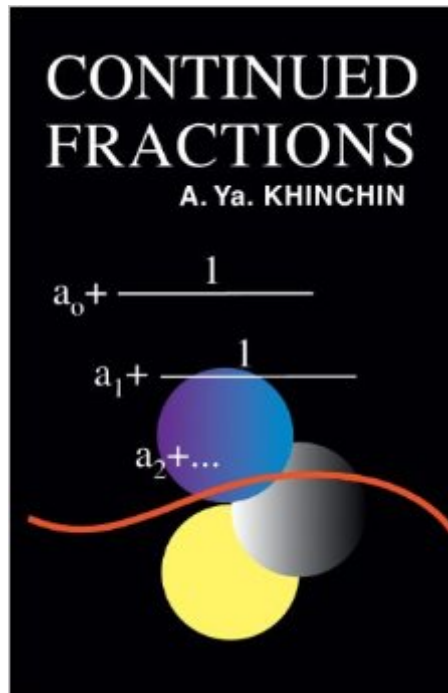


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# Continued Fractions (Dover Books On Mathematics)



## Synopsis

In this elementary-level text, eminent Soviet mathematician A. Ya. Khinchin offers a superb introduction to the positive-integral elements of the theory of continued functions, a special algorithm that is one of the most important tools in analysis, probability theory, mechanics, and, especially, number theory. Presented in a clear, straightforward manner, the book comprises three major chapters: the properties of the apparatus, the representation of numbers by continued fractions and the measure theory of continued fractions. The last chapter is somewhat more advanced and deals with the metric, or probability, theory of continued fractions, an important field developed almost entirely by Soviet mathematicians, including Khinchin. The present volume reprints an English translation of the third Russian edition published in 1961. It is not only an excellent introduction to the study of continued fractions, but a stimulating consideration of the profound and interesting problems of the measure theory of numbers.

## Book Information

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Continued fractions are fractions with multiple denominators; e.g., the golden ratio =  $1 + \frac{1}{1 + \frac{1}{1 + \dots}}$ , the square root of 2 =  $1 + \frac{1}{2 + \frac{1}{2 + \dots}}$ . Indeed, all quadratic irrationals have repeating continued fractions, giving them a convenient and easily memorable algorithm. Continued fractions may be truncated at any point to give the best rational approximation. For example  $\frac{1}{\pi} = \frac{113}{355}$  -- something that is very easy to remember (note the doubles of the odd numbers up to five).

Therefore, an excellent approximation for pi becomes 355/113. The fraction approximates pi to an error better than  $3E-7$ , more than accurate enough for any practical use including astronomy. Thus for both transcendental and analytical irrationals, continued fractions are enormously useful. Never heard of them? You're not alone. The first recorded instance of continued fractions was by Lord Brouncker in the 17th century which makes them a relatively new addition to mathematics. Nor are they taught in typical undergraduate scientific curricula. Notwithstanding, if they were discovered by the Pythagoreans, history may have been much different. The Pythagoreans were a mystical sect that believed that all things geometric could be described by rational numbers (i.e., wholes and fractions). Something like the square root of two was clearly geometric (the diagonal of the unit square) yet, irrational. Legend has it that Hippasus (5th century B.C.) was expelled from (or killed by) the Pythagorean school for proving the irrationality of a number such as the square root of 2 or the golden ratio. This ultimately destroyed the Pythagorean religion.

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