

Is e^x zero in some extended number system?

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 - *Date:* 30 Jan 2006 07:21:18 -0800
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I came across the following a couple of days ago and I'm curious if any related work has been done along these lines.

Paul Dienes, "The exponential function in linear algebras", Quarterly Journal of Mathematics (Oxford) 1 (1930), 300-309.
<http://www.emis.de/cgi-bin/JFM-item?56.0151.02>

The text of the first two paragraphs follows.

"The introduction of complex numbers was chiefly suggested by the problem of determining the zeros of polynomials. Some integral functions, such as e^x , have no zero in the field of complex numbers. This fact suggests the following question. Can we generalize the idea of number to such an extent that the exponential function may have a zero in the extended field?"

"We shall prove in this Note that the exponential function has no zero in the linear associative algebra to a finite base, and that it has no zero in finite non-associative linear algebras. [Dienes assumes, of course, that the algebra product has a multiplicative identity.] This result extends to a large class of algebras to an infinite base. In particular, the exponential function has no zero in the tensor algebra of relativity theory and it misses only singular tensor values which do not divide some tensor. Moreover, in Hilbert's [*] algebra of infinite bounded matrices, so important in atom mechanics, the exponential function has no absolutely bounded matrix zero."

[*] "D. Hilbert, 'Grundzüge einer allgemeinen Theorie der linearen Integralgleichungen', Leipzig (1912), pp. 128-9."

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◇ *From:* Robert Israel

◆ *Re: Is e^x zero in some extended number system?*

◇ *From:* David W . Cantrell

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