

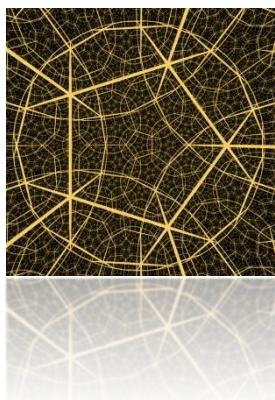
Three Italians died trying.

A Norwegian and a Frenchman died after failing successfully.

The familiar formula for solving quadratic polynomial equations that we all learn in high school algebra has been well known for almost 1,400 years. In the sixteenth century, two Italian mathematicians, Niccolò Tartaglia and Gerolamo Cardano, developed a general formula for solving cubic polynomial equations. Around the same time Cardano's student Lodovico Ferrari found a formula for solving quartic equations. All three competed to find a formula for solving the general quintic equation, but none was successful.

Finally, in the early 19th century, the Norwegian Niels Henrik Abel and, shortly thereafter, the Frenchman Évariste Galois proved that a general quintic formula cannot exist. In fact, the work of Galois showed that a general solution can never exist for n -th degree polynomials if n exceeds four. Alas, neither Abel nor Galois had much time to savor his success: Abel died of consumption at age 26, and Galois died in a duel before turning 21.

In **Math 221B** we will study Field Theory, including Galois Theory, and see the proof that general solutions cannot exist for polynomial equations of degree five or higher. (Indeed, Galois Theory also shows the futility of seeking compass-and-straightedge solutions to the classical geometric problems of *Doubling the Cube* and *Trisecting a General Angle*.) We will see the exquisite *Galois Correspondence* that associates ascending towers of fields that arise in the study of roots of polynomial equations with descending towers of groups. Finally, we will note that because of this correspondence, a polynomial equation will be solvable by radicals if and only if the corresponding Galois group is solvable.



Math 221B: Higher Algebra II

MW 1630-1745

Instructor: R. P. Kubelka

Text: *Algebra*, Thomas W. Hungerford,

ISBN 9780387905181

Contact Professor Kubelka at

kubelka@math.sjsu.edu for further details.