MA 411/511 - 7P – Integrating Mathematical Ideas

UAB Department of Mathematics - Spring 2024

Instructor: Dr. Tricia Phillips
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Class Time: W 5-7:30pm (University Hall 4002)
Office Hours: M 2:30-3:30, W 3:30-4:30, R 12:30-1:30, or by appointment
Office: University Hall 4053
Phone: 205-934-2154

Class Materials: You will need graph paper, scissors, a ruler, colored pencils or pens, and a binder or folder to organize handouts from class. There is no official textbook for this course.

Course Description: (3 semester hours). This course will integrate ideas from algebra, geometry, probability, and statistics. Emphasis will be on using functions as mathematical models, becoming fluent with multiple representations of functions, and choosing the most appropriate representations for solving a specific problem. Students will be expected to communicate mathematics verbally and in writing through small group, whole group, and individual interactions. *Prerequisite*: Minimum grade of C in (MA 125 or MA 225) and MA 314, or MA 316.

Course Overview:
This course serves as the capstone course for the Mathematical Reasoning Track. It 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 other courses in the Mathematical Reasoning Track. The course will integrate ideas from numbers, 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. Inquiry-based learning will pervade the course, as well as an emphasis on communication skills.

Learning Outcomes: Upon successful completion of this course, a student will be able to:

- apply reasoning to problems, including:
  - deductive reasoning
  - mathematically convincing arguments (leading to mathematical proofs)
  - inductive reasoning
  - reasoning by analogy
  - plausible reasoning
  - educated guessing
  - critical ability
- identify patterns in data, geometry, pictures, algebra, probability, and numbers, and develop models, including:

  - using conjecturing and plausible reasoning in finding significant patterns
  - functional relations based on patterns
  - building algebraic models from geometric and numerical patterns
  - exact and approximate representations

- demonstrate knowledge of relations and functions, including:
  - concept of a function and 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, with representations including:
    - 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

- communicate mathematical ideas orally and in writing including making mathematically convincing arguments;
  - 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
  - understanding that "if you can't explain it, you don't fully understand it"

- demonstrate the ability to interact within groups, and with the class as a whole, while demonstrating cognizance of working with peers at different levels; and
- demonstrate a positive disposition toward persistence and reflection in doing mathematics.

Grades

Grade Components: All grades will be posted on Canvas.

Assignment	Percent
Attendance/Participation	4
Reading Reflections	6
Menus	25
Project	5
Midterm Exam	25
Mathematics Portfolio	10
Final Exam	25

Final Grades: The final grade for this course will be assigned using the following scale:

Total Points	90-100	80-89	70-79	60-69	0-60
Letter Grade	A	B	C	D	F

Specific grade cases:

- Earning an overall A on coursework prior to the Final Exam *and* having perfect attendance throughout the term will make the Final Exam optional.
- Missing 4 or more classes during the semester that are unexcused will result in an automatic F for the course.

Assignment Descriptions

Attendance/Participation:

Attendance and active participation in all class sessions is required. Missing 4 or more classes (25% or more) with unexcused absences will result in a grade of F for this course; note that official university activities, documented illness, and jury or military duty are excused. Attending class but not actively participating results in a score of 50% for that class session. Attending class and actively participating results in a score of 100% for that class session.

Reading Reflections:

You will turn in a paper copy of a 1 - 1.5 page reflection at the beginning of class on the due date for each reading assigned either in paragraph or bullet form. Participation in class discussions regarding the readings are also required.

Menus:

Menus consist of a set of problems you will work on solving throughout the term and that which you will hand in a neatly written paper copy at the beginning of class on the given due dates. Using GoodNotes is a great option if you choose to write on a tablet but must be printed off and turned in via hard copy.

Project:

This assignment will offer students the opportunity to create a visual, aural, or tactile representation of the concepts and tasks we have covered in class. You will hand in your project at the beginning of class on the given due date.

Midterm Exam:

This will occur during our regularly scheduled class time and a set of problems will be given to solve.

Mathematics Portfolio:
This assignment will include tasks to demonstrate the development and growth of your conceptual understanding, use of processes and strategies, problem-solving abilities, and abilities to communicate mathematically. You will turn in a paper copy at the beginning of class on the given due date.

Final Exam:
This will be a take-home final in which a set of problems will be given to solve. You will turn in via email on the due date. Note: If you achieve an A in the course prior to the Final Exam and have perfect attendance, you are not required to take the Final Exam.

Class Policies & Student Expectations
Class Preparation & Collaboration:
I expect you to show respect to the instructor and classmates by putting away distracting items such as cell phones and coursework not related to our class. I ask that you have a positive and productive disposition toward yourself, your classmates, and mathematics and are respectful of fellow classmates and the instructor as you share ideas. During group work, I expect everyone to contribute to the discussion (if you don't know how to answer the question, then *ask* a question).

You are expected to spend a substantial amount of time working through the course activities and assignments every week. Please know that time management and self-motivation are key components for success in this course. In addition to class time, you should spend about 6 hours per week reading, studying, preparing for class discussions, and/or completing assignments.

You may collaborate with peers on solving menu tasks. However, it is imperative that you are able to solve problems on your own to be prepared for the exams. A good guideline is that after you have solved a problem, you should feel confident that you are able to explain your solution to the class.

Make-up Policy:
There are no make-ups for assignments and no late submissions are accepted. If a student has an unplanned, emergency circumstance that temporarily prevents them from participating in the class (such as a documented hospitalization or mandated isolation for Covid-19), then the instructor should be contacted to discuss.

Instructor Support - Emails & Office Hours:
I will respond to your emails as promptly as possible (usually within 24 hours, except on weekends). If you email me after 5pm, expect a response the next day unless it is over the weekend in which case I will respond the beginning of the following week. Please check your email and Canvas course regularly for announcements and updated class documents. Students are expected to check their UAB email daily and respond within 24 hours to instructor emails (with the exception of weekends). All students are required to obtain and use the UAB email address that is automatically assigned to them as UAB students, as official correspondence will be sent ONLY to your @UAB.edu email address.

During office hours, you may drop by without making an appointment to receive assistance on any assignment.

AI Tools:
The use of AI tools is strictly prohibited in this course. Academic misconduct is present in an academic work wherever AI assistance has been used when unauthorized. Such behavior is considered deceit and a violation of UAB's shared commitment to truth and academic integrity. Deceit constitutes academic misconduct and is subject to review according to UAB's Academic Integrity Code. The developments around AI are in flux and the rules that are expressed in this syllabus are subject to change on short notice.

Success Tips:
Hard work goes a long way and the more effort you put in, the more understanding you will have – that includes coming to class on time, fully participating in the activities of the day, and spending 6-8 hours outside of class completing assignments, reviewing notes, and reading for understanding. Actively participating in class dialogue, rather than simply observing, is essential for understanding. Most importantly, ask questions – inside the classroom, in office hours, or over email. The earlier on you ask questions, the better, since concepts in mathematics build upon each other. Although you are responsible for your own learning, I encourage you to communicate with me so I know best how to help you succeed. I offer the following pieces of advice for your consideration:

- Review notes and do math every day.
- Actively participate in class every day.
- Help each other.
- Go to office hours.
- Analyze and understand your mistakes.
- Ask plenty of questions.
- Don't let yourself get behind.
- Go to the Math Learning Lab.

UAB Policies & Resources:

Math Learning Lab (MLL):
Located in Heritage Hall 202, the MLL offers in-person tutoring (no appointment needed). Tutors will not help with graded assignments, solve all of your problems, or work with you for extended periods of time, but they will help guide you so that you can complete your work independently. Be sure to bring your class materials with you. The MLL is open Monday-Friday from the first day of class to the last day of class. Tutoring is not available during holidays, breaks, and Final Exam week. No food or drink is allowed except bottled water.

University Academic Success Center (UASC):
The UASC provides students with a host of free services and resources that include Tutoring and Supplemental Instruction. For more information, click here.

Academic Misconduct:
The University of Alabama at Birmingham expects all members of its academic community to function according to the highest ethical and professional standards. It will be important that you review and become familiar with the University's Academic Integrity Code found here.

Disability Support Services Accessibility Statement:
UAB is committed to providing an accessible learning experience for all students. If you are a student with a disability that qualifies under the Americans with Disabilities Act (ADA) and Section 504 of the Rehabilitation Act, and you require accommodations, please contact Disability Support Services for information on accommodations, registration, and procedures. Requests for reasonable accommodations involve an interactive process and consist of a collaborative effort among the student, DSS, faculty, and staff.

If you are registered with Disability Support Services, please contact them to discuss accommodations that may be necessary in this course. If you have a disability but have not contacted Disability Support Services, please call (205) 934-4205, visit their website, or visit their office located in Hill Student Center Suite 409.

Title IX Statement:
UAB is committed to providing an environment that is free from sexual misconduct, which includes gender-based assault, harassment, exploitation, dating and domestic violence, stalking, as well as discrimination based on sex, sexual orientation, gender identity, and gender expression. If you have experienced any of the aforementioned conduct we encourage you to report the incident through one of several avenues for reporting. For more information about Title IX, policy, reporting, protections, resources and supports, please visit the UAB Title IX webpage for UAB's Title IX, UAB's Equal Opportunity, Anti-Harassment, Duty to Report, and Non-Retaliation policies.

Tentative Schedule

Class #	Date	In-Class	Assignment Due
1	W: Jan 10	Course Intro Number Talks Tiles/Flowerbed Task Function Families Pre-Assessment	
-	T: Jan 16		*Last Day to Drop/Add*
2	W: Jan 17	Generic Number Talk Navigating the Pentagon: Graphing Expression make sense? Growing Dots A,B,C Rod Stamping into Menu 1	
3	W: Jan 24	Number Talk: multiplication Discuss: Ruth Parker article One pattern: three expressions Menu 1 work: Roller Coaster, Dalia's Process Growing Dots Process Rod Rafts	Reading Reflection #1
4	W: Jan 31	Number Talk: multiplication Discuss: Skemp article Group Task: Squareable Numbers Menu 1 work	Reading Reflection #2
5	W: Feb 7	Number Talk: multiplication Process: Squareable Numbers Always, Sometimes, Never True? Group Task: Linear or Quadratic Menu 2: In/Out Tables Graph Trip to UAB Café Allegro into Menu 2	Menu 1
6	W: Feb 14	Student Number Talk #1: multiplication Discuss: Reinhart article Group Task: Is it a function? Process Café Allegro: analyzing standard form Seeing Red into Menu 2 Midterm Review	Reading Reflection #3
7	W: Feb 21	Midterm Exam	
8	W: Feb 28	Student Number Talk #2 Discuss: Thinking Classroom article Exploding Dots: Intro	Reading Reflection #4
9	W: Mar 6	Student Number Talk #3 Group Task: Averages Increasing Pattern #5 a,b,c Exploding Dots: Insight	
-	Mar 11-17	*Spring Break - No Classes*	

Class #	Date	In-Class	Assignment Due
10	W: Mar 20	Student Number Talk #4 Discuss: Knuth article Car Crash Task Exploding Dots: Addition	Reading Reflection #5
-	F: Mar 22		*Last Day to Withdraw ("W")*
11	W: Mar 27	Student Number Talk #5 Exploding Dots: Addition and Multiplication M & M Problem	Menu 2
12	W: Apr 3	Student Number Talk #6 Discuss: Su article Exploding Dots: Subtraction	Reading Reflection #6
13	W: Apr 10	Student Number Talk #7 Exploding Dots: Division	Project
14	W: Apr 17	Student Number Talk #8 Exploding Dots: Place Value & All Bases Video: factoring issue Problem & Resolution	Portfolio
-	W: Apr 24		Take-Home Final by 7pm (email)

Note: The course syllabus and schedule serve as a contract by which the student must comply. The syllabus and schedule are subject to changes through announcements made in class and/or email.