithms for roots of general equations of degrees higher than five is also included If you want something truly unusual try this book by R Bruce King which revives some fascinating long lost ideas relating elliptic functions to polynomial equations *New Scientist*

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elliptic functions to polynomial equations *New Scientist* **BEYOND THE QUADRATIC FORMULA** RON IRVING.,2020

Beyond the Quadratic Formula Ron Irving,2020-01-29 The quadratic formula for the solution of quadratic equations was discovered independently by scholars in many ancient cultures and is familiar to everyone Less well known are formulas for solutions of cubic and quartic equations whose discovery was the high point of 16th century mathematics Their study forms the heart of this book as part of the broader theme that a polynomial's coefficients can be used to obtain detailed information on its roots The book is designed for self study with many results presented as exercises and some supplemented by outlines for solution The intended audience includes in service and prospective secondary mathematics teachers high school students eager to go beyond the standard curriculum undergraduates who desire an in depth look at a topic they may have unwittingly skipped over and the mathematically curious who wish to do some work to unlock the mysteries of this beautiful subject

Journal of the Indian Institute of Science Indian Institute of Science, Bangalore,1997 **The Principles of Elementary Algebra** Nathan Fellowes Dupuis,1892 *Beyond Numeracy* John Allen Paulos,1991 Introduces a broad spectrum of mathematical concepts from the basic to the complex in a study that integrates concise definitions with witty mathematical essays **For the Learning of Mathematics** ,1986 *Matemática for Electronics* Forrest I. Baker, Gershon J. Wheeler,1968 **Mathematica - revue d'analyse numérique et de théorie de l'approximation** ,1997 **Choice** ,1997 **New Scientist** ,1997 **An Elementary Treatise on Cubic and Quartic Curves** Alfred Barnard Basset,1901 **Mathematics** David Bergamini,1963 *Abstracts of Papers Presented in Symposia* ,1985 *Kalman Filtering* Mohinder S. Grewal,Angus P. Andrews,2001-01-16 Disk contains Demonstation programs and source code in MATLAB for algorithms in text Beyond the Desert 1997 Hans Volker Klapdor-Kleingrothaus,Heinrich Päs,1998 This book contains the Proceedings of the First International Conference Beyond the Desert on Particle Physics beyond the Standard Model held in June 1997 The conference brought together leading researchers from particle physics and astrophysics to present recent developments and future perspectives both experimental and theoretical in this topical field The complementary approaches of accelerator and non accelerator research were given equal emphasis The invited review papers provide a good overview of the field and the contributed papers give the latest results and point the way forward with possible future experiments

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## **Table of Contents Beyond The Quartic Equation**

1. Understanding the eBook Beyond The Quartic Equation
  - The Rise of Digital Reading Beyond The Quartic Equation
  - Advantages of eBooks Over Traditional Books
2. Identifying Beyond The Quartic Equation
  - Exploring Different Genres
  - Considering Fiction vs. Non-Fiction
  - Determining Your Reading Goals
3. Choosing the Right eBook Platform
  - Popular eBook Platforms
  - Features to Look for in an Beyond The Quartic Equation
  - User-Friendly Interface
4. Exploring eBook Recommendations from Beyond The Quartic Equation
  - Personalized Recommendations
  - Beyond The Quartic Equation User Reviews and Ratings
  - Beyond The Quartic Equation and Bestseller Lists

5. Accessing Beyond The Quartic Equation Free and Paid eBooks
  - Beyond The Quartic Equation Public Domain eBooks
  - Beyond The Quartic Equation eBook Subscription Services
  - Beyond The Quartic Equation Budget-Friendly Options
6. Navigating Beyond The Quartic Equation eBook Formats
  - ePub, PDF, MOBI, and More
  - Beyond The Quartic Equation Compatibility with Devices
  - Beyond The Quartic Equation Enhanced eBook Features
7. Enhancing Your Reading Experience
  - Adjustable Fonts and Text Sizes of Beyond The Quartic Equation
  - Highlighting and Note-Taking Beyond The Quartic Equation
  - Interactive Elements Beyond The Quartic Equation
8. Staying Engaged with Beyond The Quartic Equation
  - Joining Online Reading Communities
  - Participating in Virtual Book Clubs
  - Following Authors and Publishers Beyond The Quartic Equation
9. Balancing eBooks and Physical Books Beyond The Quartic Equation
  - Benefits of a Digital Library
  - Creating a Diverse Reading Collection Beyond The Quartic Equation
10. Overcoming Reading Challenges
  - Dealing with Digital Eye Strain
  - Minimizing Distractions
  - Managing Screen Time
11. Cultivating a Reading Routine Beyond The Quartic Equation
  - Setting Reading Goals Beyond The Quartic Equation
  - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Beyond The Quartic Equation
  - Fact-Checking eBook Content of Beyond The Quartic Equation
  - Distinguishing Credible Sources
13. Promoting Lifelong Learning

- Utilizing eBooks for Skill Development
  - Exploring Educational eBooks
14. Embracing eBook Trends
- Integration of Multimedia Elements
  - Interactive and Gamified eBooks

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