

## Re: $x^x = 1/4$

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*Source:* <http://sci.tech-archive.net/Archive/sci.math/2006-01/msg01183.html>

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- *From:* quasi <quasi@xxxxxxxx>
  - *Date:* Tue, 10 Jan 2006 08:46:18 -0500
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On 9 Jan 2006 16:26:53 GMT, israel@xxxxxxxxxxxx (Robert Israel) wrote:

>In article <4uk4s11veqoqhbr0rp5f89sqgs9m60t7h2@xxxxxxx>,  
>quasi <quasi@xxxxxxxx> wrote:  
>>On 8 Jan 2006 23:54:17 -0500, "Keith F. Lynch" <kfl@xxxxxxxxxxxxxxxx>  
>>wrote:  
>  
>>>If you're speaking of the change of sign of the imaginary, that's  
>>>meaningless. Any solution to  $x^x$  equals a real number has another  
>>>solution with the opposite sign on the imaginary, i.e. the complex  
>>>conjugate.  
>>  
>>Is this obvious?  
>  
>Yes.  
>  
>>Even if it is, can you explain it a little?  
>  
>conjugate( $x^y$ ) = conjugate( $\exp(y \ln(x))$ )  
> =  $\exp(\text{conjugate}(y \ln(x)))$   
> =  $\exp(\text{conjugate}(y) \ln(\text{conjugate}(x)))$   
> =  $\text{conjugate}(x)^{\text{conjugate}(y)}$   
>  
>Assuming you're taking the principal branch, this is valid except in the  
>case where  $x$  is a negative real: thus  $(-1)^y = \exp(i \pi y)$  and  
> $(-1)^{\text{conjugate}(y)} = \exp(i \pi \text{conjugate}(y))$ , not  $\exp(-i \pi \text{conjugate}(y))$ .  
>If you allow all branches, the statement is that every value of  
>conjugate( $x^y$ ) is a value of  $\text{conjugate}(x)^{\text{conjugate}(y)}$  and vice versa.  
>

This makes sense. Thanks.

Let me ask a related question.

Suppose  $f(z)$  is a function from  $\mathbb{C}$  to  $\mathbb{C}$  which can be represented as "an expression in closed form with real coefficients" (whatever that means). Is it necessarily true that the nonreal zeros of  $f$  come in complex conjugate pairs?

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I know the answer is yes if  $f(z)$  is a polynomial with real coefficients, and based on this thread, it's now clear that the answer is also yes if  $f(z)=z^z$ .

How generally is this true?

As far as conditions on  $f$ , add them as needed.

quasi

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• **Follow-Ups:**

◆ **Re:  $x^x = 1/4$**

◇ From: Robert Israel

• **References:**

◆ **Re:  $x^x = 1/4$**

◇ From: Keith F. Lynch

◆ **Re:  $x^x = 1/4$**

◇ From: quasi

◆ **Re:  $x^x = 1/4$**

◇ From: Robert Israel

• Prev by Date: **Re: Generalized of dominated convergence theorem**

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