Solving Algebraic Equations with Fibonacci Sequences

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Abstract

It is well known that the classical Fibonacci sequence 0,1,1,2,3,5,8,13, ... , F_n, ... can be used to define the Golden Mean φ as the limit $\lim_{n\to\infty} \frac{F_{n+1}}{F_n}$. This limit value is the (positive) solution of the quadratic equation $x^2 - x - 1 = 0$. To visualize the Fibonacci sequence one uses a nested set of squares and derives a construction of "the" Golden Spiral, a bi-arc spiral consisting of quarter circles. The mentioned procedures can easily be extended to algebraic equations of higher order. To each such equation it is possible to find a Fibonacci type sequence such that one real solution (if existing) becomes the limit of the quotient of consecutive elements of that sequence. In case of the limit exists one has therewith an additional way to find solutions of algebraic equations, besides Newton's method and the regula falsi. As standard high school problems are algebraic, the presented method could be implemented into mathematics courses as well as in courses of informatics. Thus the lecture addresses itself to teachers and teacher students.