In this book the authors have brought together a wealth of material involving the Fermat numbers $F_m := 2^{2^m} + 1$ (some of these are results due to the authors themselves). As is well-known Fermat once thought all these numbers are primes, a conjecture that was first disproved by Euler who showed that 641 is a divisor of F_5. The deepest and one of the nicest results on Fermat numbers in this book is that of Gauss and Wantzel to the effect that the regular n-gon is constructible by ruler and compass if and only if $n = 2^i p_1 \cdots p_j$, where $n \geq 3$, i and j are non-negative and $p_1, \cdots, p_j$ are distinct Fermat primes (so far $F_0, \cdots, F_4$ are the only Fermat primes known). The remaining results are proved using only very elementary tools (which are developed in the chapter 'Fundamentals of Number Theory'). As a result also amateurs and high-school students should be able to profitably read this well-written book.

I will now sketch what type of results can be found in the book. An important topic is, not surprisingly, divisibility properties of Fermat numbers, an example being Pepin's famous test for the primality of F_m. In an Appendix one finds a table of Fermat numbers and their prime factors. Can numbers of a certain shape ever occur as factor of a Fermat number ? To that question also a chapter is devoted. Moreover, Diophantine questions on Fermat numbers are considered, e.g.; can a Fermat number be a polygonal number ? Can it appear in the inside of Pascal's triangle ? What are the solutions of $\varphi(|x^n - y^n|) = 2^j$, where φ is Euler's totient function ? Generalizations of Fermat numbers are considered. There is also a chapter with open problems. Several characterizations of Fermat primes appear; for example for $n \geq 3$ and odd, n is a Fermat prime if and only if the set of primitive roots mod n equals the set of quadratic non-residues mod n. The irrationality of certain sums involving Fermat numbers is studied. Also some applications of Fermat numbers in engineering are considered; the Fermat number transform, which is somewhat similar to the discrete Fourier transform and applications of Fermat numbers in the developing of so-called hashing schemes. Furthermore, it is shown how Fermat numbers and Mersenne numbers (to which Appendix B is devoted) arise in the study of the logistic equation $x_{n+1} = \lambda x_n(1 - x_n)$.

The book is dedicated to Pierre de Fermat on his 400th birthday (as is mentioned in the book the general accepted date of his birth is 1601, but there is some disagreement regarding it) and several pictures involving Fermat can be found in this book. It has 71 illustrations in total, an extensive list of references and a good subject and name index. The title of the book reminded the reviewer of the book '13 lectures on Fermat's last theorem' by P. Ribenboim [MR 81f:100023].