Infinite Series Strategy Sheet

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Know the Famous Series

Did I mention you should know the Famous Series?

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  - Sin
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  - ln (1+x)
  - arctan (x)

Test for Divergence

Unless you immediately recognize a series (*e.g.* it's one of the Famous Series, or an obvious candidate for one of the Convergence Tests) always start with this one. Why?

At best, you could be done already!

If $\lim_{k\to\infty} u_k \neq 0$ then $\sum u_k$ diverges.

At worst, you'll have a great idea how to proceed:

If $\lim_{k\to\infty} u_k = 0$ then $\sum u_k$ you don't know what happens. **Despair Not!** Your work was not in vain.

- Ask yourself: **How** does u_k go to zero?
- In the limit, does u_k resemble terms in a famous series?
- Does the famous series have known convergence properties?
    - If so, the problem series almost certainly has similar convergence properties. Set up a comparison with the famous series. The Limit Comparison Test is usually a good bet here, since you've already been looking at a similar limit.
    - If not, go back and review Famous Series it's probably there.

Did I mention you should know the Famous Series?

Limit Comparison Test

If you don't find an easy match to a Famous Series, The *Test for Divergence* will almost always provide you with a Famous Series to use with the *Limit Comparison Test.* Set up the ratio between individual terms of the unknown series and the Famous Series and find the limit, L . If $0 < L < \infty$ then the two series behave the same. If L is 0 or ∞ with any luck, your Famous Series "wins" the limit of the ratio in a useful way:

- Your unknown series converges if it is clearly smaller than a convergent Famous Series -- think about it.
- Your unknown series diverges if it is clearly larger than a divergent Famous Series -- think about it.

Did I mention you should know the Famous Series?

Convergence Tests

What are the various Convergence Tests?

Which one should I use?

You have a number of Convergence Tests available, and most series can be analyzed with more than one of them. The Convergence Tests page has guidelines for diagnosing when a test is likely to work on a particular series.

-- DickFurnas - 17 Nov 2008

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