Re: −− Limit of ratio of consecutive primes = 1 ?

Source: http://sci.tech−archive.net/Archive/sci.math/2008−05/msg03776.html

- *From*: bill <b92057@xxxxxxxxx>
- *Date*: Sun, 25 May 2008 17:44:10 −0700 (PDT)

On May 24, 5:31 am, David C. Ullrich <dullr...@xxxxxxxxxxx> wrote:

> On Fri, 23 May 2008 13:26:39 −0700 (PDT), bill <b92...@xxxxxxxxx>
> wrote:
>
>> On May 22, 5:12 am, David C. Ullrich <dullr...@xxxxxxxxxxx> wrote:
>>
>>> On Wed, 21 May 2008 11:48:23 −0700 (PDT), bill
>>> <b92...@xxxxxxxxx>
>>> wrote:
>>>
>>>> On May 21, 9:34 am, David W. Cantrell
>>>> <DWCantr...@xxxxxxxxxxx> wrote:
>>>>
>>>>> Ray Johnstone
>>>>> <r...@xxxxxxxxxxxx>
>>>>> wrote:
>>>>>
>>>>>> On 07 May
>>>>>> 2008
>>>>>> 23:32:48
>>>>>> GMT,
>>>>>> David W.
>>>>>> Cantrell
>>>>>> <DWCantr...@xxxxxxxxxxx>
>>>>>> wrote:
>>>>>>
>>>>>>> Let
>>>>>>> p(n)
>>>>>>> denote
>>>>>>> the
>>>>>>> nthprime.

It seems that, as n −> oo, limit(p(n + 1)/p(n)) = 1. Is that correct? If so, how can it be proven?

Does it perhaps depend on some result (unfamiliar to me) concerning how big, for given n, the gap between p(n) and p(n + 1)

can
be?

So is there a
limit? There
seems to be
no answer
in this long
thread.
If there is
one it seems
to be
between 1
and 2.

The limit is 1. That was
proven early in the thread.

David

The first order limit is => 1.

What in the world does that mean?

The _limit_ of P(n+1)/P(n) _is_ 1.
Another way to say that would be to say that
P(n+1)/P(n) −> 1. But the _limit_ _is_ 1,
it does not "tend to 1". And nobody but
you knows what a "first order limit" is.

Since P(n+1) cannot be less that P(n) ;
the limit
must be => 1. . .
.
Twin primes quickly push the limit to 1
exactly.

> > > Huh? That shows that limit is 1 _assuming_ two
> > > things: (i) there are infinitely many twin primes,
> > > (ii) the limit _exists_. But nobody knows whether
> > > (i) is true, and (ii) is not something you're allowed
> > > to assume here, it needs to be proved.

> > I understand now why you did not bother to explain this to me
> > earlier..
> > I would have to be able think like a mathematician to make any sense
> > out of the above

The reason I didn't say anything about those points earlier
is that they were not relevant to anything you'd said. The
same applies to almost all of the math I know.

> > > All of this has been based on a certain theorem known
> > > as thePrimeNumber Theorem, which says that a certain
> > > other limit is 1. That is a very deep theorem. But if you
> > > simply assume that the limit in question exists the PNT
> > > becomes quite simple.

> > Way over my head!

Not every sequence _has_ a limit. An example of a seuqence
that does not have a limit is given by one of your other
errorneous comments about the limit of sin(n); that sequence
does not have a limit. A simpler example is this:

1, −1, 1, −1, 1, −1, ...

That sequence does not have a limit (very informally, the
limit can't be 1 because there are infinitely many −1's in
the sequence, the limit can't be −1 for similar reasons,
and the limit certainly can't be anything other than 1 or
−1.)

If pi(n) is the number of primes less than or equal to n
thePrimeNumber Theorem says that the sequence
defined by

pi(n)*ln(n)/n

has limit 1. That theorem is very difficult. But if we
assume that that sequence _has_ a limit it's "easy"
to prove that the limit must be 1; the very hard part
of the proof is showing that the sequence _has_ a limit.

I have forgotten what this has to do with the
limit [P(n+1) / P(n)].

P(n+1) is asymptotic to (n+1) * ln (n+1) and
P(n) is asymptotic to n*
ln (n)
For significantly large 'n', these two curves
are virtually
identical. This
might be useful information.

Bill J

David C. Ullrich

David C. Ullrich

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