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Continued fractions: rational approximations in the classroom. II.

Math. Sch. (Leicester) 39, No. 4, 15-17 (2010).

From the introduction: In [the author, ibid. 39, No. 2, 16–17 (2010; ME 2011b.01005)], we looked at simple ways of obtaining ever-better rational approximations to numbers of the form $\sqrt{m}$, where $m \in \mathbb{N}$ is not a perfect square. We also showed how to derive rational approximations to the transcendental number e. In both cases the approximations were calculated by way of recursive procedures. While perfectly acceptable, these methods may have appeared to be rather ad hoc. As mathematicians, rather than having to resort to ad hoc procedures in this way, we would much prefer to develop a general method for obtaining these approximations. Thus, in the second article of this series, we start to piece together a coherent mathematical framework for dealing with the problem of approximating irrational numbers by rational ones. It is hoped that teachers might wish to create their own classroom activities based on the ensuing mathematical ideas.

Classification: F60 F50 N20
Keywords: finite continued fractions; infinite continued fractions; Euclid's algorithm; limits; periodic infinite continued fractions; irrational numbers; irrational roots of quadratic equations with rational coefficients; surds; roots; decimal fractions; number representations; infinite continued fraction expansions; rational approximation