Course Description.
This course will help students achieve an integrated working grasp of mathematical ideas, engage students in inquiry and reflection in the learning and practice of mathematics, help students develop a productive disposition in tackling mathematical problems, and develop the ability to communicate mathematics and mathematical ideas at all levels, both verbally and in writing.

The course will continue the inquiry-based learning environment of courses in the Mathematical Reasoning track in the undergraduate mathematics major. This course is not open to students who have had a similar course in the major. This course will integrate ideas from number, algebra, geometry, probability, and statistics. In doing this the student will gain understanding and ability in plausible reasoning, conjecture, and justification in the study of patterns and models, functions, and use of technology. The course will emphasize the use of functions as mathematical models, the various ways of representing functions, and the power and uses of these representations in different contexts, and the application of technology such as graphing calculators in the study of functions. Inquiry-based learning and appropriate technology will pervade the course. Students will be expected to communicate mathematics verbally and in writing through small group, whole group, and individual interactions.

Topics.
The course will include the following topics, divided among five fundamental categories. It is important to realize that these topics cannot be treated each in isolation, but only in relation to each other. Therefore, this should not be read as a timeline of the course.

(I.) Reasoning
- Deductive reason and its prime importance for mathematics
- Mathematically convincing arguments (leading to mathematical proofs)
- Inductive reasoning
- Reasoning by analogy
- Plausible reasoning
- What it means
- Developing ability to make educated guesses
- Developing critical ability

(II.) Patterns and Models
- Seeking and finding patterns in data, geometry, pictures, algebra, probability, and numbers
- Conjecture and plausible reason in finding significant patterns
- Functional relations based on patterns
- Building algebraic models from geometric and numerical patterns
- Exact and approximate representations

(III.) Relations and Functions
- The function concept and the notions of dependence; dependent and independent variables, domain and range.
- Multiple ways to represent a function, the questions they help us answer, advantages and disadvantages of each, and transforming one type of representation into another. Among the representations examined are:
  - Verbal descriptions of functions
  - Graphical representations
  - Numerical/tabular data
- Algebraic representations (mathematical formulas)
  - Functional notation and its uses
  - Discrete and continuous variables
  - Continuous and discontinuous functions
  - Piecewise defined functions
  - Comparison of functions
  - Slope and rate of change
  - Transformations and combinations of functions
  - Special types of functions, with practical, everyday examples of each:
- Linear functions, slope and intercept (extensive and varied approaches to these, with many examples of sources)
- Piecewise linear functions
- Quadratic functions
- Higher order polynomial functions
- Rational functions
- Exponential and logarithmic functions
- Trigonometric functions and periodic or repetitive phenomena or behavior
- Functions not fitting into any standard mathematical category, and how to deal with them

(IV.) Technology and functions, patterns, and models --- Use of graphing calculators will pervade the course

(V.) Communication: Writing and Speaking
- Communication of mathematics verbally and in writing
- Mathematics is not just a collection of techniques, but is a structured body of knowledge essential to the modern community and to science
- Writing is essential to mathematics, in proofs, explanations, descriptions, and in communication to others (e.g., teaching) and to ourselves
- "If you can't explain it, you don't fully understand it"

Prerequisites. You are expected to have taken MA 125, MA 313, and at least one of MA 314, 315, 316, or 317 (or graduate). If you do not meet these prerequisites, please see the instructor before continuing.

Course Structure. This is not a lecture course, but a hands-on course. Evaluation of student performance will be consistent with this approach.
Materials. All written textual materials will be provided. You will be required to purchase a graphing calculator within the first two weeks. The TI-84 Plus Silver Edition is recommended. The TI 84 Plus is approved. See instructor before purchasing some other graphing calculator.

Notebook. Students are required to have a notebook in which they can record class meeting notes, write reflections, file this syllabus, file instructor e-mail messages, and file other course related information.

Portfolio. Students will maintain with their notebook a portfolio of all work done in the course. A selection will be made from this portfolio and evaluated in lieu of a final exam.

Course Grades: Students earn their grade in the course through evaluation of their work and class participation. Course grade is determined by overall average of grades earned weighted as follows, on scale: 90-100=A, 80-89=B, 65-79=C, 50-64=D, and below 50 is F.

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<tr>
<th>Grade Element</th>
<th>Percent of Grade</th>
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<tbody>
<tr>
<td>Menu Work</td>
<td>25</td>
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<tr>
<td>Group Work</td>
<td>10</td>
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<tr>
<td>Participation</td>
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<tr>
<td>Portfolio</td>
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<td>Performance Assessments</td>
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<td>Reflections</td>
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<tr>
<td>Total</td>
<td>100</td>
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Rubric. The rubrics for evaluating all grade elements in the course will be made available to the students. The correspondence between rubric scores and letter grades on each piece of work evaluated will be made known. Graduate students will be held to a higher performance standard than undergraduate students. Written reflections are expected to show a maturity appropriate to graduate status.

Cell Phones. Student cell phones must be TURNED OFF and PUT AWAY during ALL class meetings.

Disability Support Services (DSS). DSS offers tutoring and special accommodations to students who qualify. The UAB DSS office is located on the fifth floor of the Hill University Center, telephone: 934-4205, e-mail: dss@uab.edu. Students who have a DSS-approved accommodation for extended test times will take quizzes and tests that have a longer time duration. See your instructor for further information.

Withdrawal: The last day for withdrawing from this course without the payment of full tuition and fees is January 11, 2011. The last day (graduate) to withdraw from this course with a grade of W is April 25, 2011. Students withdraw from a course by completing the appropriate paperwork in the UAB Registrar’s Office in the Hill University Center. The signature of the instructor is not required.