**Course Learning Goals**

1. Reach for Appreciation of the Aesthetics of Mathematical Patterns &
   Interconnections

2. Improve Abilities & Attitudes to Explore Open-Ended & Ambiguous Math Canvasses
   - Investigation Strategies

3. Improve Abilities to Express & Communicate Math Thoughts
   a. Definitions, Vocabulary, Phrases & Mathematical Grammar
   b. Notations, Tables, Diagrams, Formulas
   c. Organization

4. Develop Habits of Going at a Problem in More than One Way,
   and of Thoroughly Looking Back

5. Improve Mathematics Content Knowledge, in:
   kinds of numbers & numeration systems, rational numbers (fractions & decimals; manipulatives),
   approximations, size issues, combining numbers (addition, division, exponents & square roots),
   the concept of a function, basic ideas of algebra (commutativity, associativity, distributive law, identities,
   inverses), sets & subsets & counting combinations, prime numbers & divisibility criteria for whole
   numbers, the language of mathematics (equations, expressions, definitions, graphs, equivalences,
   vocabulary, reasons, conjectures), dimensional analysis (a.k.a. units or labels) in 'story problems'.
   the language of math: function, equation, expression, definitions, graph, equivalence, reasons, conjecture.

6. Make Connections with Previous Mathematics Learning

7. Improve Abilities & Attitudes for Working with Others — Diverse Perspectives,
   Personalities, Preparedness, Skill Assortments, Levels of Professionalism

8. Deepen Self-Knowledge and Awareness of Psychological Issues in Learning
   a. Dealing with Frustration, Confusion, Boredom, Apathy
   b. Enthusiastic Utilization of Instructor's Assistance & Direction

9. Improve Self-Assessment Abilities, Evaluating your own Learning & Performance
e-Resources: I will try to use some e-resources –
(2) I hope to use the Blackboard™ Learning System to post course materials, etc.
Details on these will be covered in future handouts. If you don’t have FSU e-mail or Blackboard account, get them at http://www.frostburg.edu/admin/acacom/access/studentaccountapp.htm and http://www.frostburg.edu/admin/cit/bbAccountRequest.htm

Course Methods: Investigative Projects with Reports; Lectures & Class Discussions; Presentations; Tests, Quizzes & Homework; Working with ‘Manipulative’ Conceptualization Tools; www & PC tools.

Handouts: The student should of course read all handouts (including this one!), even if they are not explicitly assigned. Sometimes you can use a handout as a starting-point for taking individual initiative to explore some issues more deeply. All handouts are fair game for quizzes & exams.

Text and Materials: While we will cover many topics covered in the text Mathematics for Elementary Teachers by Gary L. Musser and William F. Burger, we will not follow the presentation of that book. It will, however, be used as a resource. The instructor will provide investigative materials. Your results from those investigations, when written up carefully will comprise the balance of the course “text”. A folder or notebook for storing materials, graph paper, colored pens, calculator, ruler, etc. will be needed. The 6th Edition has an associated website with some nifty interactive activities, perhaps to be assigned as homework. The Updated 5th Edition includes most of these activities on a CD-ROM in the book. I have installed this CD-ROM on the dozens or so PCs in Dunkle Hall 208 (the program icon looks like the pyramid of spheres on the 5th edition cover, this icon being labeled by the title “MathEled”). I also strongly recommend that students purchase at the FSU bookstore the nearly free (FSU subsidized) Microsoft Office 2000 Premium CD-ROM ($20 vs. a normal price of a few hundred dollars) which includes among others WORD, Excel spreadsheet, PowerPoint (a beautiful program) – which are all well worth your learning! (& useful for this course); for info go to http://www.frostburg.edu/dept/math/wojnar/webpages/universal/techool3.htm

Basic Philosophy: Many educators currently believe that a person learns more thoroughly with confidence & long-term retention if s/he discovers new knowledge her/himself or co-discovers new insights via working with peers. “One learns by doing.” For the student such a learning experience is radically different from a traditional class where the facts are simply told to you. It demands persistence & positive mental attitude to work toward new knowledge rather than just being a sponge or a couch-potato learner. But discovery learning is surely a slower process than just receiving direct infusion of facts from a teacher or text. It took civilization thousands of years to build up our current mathematical knowledge (mathematicians are still discovering/creating new knowledge every day), and it is too inefficient to have students discover everything without some infusion from our accumulated warehouse of knowledge. This course strives to orchestrate a vitalized balance between dynamic discovery learning and infusion of knowledge from civilization’s warehouse of cumulative learning efforts. Another issue that affects this balancing act is that oftentimes a clear ‘big picture’ emerges only after a certain critical-mass of successful ideas have been built together into something which ends up being more than just the sum of the individual smaller ideas. In order to reach the culmination point where the full picture can be seen, either students must spend several semesters working at the ideas or else – to save time – there must be some infusion in a more traditional sense.
Regardless of the modality, discovery or infusion, there will at times be topics which are difficult to appreciate at the moment, topics whose beauty or worth only become more apparent after one reaches the culminating destination. The athlete or artist or musician or architect who doesn’t believe in a future beyond, will have difficulty sustaining her/himself through the rigors of training & exercise or seeming grunt-work, which might seem monotonous or overly removed from the culminating goal. A true teacher does not want to sadistically torture her/his students with nonredemptive exercises or topics; a true student will need entrust her/himself (partially) to the direction & demands of her/his well-meaning teacher.

Learning, whether via discovery or infusion or by a fusion of these two, whether done individually or working with other(s), will sometimes be daunting. It helps to have a blend of enthusiasm, persistent & patient courage, humility to accept the fact of one’s initial state of not knowing as well as humility to expose one’s confusions to peer(s) or teacher (or self?!).

Of course, any teacher (whether yours truly or yourselves a few years down the road from now) is not without his/her weakness. In the past some of my weaknesses were: slowness to return submitted work; insufficient explanation of the nature of my exams & grading. Hopefully (your hopes as well as mine) I shall be more organized this semester. My exam philosophy has been to present students with a huge smörgåsbord of questions - from which you can choose some questions to address thoroughly. Trying to eat an entire smörgåsbord is certain to leave one with indigestion, no matter how good the food. The hope of a smörgåsbord exam is that every student can find sufficiently many questions via which to manifest her/his learning. A short exam runs the danger of hitting all of a student’s weak areas. Another aspect of the exams stems from the fact that a large portion of this course is in problem exploration & problem solving - to test such goals, the exam must present students with some things that the students have never really seen before. This can be disconcerting to a student who expects to see only those facts which were directly addressed in classroom activities or homework.

Another unusual aspect of this course is that students are assumed to THINK without being told what to think - work items are sometimes not presented as explicit questions but rather as landscapes of information for which the student is first expected to formulate appropriate questions and secondly to try to answer those questions. For example, suppose you are presented the following collection of data: 60 mph, 180 miles, 30 mpg, $1.50/gal. The student can then create her/his own list of relevant questions: (i) how much time does the trip take? (ii) how much does gas for the trip cost? (iii) how much gas does the trip require? (iv) how much per mile does the trip cost? (v) how much gas per hour does the car use? (vi) how much money per hour does the trip consume? Part of your response is in the issue of organization of how you present your thoughts, e.g. perhaps the above six questions can be systematically arranged in a 3x2 rectangular table. Oftentimes, there are important insights that flow from a natural organization of your thoughts. Besides, organizing ideas in a table or other format can make it much easier to remember - one need only remember one big picture instead of remembering six separate facts. Of course, after you list your questions & organize them the next thing to do is to answer them. Thereafter the responsible student tries to organize the answers and to look for patterns in the answers, and for new questions that might still be explored. It is important to realize that some of the questions you come up with will be too difficult or require too much time to pursue. But the honest student will not fail to answer those questions which can be realistically addressed. Some questions would appropriately be responded to by your presenting plans or desires of what math issues you would like to pursue if you had greater resources.
National Principles for Mathematics Education:


There are ten standards: five content standards and five process standards that describe ways of acquiring and using content knowledge. Even though these standards apply to all grade levels the emphasis varies at different grade levels. The details of this variation are explained in Principles and Standards. These standards will continue to guide our study of mathematics in MATH 207 just as they do in MATH 206. The basic standards are listed below (and can be found on the inside cover of your text).

**Number and Operations Standard**
Instructional programs from prekindergarten through grade 12 should enable all students to—

- understand numbers, ways of representing numbers, relationships among numbers, and number systems;
- understand meanings of operations and how they relate to one another;
- compute fluently and make reasonable estimates.

**Algebra Standard**
Instructional programs from prekindergarten through grade 12 should enable all students to—

- understand patterns, relations, and functions;
- represent and analyze mathematical situations and structures using algebraic symbols;
- use mathematical models to represent and understand quantitative relationships;
- analyze change in various contexts.

**Geometry Standard**
Instructional programs from prekindergarten through grade 12 should enable all students to—

- analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships;
- specify locations and describe spatial relationships using coordinate geometry and other representational systems;
- apply transformations and use symmetry to analyze mathematical situations;
- use visualization, spatial reasoning, and geometric modeling to solve problems.

**Measurement Standard**
Instructional programs from prekindergarten through grade 12 should enable all students to—

- understand measurable attributes of objects and the units, systems, and processes of measurement;
- apply appropriate techniques, tools, and formulas to determine measurements.

**Data Analysis and Probability Standard**
Instructional programs from prekindergarten through grade 12 should enable all students to—

- formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them;
- select and use appropriate statistical methods to analyze data;
- develop and evaluate inferences and predictions that are based on data;
- understand and apply basic concepts of probability.
Problem Solving Standard
Instructional programs from prekindergarten through grade 12 should enable all students to—
• build new mathematical knowledge through problem solving;
• solve problems that arise in mathematics and in other contexts;
• apply and adapt a variety of appropriate strategies to solve problems;
• monitor and reflect on the process of mathematical problem solving.

Reasoning and Proof Standard
Instructional programs from prekindergarten through grade 12 should enable all students to—
• recognize reasoning and proof as fundamental aspects of mathematics;
• make and investigate mathematical conjectures;
• develop and evaluate mathematical arguments and proofs;
• select and use various types of reasoning and methods of proof.

Communication Standard
Instructional programs from prekindergarten through grade 12 should enable all students to—
• organize and consolidate their mathematical thinking through communication;
• communicate their mathematical thinking coherently and clearly to peers, teachers, and others;
• analyze and evaluate the mathematical thinking and strategies of others;
• use the language of mathematics to express mathematical ideas precisely.

Connections Standard
Instructional programs from prekindergarten through grade 12 should enable all students to—
• recognize and use connections among mathematical ideas;
• understand how mathematical ideas interconnect and build on one another to produce a coherent whole;
• recognize and apply mathematics in contexts outside of mathematics.

Representations Standard
Instructional programs from prekindergarten through grade 12 should enable all students to—
• create and use representations to organize, record, and communicate mathematical ideas;
• select, apply, and translate among mathematical representations to solve problems;
• use representations to model and interpret physical, social, and mathematical phenomena.

Advice, Office Hours, Attendance, Class Participation, Homework, Quizzes, Exams:
It is imperative that students attend all classes - the nature of this course makes your presence essential both to You & to your peers. Your grades on Project Reports will be docked depending upon your personal attendance record for that project, according to the following formula: Adjusted Project Score = Original Project Score × (% days attended/total # of project days). The responsible student will consult classmates and/or the instructor to learn anything missed by absence or tardiness. Students are in particular expected to attend class on days surrounding holidays - I have been known to hold a quiz or exam on such days. For the unavoidable cases, a student should notify the instructor BEFORE any absence. Making up of any missed dates will be entirely at the discretion of the instructor. An excess of absences &/or tardiness will make it impossible to earn an ‘A’ for the course, and even more absence or tardiness will incrementally make it impossible to earn a ‘B’ or ‘C’.

I strongly encourage class participation - questions are always welcome. If You just don’t bother to ask about a confusion, then You are in danger of suffering from an avalanche of subsequent difficulties. The nature of learning is that You start out not knowing the subject, so it is expected that You don’t understand things. It helps even to just frame your question, trying to put a finger on what You don’t understand. Learning is not supposed to be always easy; there’s nothing wrong (in fact there’s something admirable) in going back repeatedly at something that was first confusing, and that even at second or third attempt was still confusing. Developing persistence will yield You lifelong rewards. Even after You get a problem or concept, You still need to work at it to get it secure, in your bones - it’s extremely worthwhile to
review problems after solving them. Try to secure, lock in, and deepen your understanding by reviewing a successful problem to see how the pieces fit together, and what strategies You used to solve it. Even put your answer aside, and do the successful problem over again from scratch. The extra ounce of dedication moves a student from the common situation of saying “But I understood it in class or on the homework” or “I think I understand it” to “Now I understand this and how it ties in with other things I’ve learned” and “I’m proud of my exam”. Without the extra ounce of dedication, too frequently do many hours of effort not quite bear fruit, or the fruits are undergrown or spoil quickly. Just as in sports and many other areas of life, it’s that extra effort that brings success.

Tentative Grading (subject to adjustment):

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
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<tbody>
<tr>
<td>CARE*</td>
<td>5%</td>
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<tr>
<td>Quizzes &amp; Homework</td>
<td>19%</td>
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<tr>
<td>Project Work/Service Learning</td>
<td>19%</td>
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<tr>
<td>2 (or 3) Term Exams</td>
<td>32% (or 36%) #</td>
</tr>
<tr>
<td>Final Exam</td>
<td>25% (or 21%) #</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
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*CARE (Committed Action of a Responsible Educator) Initiative: It is presumed that one who aspires to teach has a hunger & thirst for learning. Thus it is natural to expect that one aspiring to be a teacher would go beyond the standard confines of a course & do more than is explicitly asked of you, you, your course average will be 95% — to get that last 5% you must do some things extra. Such initiative might be: fiddling with some related ideas at home, going beyond what was asked, and presenting your efforts to the class or to the instructor; responding more thoroughly to some of the “for your benefit” handouts; exploring the WWW; reading the NCTM (National Council of Teachers of Mathematics) Principles and Standards for School Mathematics (newly issued April 2000 goals & strategies for mathematics instruction); reading a book; watching & reporting on a mathematics PBS program; providing special help to a struggling classmate; working in my office hours or help sessions; making up your own assignments; etc.

# Exam Weights Benefit: Your best of the 3 exams will be weighted an additional 4% (thus if your best exam is 1 of the 2 term exams it will count for 20% = 16% + 4%, or if your best exam is the Final, it will count for 29% = 25% + 4%), while your worse of the 2 term exams will be weighted 4% less (thus making it count for 12% = 16% - 4%). However, this benefit will be lost if you display substandard class participation and/or attendance.

Academic Dishonesty: Cheating or plagiarizing is very serious & will normally yield a grade of “F” in the course. Students are expected to understand the meaning of the terms cheating and plagiarizing (see the Pathfinder pp.4-7).

Disruptive Behavior: A faculty member may require a student to leave the classroom when his/her behavior disrupts the learning environment of the class. A student found responsible for disruptive behavior in the classroom may be administratively withdrawn from the course (see Student Code of Conduct).

Use My Office Hours & Help Sessions! I am here for You. Better than any tutor, I know what aspects of the course material that I want emphasized in what fashion & in what depth. Besides, it impresses any instructor that a student comes to office hours prepared with specific questions that the student has worked at. A good idea is to make it a point to force yourself to visit
my office hours sometime within the first 2½ weeks of the semester – if You wait until You feel utterly confused, then You might (unjustifiedly) begin to feel uneasy about baring your soul & your confused brain to the person who will give You a grade. (This attitude is the bigger mistake.) Don’t worry! You are supposed to be confused & struggling - learning starts with absence or incompleteness of knowledge, and it’s my job to help You change that. Just like if You have a bank loan or doctor’s bill & You can’t make the payment schedule, the best course of action is to face the situation, calling up the creditor BEFORE the payment is due and letting them know that You want to pay but are suffering temporary difficulties. They don’t like the surprise of seeing missed payments without forewarning.

How to Get the Most Out of This Course: Stay on top of the material from the start. Mathematics frequently builds on earlier material, so it’s a mountainous task to try to catch up after falling behind. Make me work for my pay - utilize my office hours. Make yourself work for your grade, and more importantly for general good habits that will last a lifetime. Get & stay enthusiastic. Don’t sell yourself short by curtailing your efforts if You get annoyed at your instructor’s imperfections or at your own imperfections (we all have plenty). Communicate with your instructor. Work both with classmates (best is with different ones, sometimes a single other, sometimes a group) as well as independently. Strive to develop the habit of checking your own work (this is a nice freebie in math, that there often are some direct ways of checking a solution to assure us that our efforts were not flawed - many other fields have no such “double-checks” available). One such doublecheck method is to work the problem in two or more different ways. By seeing a problem in more than one way, one deepens one’s understanding, & develops self-confidence. The habit of looking at things from different perspectives is a valuable life habit, and develops respect for other person’s ways of thinking. The more You can check your own work, the more You build your self-confidence. Self-confidence is the key to unlocking your potential, in particular during an exam. So many times we hear a student say within minutes of leaving an exam “@*%! I knew how to do that one!” Avoid this by practice & confidence.

Best success on all your courses this semester!

Final Exam: Begin preparing 3 weeks in advance!
Section 003 Wednesday, 17 December 2002 11:15 a.m. – 1:45 p.m. (in regular classroom)

Mid-Semester Warnings: 14 October.
Thanksgiving Break: November 27 - 30
Withdraw Deadline "W": 27 October
Withdraw Deadline "WF": December 12

(** The instructor reserves the right to alter any course policies as circumstances dictate.)