

A proof of the irrationality of π and the rational powers of e

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Abstract

In this note we give a very short proof of irrationality of π , and a proof of the irrationality of the rational powers of e . The canonical proof of the irrationality of π is due to Lambert (1767), and the one for e to Euler (1737).

Keywords : Number theory, irrationality, π , e .

1. The irrationality of π

In this first section we give a proof of the irrationality of π which we gave first in [1]. We begin with the following:

Theorem 1.1. π^2 is irrational.

*Proof.*¹ We suppose that π^2 is rational i.e. we suppose that there exist $a, b \in \mathbb{N}$, with $(a, b) = 1$, such that $\pi^2 = \frac{a}{b}$, because π^2 is positive.

Then there exists a number $m \in \mathbb{N}$ such that $\pi \frac{a^m}{m!} < 1$ (π is a finite quantity and the succession with generic term $\frac{a^n}{n!}$ is infinitesimal, for

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¹Cfr. F. Eugeni and G. Ippoliti, Una prova dell'irrazionalità di π , in *Proceedings of Annual Conveign of Mathesis*, Anzio, 2004.

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