Analysis of Irrational Proofs and An Exploration into Alternate Solutions for *e*

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Abstract

The constant *e* was first discovered by Gottfried Leibniz in 1646 as the upper bound of the integral $\int_{1}^{k} \frac{1}{x} dx$. It has been further studied by many mathematicians, such Leonard Euler, because of its applications in calculus, probability, and number theory (Glaz, 2010). This paper will analyze proofs of *e*'s irrationality and present three alternative methods that I used to try to prove *e*'s irrationality: applying Lambert's proof for π to *e*, manipulating the Wallis product for a contradiction, and expanding on Jonathan Sondow's geometric proof. In the end, expanding on Sondow's geometric proof was the only method that resulted in success and also revealed a new series expansion for *e*. The implications of this finding could help solve unproven numbers such as $e + \pi$.