Re: A trap: TWO HOWLERS in Mathematica 6 making a dangerous match

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- *From*: dimitris <dimmechan@xxxxxxxxx>
- *Date*: Sun, 17 Jun 2007 02:43:23 −0700

I guess this feature of quadrature can be a blessing or a curse

For me, dealing with integrals convergent only in the Hadamard
sense it will be Eulogy!

Dimitris

/ Daniel Lichtblau :

On Jun 16, 7:57 pm, Vladimir Bondarenko <v...@xxxxxxxxxxxxxxx> wrote:

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(* A freshman − or a biologist etc − tries to calculate a
divergent integral not realizing that it diverges... *)

Integrate[(1+z) Sin[z]/z, {z, 0, Infinity}]

(* Mathematica 6 returns an invalid answer, − but without
any warning message, the first defect. *)

(2+Pi)/2

%//N

2.5708

(* The customer has heard about some Vladimir and his VM
machine and realizes already that computer algebra systems
tend to have bugs, so he or she tries to verify the above
result via a quadrature... *)

NIntegrate[(1+z) Sin[z]/z,{z,0,Infinity}]

(* ... and encounters yet another Mathematica 6 eerie defect
− not a only a finite number is given − again without any
warning message which is itself a bug... − but this number
coincides identically with the approximation of the exact
answer... nothing to add. *)
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2.5708

This is, I think, an interesting phenomenon from the point of view of both symbolic and numeric calculus. I don't claim to fully understand it but, having encountered it over the years, I can say a bit. The first trouble, for both symbolic and numeric integration, is the failure to detect divergence. But why do such disparate methods then give numerically equivalent results? This is because some singularity−crushing quadrature schemes have the effect, in cases of divergent integrals, of giving a finite result that agrees with the generalized integral (that is, the result of removing singular parts e.g via series expansion).

I guess this feature of quadrature can be a blessing or a curse. It depends on whether you are striving for a numerical evaluation of a generalized integral, or trying to double−check your symbolic result and wanting to know if in fact it diverges (or using a symbolic computation to check your numeric routine).

While I'd not refe