Background

Mathematics is filled with exciting and surprising ideas. This summer, the Department of Mathematics at the University of Southern Mississippi will offer a unique class, Mathematical Culture, giving students an overview of a few of these topics. This course is designed for teachers, not researchers; the textbooks have been selected not for their potential as a reference for a professional mathematician, but for the enjoyment of reading their casual, yet careful, exposition at a level accessible to those who either lack a strong background in mathematics, or whose days of active study are in the past.

Topics and Texts

Ian Stewart, “Cows in the Maze”

Scientific American magazine often runs a column on recreational mathematics. Articles address questions such as,

- How can you arrange a fence to be as short as possible, yet block every line of sight? (It need not be closed, nor even continuous.)
- How do you make an ice cream cone into a square?
- What is the most common gap between two prime numbers?

These and other recreational problems can be explored, expanded, and re-examined. They stimulate new areas of study, and are accessible even to non-mathematicians, and reveal mathematical thinking in surprising places!

John Derbyshire, Prime Obsession

In the branch of mathematics known as number theory, it is easy to describe deceptively simple questions that flower into a beautiful, unexpected new field. One such question asks,

How many prime numbers lie between 0 and a positive integer $n$?

For example,

- if $n = 10$, there are 4 ($2, 3, 5, 7$);
- if $n = 100$, there are 25; and
- if $n = 1000$, there are 168.

In fact, no precise answer is known, although approximate answers exist. These are related to an unsolved problem called the Riemann Hypothesis. This textbook won the Mathematical Association of America’s first Euler Book Prize for its exceptionally good writing.

James Gleick, Chaos: Making a New Science

Nature is full of events for which a small difference in one variable has an enormous effect on the final result. For instance,

Does the flap of a butterfly’s wings in Brazil set off a tornado in Texas?

The question seems astonishing, yet the sensitivity of the variables that affect weather could imply this!

The study of chaos theory is related to fractals, a branch of geometry where objects can have “unnatural” dimension: a line is one-dimensional, and a plane is two-dimensional,
but the dimension of the Cantor Set is
\[ \frac{\log(2)}{\log(3)} \approx 0.6309. \]

This book was nominated for the Pulitzer Prize.

**Leonard Wapner, The Pea and the Sun**

Mathematicians ask some strange questions:

Can you take a sphere, split it into finitely many pieces, and rearrange them without stretching or squeezing, resulting in *two spheres of the same radius*?

That’s obviously impossible, right? In fact, *natural, fundamental* ideas of mathematics imply that *this is quite possible!* This text will introduce you to some characters from set theory who look perfectly sensible at first glance, but act in ways you would never expect!

**Goals and Expectations**

The goal of a traditional math class is *depth* of knowledge on a particular kind of problem-solving. The goal in this class is to expand students’ *breadth* of knowledge on a range of ideas that are genuinely mathematical but outside the mainstream of high school and undergraduate curricula. We want to nourish a joy and love for mathematics as the playground of the mind’s imagination.

Thus, this course will focus on reading, understanding, and writing about general ideas in mathematics. Class meetings allow the instructor to provide supplementary mathematical background and to elaborate on details that students find unclear. Assessment will be based on written essays and a project that demonstrate comprehension and the ability to communicate the material in a clear and correct manner.

**Prerequisites and Registration**

Interested? The only mathematical prerequisites are a familiarity with calculus and a willingness to think logically. We will use pre-calculus algebra and trigonometry, including matrix algebra, in ways that you may not expect. For student convenience, the class will meet in the evenings.

To register, you will need instructor permission; contact information appears below. This class will be offered in **Summer 2012** as **MAT 592**. As a graduate-level class, it counts for recertification. Students not enrolled in the university’s Center for Science and Math Education can enroll as a non-degree student. For details, visit

[www.usm.edu/graduate-school/](http://www.usm.edu/graduate-school/),
click on “Prospective Students”, subsequently on “Graduate Admissions”, and “Application for Non-Degree”.

Further information on the Department of Mathematics is available by email at [mathdept@usm.edu](mailto:mathdept@usm.edu)
or online at

[http://www.usm.edu/math/](http://www.usm.edu/math/)