# Mathematics Newsletter

## Can You Solve This?

1.  If $f(x) = x^2 + x$, prove the equation $4f(a) = f(b)$ has no solutions in positive integers $a$ and $b$.

2.  Prove that, for any positive integer $n$,

    $$1492^n - 1770^n - 1863^n + 2141^n$$

    is divisible by 1946.

3.  A gambling student tosses a fair coin and scores one point for each head that turns up and two points for each tail. Prove that the probability of a student scoring exactly

    $n$ points is $\dfrac{1}{3}\left[2 + \left(-\dfrac{1}{2}\right)^n\right]$

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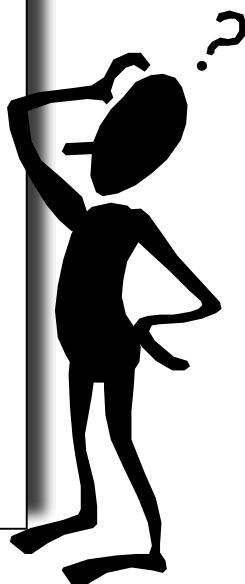
## Spring Graduates

Twenty-five students graduated with B.S. Degrees in Mathematics or Applied Mathematics in May 2001. Congratulations to these graduates!

| | |
|---|---|
| William Joseph Buracker II | *Mathematics* |
| James Steven Cook | *Mathematics* |
| Catherine Ashley Daubert | *Mathematics* |
| Judith Ellen Harney | *Mathematics* |
| Darryll Brice Lobasso | *Mathematics* |
| Thomas Arthur McAvoy IV | *Mathematics* |
| Pritpal Singh Narula | *Mathematics* |
| Martin Christopher Smith | *Mathematics* |
| Marco Antonio Soto | *Mathematics* |
| Katherine Joy Spencer | *Mathematics* |
| Emmanuel Touprong Toploi | *Mathematics* |
| Laura Jane Weston | *Mathematics* |
| | |
| Quinton Yutaka Anderson | *Applied Mathematics* |
| Clayton Adam Barker | *Applied Mathematics* |
| Samuel Gray Gainor | *Applied Mathematics* |
| Joshua Eli Gates | *Applied Mathematics* |
| Paul Andrew Gouveia | *Applied Mathematics* |
| Jennifer Carroll King | *Applied Mathematics* |
| Alex Christopher Mayer | *Applied Mathematics* |
| David Franklin Murray | *Applied Mathematics* |
| Hugh Alton Patrick, Jr. | *Applied Mathematics* |
| Leslie Page Scheunemann | *Applied Mathematics* |
| Cathy Michelle Summerlin | *Applied Mathematics* |
| James Joseph Thrasher | *Applied Mathematics* |
| Margaret Anne Whitmeyer | *Applied Mathematics* |

## Duke Energy Winners

Each year, Duke Energy selects several students to receive full scholarships for their last two years at NC State. Students are nominated on the basis of solid academic standing, strong communication and problem-solving skills, and intellectual curiosity.

Christine Finger (AMA/ST), Nicholas Featherstone (PY/MA), and Shashank Pandit (AMA/CSC) are the Duke Energy Scholars for Fall 2001.

## Mathematics Electives Spring 2002

Here is a tentative list of mathematics courses being offered Spring Semester, which can be used as mathematics electives by students in MA or AMA. There will be additional courses at the graduate level that can also be used.

Class times are listed at
http://www.math.ncsu.edu:8370/Courses/Sprg02.txt

| | | |
|---|---|---|
| MA 293B | Intro to Applied Math | R White |
| MA 293C | Matrix Appl and Computations | R White |
| MA 401 | Applied Differential Equations II | K Ito |
| MA 408 | Foundations of Euclidean Geometry | J Kolb |
| MA 410 | Theory of Numbers | K Koh |
| MA(CSC) 416 | Introduction to Combinatorics | N Jing |
| MA 421 | Intro to Probability | R Ramsay |
| MA 426 | Mathematical Analysis II | J Rodriguez |
| MA(CSC) 428 | Introduction to Numerical Analysis II | M Chu |
| *MA 432 | Mathematical Models in Life & Social Sciences | S Lubkin |
| MA 437 | Applications of Algebra | R Hartwig |
| MA 491H | Readings in Honors Mathematics | S Paur |
| MA 493O | Long-Term Actuarial Models | C Dunn |
| MA 499 | Special Topics: Independent Research | J Scroggs |
| MA 501 | Adv Math for Engineers and Scientists I | J Selgrade |
| MA 502 | Adv Math for Engineers and Scientists II | M Haider |
| MA(OR) 505 | Linear Programming | E Peterson |
| MA 512 | Advanced Calculus II | S Paur |
| MA 513 | Intro to Complex Variables | A Fauntleroy |
| MA 515 | Analysis I | X Lin |
| MA 520 | Linear Algebra | L Chung |
| MA 521 | Abstract Algebra I | M Putcha |
| MA 537 | Nonlinear Dynamics and Chaos | J Franke |
| *MA 544 | Computer Experiments In Probability | J Silverstein |
| MA 555 | Introduction to Manifold Theory | L Norris |
| *MA(BMA) 574 | Math & Exper Modeling of Phys Processes II | Tran/Banks |
| MA(CSC) 580 | Numerical Analysis I | Z Li |
| MA 587 | Num Sol of Partial Diff Eq-Finite Element Meth | P Gremaud |
| MA 591M | Special Topics- Multivariable Calculus | J Rodriguez |
| MA 591N | Special Topics-Financial Math | J Fouque |

\* This class may be used for the math modeling requirement for AMA majors.

## MA 293B: Intro to Applied Math
### Spring 2002  1:30-2:20 MWF

http://www4.ncsu.edu/eos/users/w/white/www/white/ma226a.pdf

This three-credit course will be a survey of applications of mathematics and will be suitable for students who have taken multivariable calculus. This course will enable the AMA student to formulate a cohesive plan of study for the third and fourth years, which includes 15-27 elective credits related to applied mathematics. Mathematics education majors will find the variety of applications and a sampling of teaching styles to be very interesting. Also, prospective majors in pure or applied mathematics will find this to be a good survey of applied mathematics beyond calculus.

In the spring of 2002 there will be five three-week modules on:
Heat and pollutant transfer (R. E. White)
Acoustic waves and boundary conditions (H. T. Tran)
Cryptographic schemes (E. Stitzinger)
Biological applications (S. Lubkin)
Modeling of random phenomena (J-P. Fouque).
Each module will serve as motivation for future course work and related academic activities. Some mathematics will have to be developed "as is needed", but it is not necessary to fully describe the mathematical analysis related to the applications....this can wait for a subsequent course.

*People generally think more of the numbers and less of what is to me the interesting part: using the numbers to make decisions about everything under the sun.*

— *Hal Stern, mathematician*

# Math 493D- Long-Term Actuarial Models

Actuaries improve financial decision making by developing mathematical models to evaluate the current financial implications of uncertain events in the distant future. In this course, which is taught by a Fellow of the Society of Actuaries, students learn how to formulate and apply probability models incorporating future contingent payments and failure-time random variables. Since economic considerations, such as interest rates, often play a dominant role in long-term modeling, this course also introduces the student to the various quantitative measures of interest and annuities-certain. Students will learn how to calculate a variety of compound interest and actuarial functions using current software. Actuaries attain professional status by passing a series of examinations. For more information on the exams and entry-level jobs, refer to www.BeAnActuary.org and www.actuarialgrads.com, or contact the instructor at cwd0926@aol.com.

## Actuarial Science Openings:

Jefferson-Pilot in Greensboro may have both intern and permanent positions available, specifically:

Possible summer internships in the valuation department for NC State math students with excellent math and pc skills.

Currently there are four permanent actuarial positions open at JP. Some, but not all, positions require that applicants have already passed two of the actuarial exams.

Please email stacy_zearing@ncsu.edu for more information.

## MA 293C:  Matrix Applications and Computations

**Spring 2002  11:20-12:10 MWF**

http://www4.ncsu.edu/eos/users/w/white/www/white/mamac/mac_toc.htm

This is a one credit course on basic matrix computations, properties and applications.  It is directed at the first year undergraduate who has passed one semester of calculus (MA 121 or 131 or 141).  The material is organized in five groups of three lectures.  The five groups include visualization via matrices, algebraic systems, inverse matrices, least squares and eigenvalues.  Although the emphasis will be on hand calculations, Matlab will be used to demonstrate and extend the computations.  Each lecture will be motivated by an application, and some theory will be described. This one-credit course will be taught during a five week period with three 50-minute lectures in each week, and there will be three sections distributed among the first, middle and last thirds of the semester.

## Meet Di Bucklad

Di Bucklad is the Math Department's Office Assistant and secretary for Dr. John Griggs, the Coordinator of Classroom Instruction.  She has worked for the Math Department since June 2000 and has a long history of public and community service.  Prior to coming to NC State, she worked for the Wake County Register of Deeds for 8 years and as a teacher's assistant at Apex Elementary School for 7 years.

Di says she "loves working with kids."  She has been very involved with the youth program at her church, teaching Sunday School for the past 10 years and working with Appalachian Service Project (ASP) for 13 years.  ASP is a yearly event where members of the church's Youth Group travel to the mountains to repair homes for underprivileged families.  In addition to working with young people, Di also works at her church's booth at the State Fair each year, waiting tables and preparing "the best ham biscuits at the Fair."

Di was born and raised in Manteo, NC, home of "The Lost Colony."  She received her Associate's Degree in Business from Louisburg College and has lived in Cary, NC, since 1974.  She and her husband George have two sons in college: Brad, a senior at UNC-Asheville, and Steven, a sophomore at Appalachian.

## SUM News

The SUM club is designed for students who appreciate mathematics and wish to extend their knowledge and networking within the local mathematics neighborhood.  If you are one of these people then please stop by a meeting, you will not regret it.  (The SUM club has no dues and members are not expected to do extra work ☺). To receive updates about upcoming events, sign up for the SUM mailing list at the SUM website at http://www.math.ncsu.edu/GroupsOrgs/SUM

## Math Honors News

Eight students graduated in the Math Honors Program in May 2001:  Quinton Anderson, Darryll Lobasso, Alex Mayer, Tommy McAvoy, Alton Patrick, Marty Smith, Laura Weston, and Maggie Whitmeyer.  Nathan George graduated during the summer.  Alex Mayer is in grad school in physics at Cornell, Marty Smith is in grad school in operations research at Georgia Tech, Laura Weston is in grad school in Molecular Biophysics at Duke, Alton Patrick is deferring for one year and then will go to Georgia Tech for graduate work in computer science. Alton was also awarded both an NSF Fellowship and a Dept. of Defense Fellowship.  Quinton Anderson, Tommy McAvoy, and Nathan George are currently doing graduate work in math at NC State.

During the summer, Michael McDuffee participated in an REU at Rutgers, while David Weaver did an REU at the University of Illinois.

New students in the Math Honors Program include Jill Boroughs, Tim Bushnell, Luke Cherveny, Randy Clark, Chris Flake, Gigi Grizzard, Meng Liang, Chris Lipa, Jeremy Maness, Tim Mowrer, and Shashank Pandit.  Both Chris Flake and Luke Cherveny will participate in the Budapest Semesters in Mathematics next semester.

Students interested in finding out more about the Math Honors Program may contact Dr. Paur or other members of the Honors Program Committee (Dr. Misra, Dr. Norris, Dr. Shearer, or Dr. Tran) or check out the Honors Program web site at http://www.math.ncsu.edu/honors.

### *Mathematics is the glory of the human mind.*
*— Leibnitz*

## Pi Mu Epsilon Inducts Nineteen

Pi Mu Epsilon is the national mathematics honorary society. Nineteen students were inducted into the N.C. State Chapter of Pi Mu Epsilon last spring. The new members are:

| | |
|---|---|
| Samer Al-Ashhab | *Applied Mathematics* |
| Katie Baily | *Mathematics Education* |
| B.J. Buracker | *Mathematics* |
| Randy Clark | *Mathematics / Meteorology* |
| William Cook | *Mathematics* |
| Chris Flake | *Applied Mathematics* |
| Robert Futrell | *Computer Science / Applied Mathematics* |
| Greta Grizzard | *Electrical Engineering / Applied Mathematics* |
| Sharon Isley | *Statistics* |
| Alana Kirby | *Physics / Chemistry / Applied Mathematics* |
| Shalin Oza | *Mathematics* |
| Matthew Perry | *Mathematics Education* |
| Lauren Shupp | *Mathematics / Computer Science* |
| Joshua Smith | *Physics / Mathematics* |
| Laura Taylor | *Statistics / Applied Mathematics* |
| Jason Turner | *Applied Mathematics / Computer Science* |
| Joseph Wagner | *Nuclear Engineering / Applied Mathematics* |
| Kathryn Woodside | *Statistics* |
| Song Zhong | *Mathematics* |

# Can You Solve This?
## *Solutions to Previous Problems*

1.  If $A, B, C, D$ are four points in space such that $\angle ABC = \angle BCD = \angle CDA = \angle DAB = \pi/2$, prove that $A, B, C, D$ lie in a plane.

    Solution: Set up a $(x, y, z)$ coordinate system with $B = (0,0,0), C = (0, y, 0), A = (x, 0, 0)$. Let $D = (u, v, w)$. Then $\angle BAD = \pi/2$ implies that $u = x$, and $\angle BCD = \pi/2$ implies that $v = y$. From $\angle CDA = \pi/2$, it follows that $|AC|^2 = |AD|^2 + |DC|^2$, or $x^2 + y^2 = y^2 + w^2 + x^2 + w^2$, so clearly $w = 0$, and all four points lie in the $xy$ plane.

2.  Let $n$ be an integer. If the tens digit of $n^2$ is 7, what is the units digit of $n^2$?

    Solution: Let $n = 10x + y$, where $x$ and $y$ are integers, $0 \le y \le 9$. Then $n^2 = 100x^2 + 20xy + y^2$. Hence the tens digit of $n^2$ will be odd if and only if the tens digit of $y^2$ is odd. Hence $y^2 = 16$ or $y^2 = 36$, and the units digit of $n^2$ is 6.

3.  A geometric progression has three terms. The sum of these is 19 and the sum of the squares is 133. Find the terms.

    Solution: Suppose that $a + ar + ar^2 = 19$ and $a^2 + a^2r^2 + a^2r^4 = 133$. Then we have $(19)^2 - 133 = 2ar(a + ar + ar^2) = 38ar$, or $ar = 6$. From this, the two equations above can be reduced to $a + 6r = 13$ and $a^2 + 36r^2 = 97$. Solving for $a$ in terms of $r$ and substituting leads us to the quadratic equation $6r^2 - 13r + 6 = (3r - 2)(2r - 3) = 0$. Thus $a = 9, r = 2/3$ or $a = 4, r = 3/2$.
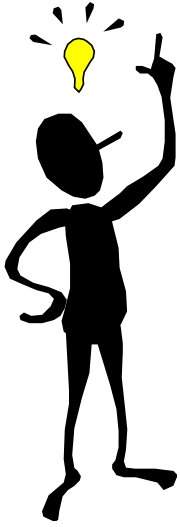
**Department of Mathematics**
**North Carolina State University**
**Campus Box 8205**
**Raleigh, NC  27695-8205**

# Wolfpack M$^6$ Contest

The Mathematics Department sponsors the Wolfpack Magnificent, Monthly, Mesmerizing, Money-Making, Minatory, Mathematical (M$^6$) Problem Contest for undergraduate students of North Carolina State University.  Each month of the academic year a problem is posted.  Sometimes the problem is somewhat tame, and sometimes it isn't!  The student submitting the first and/or the best solution for the month's problem is recognized and receives a cash prize of 1/100,000 of a Million Dollars!

Rules:
1. Contestants must be currently enrolled undergraduates at NCSU.
2. Submitted solutions must be complete and readable. Include your name, social security number, local address, class, and curriculum.
3. Submit your solution to Dr. Ramsay in HA 149 or email it to ramsay@math.ncsu.edu.  You can also leave it with the Math Department secretaries in HA 255.
4. The deadline for solutions will be posted with each problem.

Problems, winners, and solutions can be found at the contest website at http://www.math.ncsu.edu/undergrad/contest/

Spring 2001 winners:  Patrick Barrow (March), David Johnson (April)