Instructor: Dr. Mark A. Zuiker

Office: Wissink Hall 248

Office Hours: MTWF 11:00 AM to 11:50 AM and 1:00 PM to 1:50 PM, T 12:00 PM to 2:50 PM, other times by appointment, or just “drop-in”.

Phone Numbers: My Office: (507) 389-1229
Department Office: (507) 389-1324

E-mail: mark.zuiker@mnsu.edu
WWW: http://krypton.mnsu.edu/~zuikem/

Class Meetings: Wissink Hall 288, MWF 12:00 PM to 12:50 PM

Course Description: Numerical, verbal, symbolic, and graphical representations of quantitative relationships, concatenations in written mathematics, problem solving, dynamic geometry, perspective drawing, parametric equations, geometric probability, transition matrices, statistics, and calculus using technology.

Prerequisites: Foundations of Mathematics (MATH 290).

Course Goals: The course objectives are as follows:

1. Experience and demonstrate the use of calculators and computers to enhance instruction in mathematics, specifically in the content of parametric equations; statistics; matrices; numerical, symbolic, and graphical representations of quantitative relationships; geometry; perspective drawing; problem solving; and definitions for concatenations and order of operations in written mathematics appropriate to grades 5–12 mathematics.

2. Experience and demonstrate proficient use of graphing calculators, computers, and computers and the internet.

3. Experience and demonstrate proficiency in representing mathematical ideas with exemplary software such as the following: Green Globs and Graphing Equations; Geometer’s Sketchpad; Derive; Excel; geometric probability, programming, statistics, matrices, and tables on Graphing calculators.

Texts: Supplemental readings available from the E-Reserves of the Minnesota State University, Mankato Library (required). The password should be ZUIKER484.

Materials: Floppy disks for saving work done in computer labs and turning in assignments, if necessary. Access to a TI-83 Plus or other graphing calculator outside of class.

Content Outline: The course will include the following topics:

1. Content
   (a) Numerical symbolic, and graphical representations of quantitative relationships
   (b) Approximations, scaling, end behaviors, and patterns of functions
   (c) Concatenations in written mathematics
   (d) Problem Solving
   (e) Programming
2. Professional Recommendations on Technology


(b) *Minnesota Academic Standards, Mathematics K–12*. Available online at http://education.state.mn.us/content/009199.pdf.

**Evaluation:**

Components of the final grade are as follows:

1. Standards Reflective Paper  
   5%
2. Journal Article Review  
   10%
3. Internet Resources Review  
   10%
4. Course Project  
   20%
5. Course Reflective Paper  
   5%
6. Midterm Exam  
   15%
7. Problem Sets  
   20%
8. Participation in Class and Class Discussion  
   15%

*Note:* Any individual deviations from the requirements listed above, or the assignments as listed below, would need to be submitted to the instructor in writing for approval.

**Missed Exams, Quizzes, Classes, and Assignments:**

Missed exams and quizzes will not be made up. Exceptions will be made only in accordance with University and Departmental policy and at the discretion of the instructor *provided arrangements are made in advance*. I realize in the case of extreme emergencies this may not be possible. In that case, I should be contacted as soon as possible. Verification of the emergency should be provided (A note stating only that you visited the Health Center is not sufficient.). If a make-up is given, the exam or quiz given in place of the missing exam or quiz will NOT be the same as the original exam, but will cover the same material, as well as reflecting the fact that you had more time to study. That is, there is no guarantee of having the same level of difficulty.

Late or missing homework will be accepted in my office until **11:50 A.M.** on the day following the due date excluding weekends and holidays. Late homework will receive a 25% reduction in grade. Assignments incorporating the use of technology should be started sufficiently early so that there will be sufficient time to overcome any difficulties involved in using technology. In other words, I could not complete the assignment on time due to technological difficulties will not constitute a valid excuse for late assignments. Exceptions to this policy are governed by the same policy stated in the previous paragraph.

Unexcused missed classes will result in a reduction of the participation component of your grade. Exceptions to this policy are governed by the same policy stated in the previous paragraphs.

**Incompletes:**

A grade of incomplete is possible, but only in the case of prolonged absence or other excused emergency in accordance with University and Departmental policy and at the discretion of the instructor. The student must be receiving a passing grade at the time the incomplete is granted, and the missing work
must be completed in the time frame agreed upon by both the student and
the instructor. Failure to complete the missing work in the agreed upon time
frame will result in a zero for the missing work. A grade of incomplete will not
be given to a student to avoid a failing grade in the course.

**Academic Support:**

Students with disabilities who believe they may need an accommodation in this
class are encouraged to contact Julie Snow, Director of Disabilities Services at
507-389-2825, ML 116, as soon as possible to ensure that accommodations are
implemented in a timely fashion.
Assignment Details: Details for the major course assignments are as follows:

Standards Reflective Paper: Read the Principles (Chapter 2, pp. 11–27) from the Principles and Standards for School Mathematics (NCTM, 2000). Write a 2–3 page reflection on what the six Principles imply for school mathematics. Compare the principles with your own mathematical experiences. Also, specifically reflect on the Technology Principles statement “technology is essential in teaching and learning mathematics.”

Grading Rubric: The assignment will be graded as follows:

16 Reflection is clearly written and addresses all the requested components. There is evidence of thoughtful reflection that just goes beyond just summarizing a reading or stating unlinked thoughts.

12 The reflection addresses all the requested components, but the reflection is not thoughtful and engaging, or the reflection is thoughtful but does not address all the requested components.

8 Reflection address some but not all of the required components and is missing evidence of thoughtful reflection.

4 Reflection does not address any of the required components and was not thoughtfully done.

0 No attempt at reflection.

Journal Article Review: The purpose of this assignment is to give you an opportunity to locate and read some of the professional literature related to mathematics content and teaching with technology. You are responsible for one journal abstract. It should be 2–3 pages in length, double-spaced and typed. A copy of the article should be attached to your review.

Undergraduate Students: A review of a practitioner article should include a brief summary of the article’s major points. Second, critique the article. You should discuss your perspective on the methods or issues of teaching mathematics discussed in the article. That is, do you agree with the author? Why or why not? Possible sources are The Mathematics Teacher, Mathematics Teaching in the Middle School, School Science and Mathematics, and Learning and Leading with Technology.

Graduate Students: A review of a research article should include an overview of the article (a few paragraphs) that discusses the research question, methods, and conclusion. The remainder of the review should address the potential impact of the article on your teaching and/or on the teachers you work with. Possible resources are Journal for Research in Mathematics Education, School Science and Mathematics, Journal of Computers in Mathematics and Science Teaching, and International Journal of Computers in Mathematics Learning.

Grading Rubric: The assignment will be graded in the following manner:

Undergraduate Students:

Format (5 points possible):

5 Uses correct font size, spacing, documentation, and maintains appropriate length.

4 One mistake in format.

3 Two mistakes in format.

2 Three mistakes in format.

0 Does not follow the prescribed format.
Article (5 points possible):

5 Selected article is appropriate for course; journal is acceptable; article is attached to review.
0 Article or journal is inappropriate. Article is not attached to review.

Summary (20 points possible):

20 Clear, well-organized summary of article including main points and conclusions of author.
15 Reasonable, but not completely clear.
10 Vague; does not cover all the main ideas of the article.
5 Inaccuracies in summary; conflict with authors intent.
0 Summary largely unrelated to article.

Reaction (20 points possible):

20 Reflects clear understanding of article and critical thinking about contents.
15 Reflects clear understanding of article and thought about content.
10 Reflects few misunderstandings about article; little evidence of thought given to understanding.
5 Reflects only a basic understanding of article; many misconceptions evident.
0 Missing or evidence of understanding missing.

Expression (15 points possible):

15 Ideas clearly presented in professional tone; well-organized and easy to follow.
12 Ideas clearly presented in professional tone; well-organized; may lack clarity or continuity in a few places.
8 Ideas presented in professional tone; may lack clarity or continuity.
4 Lacks professional tone or lack of organization and clarity may interfere with meaning.
0 Incomprehensible with many errors in organization and continuity.

Mechanics (12 points possible):

12 Clear, accurate grammar and no spelling errors.
9 Few grammar errors and no consistent misspellings.
6 Grammar or spelling errors that do not significantly detract from understanding.
3 Occasional grammar or consistent spelling errors.
0 Errors that significantly interfere with understanding.

Graduate Students:

Format (5 points possible):

5 Uses correct font size, spacing, documentation, and maintains appropriate length.
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<th>Article (5 points possible):</th>
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<td>5</td>
<td>Selected article is appropriate for course; journal is acceptable; article is attached to review.</td>
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<td>0</td>
<td>Article or journal is inappropriate. Article is not attached to review.</td>
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<td>15</td>
<td>Reasonable, but not completely clear or is missing one of the following: research questions, methodology, and conclusions of author.</td>
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<td>10</td>
<td>Vague and/or is missing two of the following: research questions, methodology, and conclusions of author.</td>
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<tr>
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<td>Summary largely unrelated to article.</td>
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<th>Reaction (20 points possible):</th>
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<td>20</td>
<td>Clear, thoughtful discussion of how the ideas in the article would translate to the classroom.</td>
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<td>15</td>
<td>Clear discussion of how the ideas in the article would translate to the classroom.</td>
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<td>10</td>
<td>Discussion of how the ideas in the article would translate into a classroom lacks clarity and thought.</td>
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<td>5</td>
<td>Superficial discussion of how the ideas in the article would translate into a classroom lacks clarity and thought.</td>
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3 Occasional grammar or consistent spelling errors.
0 Errors that significantly interfere with understanding.

Web Resources:
You will review and evaluate a web site (using criteria we will develop in class) involving technology or technology resources and make a 10 minute presentation on the web site in class. You will provide each member of the class with a written summary.

Grading Rubric:
The Web Resources Review will be divided as follows with the indicated point values representing the total possible points.

**Presentation:**

10 Provide a glimpse of the web resource and how it rates in terms of the criteria developed in class.

**Written Summary:**

5 Summarizes the various aspects of the resource and evaluates the resource in terms of the guidelines developed. Displays a critical analysis of the resource.

4 The summary addresses all the developed criteria, but the critique is not thoughtful, or the critique is thoughtful but the summary does not address all the developed criteria.

3 Reflection address some but not all of the developed criteria *and* is missing evidence of a thoughtful critique.

2 summary does not address any of the developed criteria and was not thoughtfully done.

0 No attempt at critiquing.

Course Project:
The purpose of the course project is to synthesize what you have learned about teaching and learning mathematics, and the appropriate use of technology to enhance these processes.

Overview:
You will create a 2-day investigation of a mathematics topic that utilizes at least one technology tool explored in this course. You will include a clearly written lesson plan and student worksheets, if needed. In addition to the investigation, you will need to write a paper that supports the methods used in teaching the topic and how technology is extending or enhancing the learning of the topic. You are required to use the *Principles and Standards for School Mathematics* (NCTM, 2000) document and literature from books or journals to support your methods (Graduate students must reference research literature). Your paper will also include a reflections section about what you learned in creating your course project.

Each student will share the investigation in a 15-minute class presentation. At least 10 minutes of that presentation should engage other students in a “glimpse” of the mathematical investigation you have planned. The remaining time should be used to discuss your rationale for the methods and technology used, personal reflections, and questions/comments from the group.
Guidelines For Developing Your Investigation:

The following are suggestions for guiding the development of your topic into an investigation:

1. Choose a “big idea” in mathematics that interests you (e.g., functions, similarity, rate of change). Make a list of some of the major concepts and skills within that “big idea.” As you review the sources listed below, you should further refine and focus your “big idea” into a topic for a solid 2-day investigation at the grade level of your choice.

2. Look through the website supporting the NCTM Principles and Standards (http://standards.nctm.org/) for suggestions related to your topic of study, including the Illuminations site (http://illuminations.nctm.org/) and the Electronic Examples site (http://standards.nctm.org/document/eexamples/index.htm). You will need to cite which of the six Principles and 10 Standards you address in your investigation.

3. (a) Undergraduate Students: Do a search on your topic both on the internet and in print journals such as The Mathematics Teacher, Mathematics Teaching in the Middle School, School Science and Mathematics, and Learning and Leading with Technology. Look for suggested ways to teach your topic. You are required to reference at least 3 print journal sources.

(b) Graduate Students: Do a search on your topic both on the internet and in print journals such as Journal for Research in Mathematics Education, School Science and Mathematics, Journal of Computers in Mathematics and Science Teaching, and International Journal of Computers in Mathematics Learning. These are only suggested resources. I suggest you do a comprehensive library search. You are required to reference at least 5 research-based articles.

4. Look through textbook and workbook materials for suggested activities that address your topic.

Most importantly, keep asking yourself critical questions about HOW and WHY technology enhances or extends the teaching and learning of your topic. You need to formulate a solid rationale in support of the teaching methods and technology you will use in your 2-day investigation of this mathematics topic. This rationale should already be in place BEFORE you write your plan.

Grading Rubric:

The course project will be divided as follows with the indicated point values representing the total possible points.

**Written Paper:**

10 Describe your “big idea”, the important concepts of skills related to that big idea, and the focused topic for your investigation. Describe the grade level and course where your investigation could be taught. Also, describe the prerequisite skills and concepts that are essential for students to be successful in your investigation. (1–2 paragraphs)

15 List and briefly discuss the NCTM Principles and Standards that are addressed in your investigation and support the methods and technology used. (1 page max)

30 Include a lesson plan that has enough detail about classroom procedures, guiding questions for students, and an outline of what you and the students will be doing throughout the investigation. Be sure to include any worksheets or handouts that would be used by the students.
30 Discuss a well-formulated rationale in support of your methods and technology used for investigating the mathematics topic. The rationale should contain evidence of a synthesis of the information you learned from the NCTM Principles and Standards, textbooks, and journal literature, as well as other sources you may have referenced (include proper citations in APA style). (Undergraduate 2–3 pages, Graduate 4–5 pages)

15 Write a reflection on developing the investigation. What did you learn teaching the topic? What did you learn about the use of technology for this topic? (1 page)

**Presentation:**

15 Provide a clear “glimpse” at the investigation that actively engages the class in using technology (10 minutes).

10 Provide a clear concise summary of your rationale for the methods and technology used (5 minutes).

**Course Reflective Paper:**

On the last regular day of class, a reflective paper about the course is due. The paper should describe the five most important events in the course as you experienced them. Each event should be described and accompanied by a rationale to support its inclusion as an important event. The events may be discussions of particular topics, presentations, assignments, readings, or other occurrences during the class. A careful review of your class notes and course materials should help you prepare this assignment.

**Grading Rubric:**

The assignment will be graded as follows:

16 Reflection is clearly written and addresses all the requested components. There is evidence of thoughtful reflection that just goes beyond just summarizing a reading or stating unlinked thoughts.

12 The reflection addresses all the requested components, but the reflection is not thoughtful and engaging, or the reflection is thoughtful but does not address all the requested components.

8 Reflection address some but not all of the required components and is missing evidence of thoughtful reflection.

4 Reflection does not address any of the required components and was not thoughtfully done.

0 No attempt at reflection.

**Problem Sets:**

Problems sets for this course will be assigned and distributed on an “as needed” basis. These will be due as assigned.

**Grading Rubric:**

Each problem solution will be graded in approximately the following manner:

4 Solution is complete an accurate. All mathematics is done correctly and supporting work is shown and explained when needed. All work is clear and concise—external interpretation of work is not needed and writing is void of extraneous information. Drawings and figures are included when needed and are easy to understand.

3.5 Some elements of a score of 4 and some elements of a score of 3 are present.

3 Solution is almost complete and correct, but some minor error is made in computation, notation, or communication. Explanations are provided, although there may be some minor errors or unclear writing. Work is relatively clear and concise. Drawings and figures are included when needed and relatively easy to understand.
2.5 Some elements of a score of 2 and some elements of a score of 3 are present.

2 Solution has partially correct answer but contains some significant errors (beyond miscalculations or miscopying). Explanations are provided but are missing some critical elements. Work may be confusing to understand, be too brief, or too long. Drawings and figures are included when needed but lack some critical element that makes them easy to understand.

1.5 Some elements of a score of 2 and some elements of a score of 1 are present.

1 Some work is correct, but the student reaches an impasse early. The work shows some evidence of a chain of reasoning. This implies that the student makes some reasonable entry into the problem with at least one useful step correct and valid; however, the response fails to use this step to make further progress on a solution. Drawings and figures are not included when they are needed.

0 Work is all wrong or meaningless. No correct mathematics is used for a solution. No answer is given.

For your work to be considered complete and correct:

Solutions should show any necessary work. You need to explain your reasoning and make your computations clear. Use complete English sentences if the meaning of the mathematical sentences is not otherwise clear. Solutions not showing the necessary work will receive a grade of zero.

Use standard notation and language. Do not invent your own notation and abbreviations, and then expect me to figure out what you meant. For instance, do not use "#" in your sentence if you mean "pounds" or "numbers". Do not use the "equals" sign ("=") to mean "indicates", "is", "leads to", "is related to", or anything else in a sentence; use actual words. The equals sign should be used only in equations, and only to mean "is equal to".

Do not do magic. Plus/minus signs, "= 0", radicals, and denominators should not disappear in the middle of your calculations, only to mysteriously reappear at the end. Each step should be complete.

For graphs, use a ruler to draw the axes and straight lines, clearly labeling the axes, the scale, and the points of interest. Use a consistent scale on the axes.

If the problem is of the "Explain" or "Write in your own words" type, then copying the answer from the back of the book, or the definition from the chapter, is unacceptable. Write the answer in your words, not the text's.

Remember to put your final answer at the end of your work. Label your answer appropriately. If the answer is to a word problem, make sure to put appropriate units on the answer. For instance, if the problem involves money, then the answer should involve dollars or cents.

In short, you should prepare your assignments in such a way that you could hand them to anyone else in the class and they would be able to follow what you have done.

In summary, schools today have made the development of essential skills, the provision of significant and meaningful learning experiences, and the development of the workforce some of its primary goals for student success. As such, they want their instructors to guide the students toward a higher level of confidence and competence. In math, that translates into a greater need for clarity in mathematical writing. The intention on these "Homework Guidelines" is that you and your instructor communicate better, and that you succeed both
in your present mathematics courses and in future mathematical communication with co-workers and clients.

Guidelines For All Assignments:

The following guidelines apply to ALL assignments. Assignments not meeting these requirements in general will be returned with a \textit{25\% reduction in grade}.

1. Homework is due at the beginning of class on the assigned due date.

2. The student’s name and class period should be written clearly on the assignment.

3. Assignments should be turned in on standard-sized paper (8.5” x 11”), with no "fringe" or ragged edges running down the side as a result of the paper’s having been torn out of a spiral notebook.

4. The pages of an assignment should be stapled (note that a paper clip is NOT a staple). Do not fold, tear, spit on, or otherwise "dog-ear" the pages. If your assignment is not stapled, I would prefer that the pages be handed in loose or paperclipped together (with your name on each sheet) rather than with the corners be folded or shredded.

5. Homework must be written clearly and legibly or it will not be graded and it will be counted wrong. Pencil should be used; mistakes cleanly erased not scratched through or crossed out. If you work in ink, “white-out” should be used to correct your mistakes.

6. Problems should appear in problem number order with the exceptions of problems requiring graphs as part of the solution. If you accidentally do a problem out of order, or separate part of the problem from the rest, then include a note referring me to the missed problem or work. Graphs must appear on graph paper and may be attached at the end of the problem set. Any other work necessary to the solution of the problem must accompany the graph.

7. Problems should start near the left-hand margin, with each succeeding problem below the preceding one, not off to the right. Do not work in multiple columns down the page. Keep work within the margins. If you run out of room at the end of a problem, please continue onto the next page; do not try to squeeze lines together at the bottom of the sheet. Do not lap over the margins on the left or right; do not wrap writing around the notebook holes. Do not squeeze the problems together, with one problem running into the next or one step running into the next. Use sufficient space for each problem, with at least one blank line between one problem and the next. In short, do not hand in work that is the quality of scratch work. Do scratch work, but do it on another paper. For grading, hand-in only your final draft.

These assignments should be done in such a way that if a potential employer were to call me for an example of your work while you were here at Minnesota State University, Mankato; you would be pleased to have me show them one of your assignments.
Schedule of Meetings

The class meetings are tentatively scheduled as follows:

1. August 30
   Introduction and Syllabus
2. September 1
   Theme: Graphing Calculators Order of Operations and Concatenations
3. September 3
   “Rule of Four”
   Readings: Heid & Baylor (1993); Jensen & Williams (1993)
4. September 6
   No class, Labor Day
5. September 8
   Graphical Analysis of Equations, Systems of Equations
6. September 10
   Data Modeling
   Assignment: Standards Reflective Paper Due
7. September 13
   Data Analysis: Descriptive Statistics
8. September 15
   Descriptive Statistics (continued)
9. September 17
   Data Analysis: Med-Med Line
10. September 20
    Data Analysis: Linear Regression
11. September 22
    Linear Regression (continued)
12. September 24
    Theme: Programming and The TI-83
13. September 27
    Programming (continued)
14. September 29
    Parametric Equations
15. October 1
    Parametric Equations (continued)
    Readings: Hembree & Dessart (1992)
16. October 4
    Transition Matrices
17. October 6
    Transition Matrices (continued)
18. October 8
    Develop Criteria For Web Resource Evaluation
19. October 11
    Theme: Dynamic Geometry Geometer’s Sketchpad & Logo
    Readings: Weaver & Quinn (1999)
20. October 13
    GSP (continued)
21. October 15
    Mid Term Exam
22. October 18
   GSP (continued)

23. October 20
   GSP (continued) Geometric Probability

24. October 22
   No Class
   Readings: Glass & Deckert (2001)

25. October 25
   GSP (continued)

26. October 27
   GSP (continued)

27. October 29
   Van Hiele Model
   Readings: Crowley (1987)

28. November 1
   Theme: Data Collection Devices

29. November 3
   CBR’s (continued)

30. November 5
   Theme: Perspective Drawing

31. November 8
   Theme: Web Resources
   Web Resource Presentations

32. November 10
   Web Resource Presentations

33. November 12
   No class, NCTM Regional Conference

34. November 15
   Theme: Computer Algebra Systems
   Derive
   Readings: Goldenberg (2003); Pierce & Stacy (2002)

35. November 17
   Derive (continued)

36. November 19
   TI-89, TI-92, and TI-Voyage 200
   Assignment: Journal Article Review Due

37. November 22
   Theme: Wordprocessing Mathematics
   Microsoft Word and MS Equation Editor

38. November 24
   TI Interactive

39. November 26
   No Class, Thanksgiving Break

40. November 29
   Theme: Spreadsheets
   Readings: Baron & Hynes (1996) Microsoft Excel

41. December 1
   Microsoft Excel (continued)
42. December 3
   Calculator Based

43. December 6
   Theme: Green Globs and Graphing Equations

44. December 8
   Tracker

45. December 10
   Assignment: Course Reflective Paper Due
   Course Project Presentations

46. December 15
   Course Project Presentations
   10:15 AM to 12:15 PM
Readings:

The following constitute the primary readings for the course. The readings can be found http://ml3.lib.mnsu.edu/ (Navigate to the MNSU Home Page, Under Library, E-Reserves).


