

# Projects in Advanced Calculus:

Do two of the following projects. Both projects are due the last day of class (Friday April 11th 2003). All projects should be at least three pages long without diagrams. Attention should be paid to grammar and spelling and style. Most important, you must list all your references.

1. Write an essay entitled ''Transfinite numbers''. (Mathematics Theory/Communication Skills.)

[http://www.geocities.com/roble\\_wais/cantor\\_set\\_theory.htm](http://www.geocities.com/roble_wais/cantor_set_theory.htm)

<http://www.anselm.edu/homepage/dbanach/infin.htm>

<http://www.math.utah.edu/~alfeld/math/sets.html>

2. Write an essay entitled ''Metric Spaces: Sets where we can measure distances''. (Mathematics Theory/Communication Skills.)

<http://www.math.sc.edu/~sharp/lectures/math555/Lectures/MetricSpaceIntro.html>

<http://www.maths.mq.edu.au/~wchen/lnlfafolder/lnlfa.html>

<http://www.mathreference.com/top-ms,intro.html>

3. Write an essay entitled ''The discrete topology makes all functions continuous!'' (Mathematics Theory/Communication Skills.)

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

<http://www.gap-system.org/~john/MT3822/Lectures/L11.html>

4. Write an essay entitled ''Karl Weierstrass's contributions to analysis''. (Communication Skills/History of Analysis/Calculus.)

<http://scidiv.bcc.ctc.edu/Math/Weierstrass.html>

<http://www.everything2.com/index.pl?node=Karl%20Weierstrass>

<http://www.stetson.edu/~efriedma/periodictable/html/W.html>

5. Write an essay entitled ''Augustin Louis Cauchy contributions to analysis''. (Communication Skills/History of Analysis/Calculus.)

<http://scidiv.bcc.ctc.edu/Math/Cauchy.html>

<http://www.bartleby.com/65/ca/Cauchy-A.html>

6. Write an essay entitled ''A function that is continuous everywhere but differentiable nowhere''! (Mathematics Theory/Communication Skills.)

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

7. Write an essay entitled ''Lebesgue Integral for Simple Function''. (Mathematics Theory/Communication Skills/History of calculus.)

<http://www.shu.edu/projects/real/integ/lebes.html>

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

<http://planetmath.org/encyclopedia/Integral2.html>

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

8. Write an essay entitled ''Examples of perfect and non-perfect sets''. (Mathematics Theory/Communication Skills/History of calculus.)

<http://br.crashed.net/~loner/settheory/reals2/reals2.html>  
<http://pirate.shu.edu/projects/reals/topo/>

9. Write an essay entitled "Non-standard Analysis: Hyperreal Numbers". (Mathematics Theory/Communication Skills/History of calculus.)

<http://members.tripod.com/PhilipApps/nonstandard.html>  
<http://mathworld.wolfram.com/NonstandardAnalysis.html>

10. Write an essay entitled "Big O and little o functions". (Mathematics Theory/Communication Skills/History of calculus.)

[http://web.math.fsu.edu/~pkirby/mad3107/SlideShow/Output/Section1\\_8/Slide02.html](http://web.math.fsu.edu/~pkirby/mad3107/SlideShow/Output/Section1_8/Slide02.html)  
<http://userpages.umbc.edu/~anastasi/Courses/341/Spr00/Lectures/Asymptotic/asymptotic/asymptotic.html>

11. Write an essay entitled "Compact Sets".

<http://www.shu.edu/projects/reals/reals.html>  
<http://www.math.unl.edu/~webnotes/contents/contents.htm>  
<http://www.mathreference.com/top-cs,intro.html>

12. Write an essay entitled "Fourier Analysis, convergence and the Gibbs Phenomenon".

<http://lcavwww.epfl.ch/~balmelli/java/presentations/mmsp98/DSPBook/Demo1/theory.htm>  
<http://www.sosmath.com/fourier/fourier3/gibbs.html>  
<http://mathworld.wolfram.com/GibbsPhenomenon.html>  
<http://cnx.rice.edu/content/m10092/latest/>

13. Write an essay entitled "Constructing the set of real numbers as equivalence classes of Cauchy sequences".

<http://planetmath.org/encyclopedia/MathbbR.html>  
<http://www.cartage.org.lb/en/themes/Sciences/Mathematics/calculus/realnumbers/complete/complete.htm>  
<http://www.mathreference.com/top-ms,rcomp.html>

14. Write an essay entitled "Research on the relation between the convergence of Continued fractions and the convergence of the sequences that define them." (See:Page 167 of our book #13 (c).)

<http://www.mcs.surrey.ac.uk/Personal/R.Knott/Fibonacci/cfINTRO.html>  
<http://archives.math.utk.edu/articles/atuy1/confrac/>  
[http://www.cut-the-knot.com/do\\_you\\_know/fraction.shtml](http://www.cut-the-knot.com/do_you_know/fraction.shtml)  
<http://www.cecm.sfu.ca/organics/papers/corless/>  
<http://plus.maths.org/issue11/features/cfractions/>

15. Write an essay entitled "Infinite Products".

<http://mathworld.wolfram.com/InfiniteProduct.html>  
<http://www.mathreference.com/lc-prod,intro.html>  
<http://www.efunda.com/math/infproducts/infproducts.cfm>  
[http://www.dlc.fi/~karhyv/Inf\\_prod.html](http://www.dlc.fi/~karhyv/Inf_prod.html)  
<http://www.hypermaths.org/quadibloc/math/ide02.htm>

16. Write an essay entitled "Functional Analysis".

<http://www.wiwi.hu-berlin.de/wpol/html/pdf/>  
<http://www.math.niu.edu/~rusin/known-math/index/46-XX.html>

17. Write an essay entitled "Banach Spaces".

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

<http://www-groups.dcs.st-and.ac.uk/~history/Mathematicians/Banach.html>  
<http://www.cs.utk.edu/~mclennan/Classes/594-MNN/MNNH/MNNH-2/node1.html>

18. Write an essay entitled "Dedekind Cuts".

<http://www-gap.dcs.st-and.ac.uk/~history/Mathematicians/Dedekind.html>  
<http://www.dgp.toronto.edu/people/mooncake/thesis/node61.html>  
<http://www.gap-system.org/~john/analysis/Lectures/A3.html>  
<http://hemsidor.torget.se/users/m/mauritz/math/num/real.htm>

19. Write an essay entitled "Baire Category Theorem"

<http://www-gap.dcs.st-and.ac.uk/~history/Mathematicians/Baire.html>  
<http://planetmath.org/encyclopedia/BaireCategoryTheorem.html>  
<http://mathworld.wolfram.com/BaireCategoryTheorem.html>

Our Book.

20. Write an essay entitled "The Cantor function and its properties"

<http://www-gap.dcs.st-and.ac.uk/~history/Mathematicians/Cantor.html>  
[http://www.shu.edu/projects/reals/cont/fp\\_cantr.html](http://www.shu.edu/projects/reals/cont/fp_cantr.html)  
[http://www.cut-the-knot.com/do\\_you\\_know/cantor.shtml](http://www.cut-the-knot.com/do_you_know/cantor.shtml)  
<http://mathworld.wolfram.com/CantorFunction.html>  
<http://users.forthnet.gr/ath/jgal/math/cantor.html>

21. Any other project **APPROVED BY ME IN ADVANCE**.