

## Re: Disturbed by alternating series.. help!

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- *From:* "John Coleman" <[jcoleman@xxxxxxxxxxxxxxxx](mailto:jcoleman@xxxxxxxxxxxxxxxx)>
  - *Date:* 22 Nov 2005 09:28:10 -0800
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shevek4@xxxxxxxx wrote:

> shevek4@xxxxxxxx wrote:

>> I came across a very scary problem with alternating series, that may  
>> drive me insane.

>>

>> I was under the mistaken impression that the re-ordering of a sum could  
>> not affect it, i.e. the commutative property of addition.  $a+b = b+a$

>>

>> Or even  $a + -b = -b + a$ .

>>

>> However, it was pointed out to me that infinite alternating series do  
>> not have this property..

>> Namely,

>>

>> <http://mathworld.wolfram.com/RiemannSeriesTheorem.html>

>>

>> But this seems to throw into question using infinite series as unique  
>> solutions for differential equations..

>>

>> But can we really say that addition is commutative over the reals?

>

> addendum:

>

> We've all been told that

>

>  $1/(1+r) = \sum_i (-r)^i$

>

> but now Riemann says that the RHS could equal anything at all!

>

> even orthogonal polynomials are suspect now.. i.e. infinite Fourier  
> series with coefficients that could be negative..

you are forgetting about absolute convergence. conditionally convergent series can be somewhat pathological, but power series are absolutely convergent (hence don't change their values upon rearrangement) inside their radius of convergence. (by the way – commutativity is a property of finite sums, one can't expect infinite sums to behave the same way in all cases)

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