MATH 395-A: Undergraduate Seminar in Mathematics Fall 2012

Instructor information:

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Catalog description:

Selected topics in pure or applied mathematics. Introduction to undergraduate research. Written presentation and group discussion on selected mathematical topics and applications. Prerequisite: Departmental approval.

By the end of this course, students will...

1) Explain and demonstrate how to learn mathematics
2) Write mathematics, including formal proofs
3) Research mathematics
4) Present mathematics
5) Explain what it's like to be a professional mathematician
6) Locate and evaluate mathematics resources
7) Use free, open source mathematical software, including LaTeX, PSTricks, Maxima, Octave, R, and GeoGebra
8) Identify and remediate any weaknesses in content knowledge
9) Complete the Major Field Test in Mathematics

Course materials for Mathematics Majors (all materials are optional):

Textbook: Binder, D. & Erickson, M. *A Student's Guide to the Study, Practice, and Tools of Modern Mathematics.*
ISBN: 978-1-4398-4606-3

LaTeX

Software: : PCTeX (30-day free trial for Windows): http://www.pctex.com/trial-versions6.html
TeXnicCenter (free for Windows): http://www.texniccenter.org/resources/downloads
TeXShop (free for OS X): http://pages.uoregon.edu/koch/texshop/
MacTeX (free for OS X): http://www.tug.org/mactex/

PSTricks: PSTricks: http://tug.org/PSTricks/main.cgi
LaTeXDraw (free for Windows and OS X): http://latexdraw.sourceforge.net/
jPicEdt (free for Windows and OS X): http://jpicedt.sourceforge.net/site/index.php

CAS: Eigenmath (free for Windows and OS X): http://eigenmath.sourceforge.net/
Maple: (free 30-day trial): http://www.maplesoft.com/contact/webforms/maple_evaluation.aspx
Mathematica (free 15-day trial for Windows and OS X): http://www.wolfram.com/mathematica/trial/
Mathway (free web-based): http://www.mathway.com/
Maxima (free for Windows): http://maxima.sourceforge.net/
Octave (free for Windows and OS X): http://www.gnu.org/software/octave/download.html
Wolfram Alpha (free web-based): http://www.wolframalpha.com/
YACAS (free web-based, Windows, OS X): http://yacas.sourceforge.net/homepage.html

Statistics: R (free for Windows and OS X): http://cran.r-project.org/
SPSS (free trial): http://www-01.ibm.com/software/analytics/spss/downloads/trials.html
Stata ($32 - $179 license with GradPlan ID: MATP3): http://www.stata.com/coursegp.html
Tableau (free trial for Windows): http://www.tableausoftware.com/products/trial
Tableau Public (free for Windows): http://www.tableausoftware.com/products/public

Practice exams: Major Field Test sample questions: http://www.ets.org/Media/Tests/MFT/pdf/mft_mathII.pdf
GRE Math Practice Book: http://www.ets.org/Media/Tests/GRE/pdf/Math.pdf
GRE Math Review: http://www.ets.org/Media/Tests/GRE/pdf/GREmathPractice.pdf

Course materials for Mathematics Education Majors (all materials are optional):

Textbooks: Devlin, K. *Mathematics Education for a New Era: Video Games as a Medium for Learning* ISBN: 978-1-5688-1431-5

Lockhart. *A Mathematician's Lament: How Schools Cheat Us of Our Most Fascinating & Imaginative Art Form*. ISBN: 978-1-9341-3717-8

NCTM. *Readings in Secondary Mathematics Education - Course Pack*. http://nctm.org/catalog/product.aspx?ID=14062

NCTM. *Elementary Mathematics Methods: Course Pack for Iowa State University.* http://www.nctm.org/catalog/product.aspx?ID=14037

Sultan. *The Mathematics that Every Secondary School Math Teacher Needs to Know.* ISBN: 978-0-4159-9413-2.

Geometry Software: Cinderella (free basic version for Windows and OS X): http://www.cinderella.de/tiki-index.php
GeoGebra (free web-based): http://www.geogebra.org/cms/en/download

Practice exams: Illinois Certification Testing System study guide: http://www.icts.nesinc.com/PDFs/IL_field115_SG.pdf
Illinois Certification Testing System framework: http://www.icts.nesinc.com/PDFs/IL_fld115_FW.pdf
California Math Test framework: http://www.cset.nesinc.com/PDFs/CS_mathematics_SMR.pdf
California Math Test sample exams: http://www.cset.nesinc.com/CS_testguide_Mathopener.asp

Blogs: Devlin's Angle: http://www.maa.org/devlin/
Think Thank Thunk - http://www.shawncornally.com/
dy/dan - http://blog.mrmeyer.com/
Illuminations: http://illuminations.nctm.org/
Common Core Standards: http://www.corestandards.org/

Grading methods & criteria:

Student grades will be based on the quality of student projects. Each student will work with the instructor to develop an agreed-upon rubric for evaluating projects. All students will give some kind of presentation of their projects.

Attendance policy:

This workshop course is an opportunity for you to work independently on projects to better prepare you for certification exams and applications for employment and graduate school. You will be expected to attend all scheduled meetings with the course instructor. If you miss meetings without notifying the instructor beforehand, the lack of professionalism will be represented in your final grade.

Accommodations policy:

Students with disabilities who believe they may need accommodations in this class are encouraged to contact the Office of Services for Students with Disabilities at 333-6275 as soon as possible to better ensure that such accommodations are implemented in a timely fashion

Academic integrity policy:

Review the SAU policy at http://web.sau.edu/Registration/documents/AcademicIntegrityPolicy.pdf

Policy on the use of electronic equipment:

You are free to use any appropriate resources strategically.

Course procedures and expectations:

This writing intensive, project-based workshop course, serving as a capstone to your mathematics program, gives you an opportunity to more fully prepare yourself for employment or graduate school. While each student in this course may have a unique experience, it is expected that all students will meet the 8 learning outcomes listed on the first page of this syllabus.

All Students -- First meeting with instructor:

During the first week of classes, you must send an email to the course instructor and schedule a face-to-face meeting. At this preliminary meeting, we will discuss your plans after graduation and design the course to prepare you for those plans. If you're planning on teaching math in an elementary/secondary school, applying for graduate school, applying for a job in a specific field, or even if you have no idea what you will do after graduation, we will work to make this course as meaningful and useful as possible.

As a result of this initial meeting, we will develop a course plan identifying the projects and activities you will complete this semester. You will have at least one week to research possible project ideas and think about what you want from this course. By the end of the second week of classes, you will be required to submit a **formal course plan** that specifies the projects you will complete and the rubric by which your projects will be evaluated. This plan should reflect expectations for a 1-credit 300-level course. The plan should also ensure you complete a significant amount of writing (approximately 6,000 words or 16 standard pages of text).

Math Majors:

Mathematics majors usually plan on employment or graduate school after graduation. Because of this, your formal course plan should be designed to remediate, deepen, and extend your mathematical skills and knowledge. Projects you complete in this course should strengthen your application for employment or graduate school.

One way in which we will remediate and deepen your understanding of mathematics is explained in the "All Students -- Mathematics Exams" section below. Another straightforward, meaningful way to review and extend your understanding of mathematics is to work through the optional course textbook, *A Student's Guide to the Study, Practice, and Tools of Modern Mathematics.* This 260-page textbook, which is listed for $30 on Amazon, presents 19 short chapters on the study, practice, and tools of mathematics. Each chapter is designed to give you a better idea of what mathematics is; how mathematics is researched, written, and presented; what mathematicians do; and what tools mathematicians use.

It would be entirely appropriate to develop a formal course plan that states you will work through the course textbook, take the Mathematics Exam at the end of the course, and complete a single project in an area that interests you. In working through the textbook, you would be expected to read 4 of the 8 chapters in Part I, completing at least 3 exercises at the end of each chapter. You would also be expected to learn the basics of at least 4 of the 14 mathematical tools described in Part II, completing at least 3 exercises at the end of each chapter. The exercises at the end of each chapter are not like exercises in other math books. Rather than having you solve problems, these exercises have you explain concepts, research and summarize significant historical events in mathematics, and use mathematics-specific software to analyze, format, write, and present mathematics. These exercises prepare you for the work that would be expected of a mathematician in graduate school or employment.

Rather than working through the course textbook, you may develop an alternative formal course plan (such as one that states you will complete 2 major projects and one mini project by the end of the semester). The work you complete in this course is up to you -- as long as it meets institutional and instructor expectations for a 1-credit, 300-level, writing intensive course. See the example formal course plan at the end of this syllabus for more ideas.

Math Education Majors:

I expect most Math Education majors plan to teach after graduation. Because of this, your formal course plan should not only be designed to remediate and deepen your mathematical content knowledge, but also to improve your pedagogical skill.

One way in which we will remediate and deepen your understanding of mathematics is explained in the "All Students -- Mathematics Exams" section below. If you're planning on teaching in Illinois, let me know and we'll focus on preparing you for the Illinois Certification Test in Math. If you're planning on teaching in Iowa (or anywhere else) or if you're planning on attending graduate school, we'll focus on preparing you for the GRE or another state certification exam.

To prepare you for teaching, it would be entirely appropriate to develop a formal course plan that states you will (1) summarize and review one mathematics education book, (2) develop or contribute to a mathematics education blog weekly, (3) take an appropriate Mathematics Exam at the end of the course, and (4) complete one major project in an area that interests you (which could focus on the development of instructional materials, research in mathematics education, or any other appropriate idea). Page 2 of the syllabus lists a few blogs and math education books you could use to fulfill your formal course plan.

The work you complete in this course is up to you -- as long as it meets institutional and instructor expectations for a 1-credit, 300-level, writing intensive course. Use this course as an opportunity to learn about something new. Do not turn-in work that you have completed in another course. Because work completed in this course is intended to help you prepare for your post-graduation plans, your work may be shared with your academic advisor. See the example formal course plan at the end of this syllabus for more ideas.

All Students -- Mathematics Exams:

By the end of the semester, all students will take at least one standardized mathematics assessment. Mathematics majors will take the Major Field Test in Mathematics (published by ETS). Mathematics Education majors can choose to take the Major Field Test, a sample state mathematics teacher certification exam, or another readily available standardized test. These tests will be administered at no cost to students and scores on the tests will not impact grades in this course. Exam scores will primarily be used to make improvements to the Mathematics program at SAU.

To better prepare you for the exam, we will set aside the final two weeks of class to review practice exam questions. As an incentive, the Chair of the Mathematics Department will write a letter to any student who outscores the national average on the Major Field Test. This letter can be included in an application for employment or graduate school.

Working in Groups:

In preparing for the final exam, reviewing or working through course textbooks, or working on projects, you may choose to work in pairs. All students must complete at least one major project (or course component) individually.

As an example, Mathematics majors may choose to work together in completing exercises from the *Student's Guide* book and reviewing for the final exam. Each Mathematics major then must complete a unique project individually.

As another example, Math Education majors may choose to work together in reviewing a mathematics education book, developing a math education blog, and reviewing for the final exam. Each Math Education major must then complete a unique project individually.

To work with another student, you must get approval from the course instructor as part of your formal course plan.

Course Progression:

Don't fall behind in this seminar course. On 9/23 and 11/4, you will be required to send a brief progress report to the course instructor. This report should briefly explain any progress you've made on your formal course plan and include any work you've completed. As a result of these progress reports, we will schedule a meeting to discuss your progression.

If, at any point throughout the semester, you wish to meet with the course instructor, just send an email. If you find your original formal course plan was too ambitious, or if you change your mind and think of a better project, we can work to redesign your formal course plan to better meet your needs.

Week 1	Read syllabus. Send email to course instructor to schedule preliminary meeting. Discuss future plans and design course around those plans. Work on **formal course plan.** Email instructor with any questions you have.
Week 2	Continue working on formal course plan. Meet with instructor to get any assistance. **Formal course plan** is due on 9/2. Begin working on projects identified in the formal course plan.
Week 3	Work on projects and activities identified in your formal course plan. Meet with course instructor if you have any questions or need any assistance.
Week 4	Work on projects and activities identified in your formal course plan. Meet with course instructor if you have any questions or need any assistance.
Week 5	**By 9/23, send a progress report indicating your progression through your formal course plan.** **Send a draft of your project (or any work you have completed) to the course instructor.** **Schedule a meeting with course instructor to discuss progression.**
Week 6	Work on projects and activities identified in your formal course plan. Meet with course instructor if you have any questions or need any assistance.
Week 7	Work on projects and activities identified in your formal course plan. Meet with course instructor if you have any questions or need any assistance.
Week 8	Work on projects and activities identified in your formal course plan. Meet with course instructor if you have any questions or need any assistance.
Week 9	Work on projects and activities identified in your formal course plan. Meet with course instructor if you have any questions or need any assistance.
Week 10	Work on projects and activities identified in your formal course plan. Meet with course instructor if you have any questions or need any assistance.
Week 11	**By 11/4, send a progress report indicating your progression through your formal course plan.** **Send a draft of your project (or any work you have completed) to the course instructor.** **Schedule a meeting with course instructor to discuss progression.**
Week 12	Work on projects and activities identified in your formal course plan. Meet with course instructor if you have any questions or need any assistance.
Week 13	**Submit final projects to instructor along with formal course plan.** **Schedule project presentation with course instructor.** **Schedule time to take the final exam.**
Thanksgiving	Thanksgiving Break -- No class.
Week 14	Prepare for final exam. Make any corrections to your final project.
Week 15	Prepare for final exam. Make any corrections to your final project.
FINAL EXAM	**Math Majors: Take Major Field Test** **Math Education Majors: Take example certification exam**

Example Formal Course Plan for Mathematics Majors:

Activity	Due Date	Rubric
1. I will read at least 4 of 8 chapters in Part I of the *Student's Guide* textbook, completing at least 3 exercises from each section. If I have any questions, I will contact the course instructor.	9/23/11	A. At least 3 exercises were completed from at least 4 chapters. Exercises were turned in by 9/23. Exercise solutions are typed or written clearly and demonstrate a substantial effort to learn more about mathematics. B. At least 3 exercises were completed from at least 4 chapters. Exercises were turned in by 9/23. Exercise solutions are typed or written clearly. Chosen exercises do not demonstrate an effort to learn more about mathematics. C. At least 2 exercises were completed from at least 4 chapters (or at least 3 exercises were completed for at least 3 chapters). A notification for when exercises would be turned in was given to the instructor by 9/23. Exercise solutions are legible and demonstrate an effort to learn more about mathematics. D. Fewer than 3 exercises were completed from fewer than 4 chapters. Exercises were turned in late. Exercise solutions were difficult to read and/or demonstrate minimal effort to learn more about mathematics. F. Exercises were not completed by 9/23. No notice of when exercises would be completed was given to the instructor by 9/23.
2. I will demonstrate the ability to use at least 4 of the mathematical tools described in Part II of the textbook.	11/15/11	A. At least 3 examples of the use of at least 4 mathematical tools were submitted to the course instructor by 11/15. At least one of the examples demonstrates a substantial amount of skill with the tool (perhaps I will complete 3-5 homework problems or a test from a previous class using each tool). B. At least 3 examples of the use of at least 3 mathematical tools were submitted to the course instructor by 11/15. One of the examples of each tool matches examples given in the textbook. The other examples demonstrate the application of the tool to original problems. C. At least 2 examples of the use of at least 2 mathematical tools were submitted to the course instructor by 11/15. The examples deviate only slightly from the examples provided in the textbook. D. 1 example of the use of at least 1 mathematical tool was submitted to the course instructor by 11/15. The example deviates only slightly from the examples provided in the textbook. F. Nothing was completed by 11/15.
3. I will complete one project by the end of the semester. Since I'm interested in graduate school, my project will focus on finding a topic of interest and writing formal proofs. I will give an informal presentation of my project to the course instructor.	11/18/11	A. I will write 5 formal complete, correct proofs. I will type the proofs using LaTeX and have them evaluated by math faculty. I will correct my proofs using feedback from faculty. B. I will write 4 formal complete, correct proofs. I will type the proofs using LaTeX and have them evaluated by math faculty. I will correct my proofs using feedback from faculty C. I will write 3 formal complete, correct proofs. I will type the proofs using LaTeX and have them evaluated by math faculty.
4. I will prepare for and take the Major Field Test in Mathematics.	12/13/11	A. I take the Major Field Test in Mathematics on the scheduled date. F. I do not take the Major Field Test in Mathematics on the scheduled date.

Another project idea: Research a mathematics-related career that interests you (interviews, work samples, etc.)

Example Formal Course Plan for Mathematics Education Majors:

Activity	Due Date	Rubric
1. I will read, review, and summarize the following math education book: Mathematics Education for a New Era: Video Games as a Medium for Learning	9/23/11	A. I will write at least a 7-page summary of the book, including any critiques I have of the conclusions drawn by the author. I will write ideas for how I can incorporate ideas from this book into my own teaching. I will use feedback from another student or faculty member to improve this summary before I submit it to the course instructor. I will submit a brief review on Amazon.com B. I will write at least a 5-page summary of the book, including any critiques I have of the conclusions drawn by the author. I will write ideas for how I can incorporate ideas from this book into my own teaching. I will submit a brief review on Amazon.com C. I will write at least a 5-page summary of the book, describing general ideas that I learned. I will submit a brief review on Amazon.com. F. I will not complete this before the 9/23 deadline.
2. I will develop and update my own math education blog or contribute to one of the following blogs weekly: dy/dan, Think Thank Thunk. I will engage in an online discussion about mathematics education.	11/15/11	A. I published a substantial blog post weekly (or at least 10 blog posts total). My posts responded to others or generated new ideas for discussion. My posts demonstrate a reflection on what I've learned in my classroom and practicum experiences. My posts were all appropriate in tone and language. I attempted to interview a blogger about the advantages of blogging as professional development. B. I published at least 7 substantial blog posts, generating new ideas or responding to others. My posts demonstrate a reflection on what I've learned in my classroom and practicum experiences. My posts were all appropriate in tone and language. C. I published at least 5 substantial blog posts, generating new ideas or responding to others. My posts were all appropriate in tone and language. F. I failed to publish at least 5 substantial blog posts by 11/15.
3. Since I intend to teach math at an elementary school, I will complete two minor projects: a) The role of homework in the elementary school classroom b) How to incorporate standards-based-grading in an elementary school classroom	11/18/11	A. I will write at least one 6-page paper about the role of homework in the elementary school classroom, demonstrating what I learned from a review of recent research. I will give at least a 15-minute presentation about how to incorporate standards-based grading in an elementary school classroom. I will use feedback from peers before I submit these projects to the course instructor. B. I will write at least one 4-page paper and give a 10 minute presentation about my topics, demonstrating what I learned from a review of recent research. I can't quite explain how my projects will improve my teaching effectiveness. C. I will write at least one 4-page paper and give a 10 minute presentation about my topics, demonstrating what I learned from a review of recent research. I can't quite explain how my projects will improve my teaching effectiveness. I will complete my projects after the 11/18 deadline.
4. I will prepare for the Illinois Certification Exam.	12/13/11	A. I take the practice Illinois Certification Exam on the scheduled date. F. I do not take the exam on the scheduled date.