MATH 495/573
HISTORY OF NUMBER THEORY

Nicholls State University, Spring 2005

Instructor: Dr. Brian Heck. My office is 106-E Peltier Hall and my office phone number is 448-4383 (4383 on campus). I will be available for office hours 2M (MWF), 2T (TR), and 5M, 6M, 7M (MW) (and by appointment). Please drop by if you have any questions. Also, my email is brian.heck@nicholls.edu.

If I am not in my office during my scheduled office hours, then I am wandering the halls of Peltier. Please hang around or come and find me. If I will be unable to hold office hours, I will put a note on my door.

Course Description/Text: There will be no required text. This course will be a humanities-style course that is approximately 75% history and 25% mathematics. Class will be conducted in lecture/discussion style. Please feel free to add your own comments, conjectures, and insights.

Number theory is a very special branch of mathematics. It's history dates back to the dawn of mathematics, and yet significant, current problems can be described to people with very little mathematical background. We will thoroughly explore the developments of this amazing field from the Babylonians and Greeks, through the Medieval and Renaissance periods, and well into the 20th century.

"All is number"
- Pythagorus (approx. 550 b.c.)

Course Objectives: At the completion of this course, a student will be able to:

- define perfect, abundant, deficient, prime, figurate, Fibonacci, Liouville, algebraic, and transcendental numbers
- explain the historical significance of many achievements in number theory
- discuss the lives and contributions to mathematics of many notable number theorists
- detail the chronological developments of number theory starting with the Babylonians and Greeks, through the rise of Islam and the Renaissance in Europe, and into the 20^{th} century

Grading Structure: We will have two exams, many assignments, and a research project. These will be described fully below. Each of the four components (2 exams, assignments, and project) will be equally weighted.

Exams: We will have a midterm exam and a final. Each exam will be in-class, closed notes, and quasi-comprehensive. Exam questions will be of the following types: true/false, multiple choice, short answer, matching, essay, and mathematical. You will be expected to know math, names, dates, and places (the "what", "who", "when", and "where" of mathematics). But perhaps more importantly, you will need to understand the origins and context (the "how" and "why" of mathematics).

Assignments: You will have an assignment every week. These will range in style over the various types of problems appearing on the exams. In fact, let's get it started. **Assignment #1** is to tell me something you may have already heard or learned of number theory. Get this to me (via email or in person) by **Tuesday, January 25, 2005**.

Research Project: The **undergraduates** in class will be assigned a term paper. It can be neither all history nor all mathematics. It should be self-contained mathematically (do not assume I know what you are talking about). If you have any doubts, let a friend read it. You should use at least two references, and they cannot be web pages. Much of what you read online (if you haven't already noticed) is inaccurate. Your paper should be written using the normal college formatting (regarding spacing, bibliography, etc). If you have any trouble with this, visit the WAC lab in the library. They would be glad to help you and I'm sure they would be trilled to learn that a math class requires writing. The length is up to you. Noted mathematical historian Fred Rickey once said,

> ...[a paper] has a natural length. You are telling a story
> which needs a certain background, exposition, and detail.
> When that is successfully done, stop.

Well put. You should turn in two copies so that I may keep one. The topic of the paper is partially up to you. I have a selection of topics you may choose from. If you have something different in mind, feel free to discuss it with me. I might let you do it. Come see me whenever you are ready (at least by midterm) to pick your topic.

The **graduate students** will be assigned a number theoretical topic to research. I will give you the topic and you are to prepare a short (30-40 minutes) presentation/lecture on the topic. After you have done the research, if you feel like you might need more time for your presentation, let me know and we'll work it out. I will grade this based on clarity of presentation, as well as accuracy and completeness of details. An evaluation by your peers will also be incorporated into your grade.

Course Outline: We will focus most of our attention on modern period of mathematics consisting of the 17^{th}, 18^{th} 19^{th}, and 20^{th} centuries. Number theory as a distinct field of mathematics was "born" in the 1600's. But we will also dip back into the ancestry of number theory and briefly examine how numbers arose, how they were studied in antiquity, and the evolution of number theory to modern times.

I. Origins of Mathematics
- A. Egypt and Babylon
- B. Greece
- C. The Far East
- D. The Middle East

II. The European Renaissance
- A. Leonardo of Pisa
- B. Italy and the Theory of Equations
- C. France and Prime Numbers
- D. Pierre de Fermat
- E. Carl Friedrich Gauss

III. The Modern Age
- A. Transcendental Numbers
- B. Hilbert
- C. Hardy, Littlewood, andRamanujan
- D. American Mathematics
- E. Cryptology

Disability: If you have a documented disability that requires assistance, you will need to register with the Office of Disability Services for coordination of your academic accommodations. The Office of Disability Services is located in Peltier Hall, Room 100-A. The phone number is (985) 448-4430 (TDD 449-7002).

Final Comments: I am looking forward to this semester and to engaging discussions on a variety of topics. By no means is class meant to be all "me talking, you listening." Please feel free to ask questions, express opinions, pose conjectures, and elaborate on areas where you have something unique to offer. In fifteen weeks, we will all be that much richer because of it.