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Why Euler Didn't Prove the Irrationality of PI: A Chapter in the History of Transcendence

This paper is part of an ongoing study by the author to determine whether Leonhard Euler considered the irrationality of π adequately demonstrated or if he believed that the problem required new tools or methods. Using Euler's criteria of rigor evident in his proof that e is irrational, as set out in his Introductio (1748) and documented by Ed Sandifer (2006), the paper shows that previous proofs of π's irrationality by William Brouncker, John Wallis, and Euler himself failed to satisfy these rigorous standards. A fully satisfactory proof of the irrationality of π was obtained by Johann Lambert in 1768 using new methods devised for this purpose. In his investigation Lambert relied heavily on Euler's exposition of continued fractions. The paper examines the state of Euler's work on the problem in relation to these contemporary researches of Lambert.