EMAT 3500

Exploring Concepts (with Technology) in Secondary School Mathematics

Fall 2007

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Office Hours | Syllabus | Outline | Students | Assignments | Links

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Office Hours :

Dr. Olive (room 105 F)
Tuesdays, Wednesdays & Thursdays 1:00pm - 3:00pm **.....or by appointment** **....or drop in if I'm in my office.**

Assignments

All assignments should be created electronically and emailed as an attachment to Dr. Olive or one of the graduate assistants.
Please use the following file name format for each assignment: <first initial><last name><assignment #>.<file type>. For example, my reflection paper for assignment #1, created using Microsoft Word,

would have the file name: jolive1.doc

When on campus, your assignments can be transferred directly to Dr. Olive's computer. Macintosh users can access Dr. Olive's computer at afp://coe615g3.coe.uga.edu/ or browse for "OliveG5" by choosing Network from the Go menu in the Finder.
Windows users can access Dr. Olive's computer at \\coe615g3.coe.uga.edu\jolive using the Network Connection Control Panel

You will log on to the emat3500 volume as a "Guest" and when you double click on this network volume you should see the "EMAT3500 Fall07" folder. Simply drag your file(s) into this folder. From a Macintosh computer, you will see a message indicating that you will not be able to see the results of this operation. Click the OK button to copy your file to the folder. *REMEMBER TO SEND Dr. Olive AN EMAIL INDICATING THAT YOU HAVE DEPOSITED A FILE IN THE EMAT 3500 folder.*

NOTE: Please disconnect from the emat3500 volume when you have transferred your file (drag to the trash basket or highlight the volume and choose "Eject" from the FILE menu). This is very important as ONLY TEN people can be connected to the instructor's computer at the same time.

Click on a number in the following table to go to that assignment.
These will be updated periodically

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
Final Project									

#1 . Prepare for next class discussion on August 21 (electronic portfolio)

Visit the NCTM web site at www.nctm.org and find the electronic version of the Principles and Standards for School Mathematics. Read through all of the Principles and study the overview of the curriculum standards for both middle grades and high school. Explore the electronic examples for both middle and high school algebra. Choose one example to respond to the "take time to reflect" questions and write up your responses to share with the rest of your class (to be included in your portfolio).

Due: 08/21

Return to Assignments

#2. Investigate the Georgia Performance Standards (10 points)

Go to the web site for the new Georgia Performance Standards. Find the mathematics standards that relate to the goals of this course.

Match the topics in the outline of the course with an appropriate GPS. Save these matched items in your electronic portfolio and send a copy to Dr. Olive and the TA's as an email attachment. Remember to name your file: "your_name_2.doc"

Due: 08/23

Rubric

	(10 pts)	(8 pts)	(6 pts)	(4 pts)	(2 pts)	0
Criteria	Matches all outline topics to an appropriate GPS	Matches 80% of outline to an appropriate GPS	Matches 60% of outline to an appropriate GPS	Matches 40% of outline to an appropriate GPS	Matches 20% of outline to an appropriate GPS	Does not attempt the assignment.

Return to Assignments

#3. Research on the NCTM Standards: (portfolio)

Read Chapter 2 from *A Research Companion to Principles and Standards for School Mathematics.* Write a one-page response to the oft asked question: "Does research support the NCTM recommendations for curriculum reform?"

Due: 08/28

Return to Assignments

#4. Reflecting on Your Experiences with Mathematics Teachers: (15 points)

You have been a mathematics student for most of your life! You have experienced many different teachers who taught you mathematics. These experiences have very likely

influenced how you think about "mathematics teaching," and these can even affect the ways that you will behave as a beginning mathematics teacher. It can be important to reflect upon these past experiences, to take stock of some possible influences upon you and how you want to teach.

A. Make a short list (3-5; use initials or a pseudonym or code) of your "favorite" teachers of mathematics. For each, briefly tell why they are a "favorite." Think about them as "persons," and list any attributes that might have led you see them as a "favorite." Think about them as "teachers," and list attributes that mattered to you. Think about them in the act of teaching mathematics, and list things about their teaching that you admired. You might consider their attitudes towards students and towards mathematics, their teaching styles, and their content knowledge.

B. Make a short list (3-5) of your "least favorite" teachers of mathematics. For each, briefly tell why you see them this way. Think about them as "persons," and list any attributes that might have led you to see them this way. Think about them as "teachers," and list attributes that led you to see them this way. Think about them in the act of teaching mathematics, and list things about their teaching that you disliked. You might consider their attitudes towards students and towards mathematics, their teaching styles, and their content knowledge.

C. Think about the kind of mathematics teacher you want to be. List the positive attributes that would describe you, as a "person" and as a "teacher." Think about yourself in the act of teaching your mathematics students. List a few of the most important characteristics that might describe your teaching. You might consider your attitude towards students and towards mathematics, your preferred teaching style, and your content knowledge.

Email your Word document to Dr. Olive and the TA's.

Due: 08/30

Rubric

	Exemplary (5 pts)	Proficient (4 pts)	Partially Proficient (3 pts)	Barely proficient (2 pts)	Incomplete (1 pt)	No attempt

Section A (33%)	Lists more than 3 favorite teachers and their attributes as persons and as teachers and acts of teaching	Lists 2 or 3 favorite teachers and their attributes as persons and as teachers and acts of teaching	Lists 1 favorite teacher and his/her attributes as a person and as a teacher and acts of teaching	Lists an attribute but no characteristics of teaching	Lists names of teachers only	
Section B (33%)	Lists more than 3 least favorite teachers and their attributes as persons and as teachers and acts of teaching	Lists 2 or 3 least favorite teachers and their attributes as persons and as teachers and acts of teaching	Lists 1 least favorite teacher and his/her attributes as a person and as a teacher and acts of teaching	Lists an attribute but no characteristics of teaching	Lists names of teachers only	
Section C (33%)	Lists more than 3 attributes of oneself as a person and as a teacher and characteristics of your teaching	Lists 2 or 3 attributes of oneself as a person and as a teacher and characteristics of your teaching	Lists one attribute of oneself as a person and as a teacher and characteristic of your teaching	Lists an attribute but no characteristics of teaching	No comments on self	

Return to Assignments

#5. Relational and Instrumental Understanding (portfolio)

Read the article by Richard Skemp on Instrumental and Relational Understanding. Identify 3 main points that Skemp makes about the nature of mathematical understanding. Then reflect on your responses to assignment #4. Briefly describe how you were taught and how you learned mathematics (instrumentally and / or relationally). (2-3 pages).

Due: 09/04

Return to Assignments

#6. Composition of Functions Investigation (10pts)

(Assignment 7.3 from Chapter 7 of *Transforming Mathematics with the Geometer's Sketchpad*)

Using the GSP Dynagraphs sketch, investigate the 8 mystery functions. Create three functions of your own, each of which belongs to a different family (e.g, step, quadratic, and trigonometric) and investigate the composition of your three functions. (A sketch showing compositions of several functions can be found here.) Write-up your investigations, highlighting any interesting or surprising characteristics you discovered for your particular composition (1-2 pages). Submit your GSP sketch along with your write-up via **email attachment or file transfer** to Dr. Olive. The following description of a "write-up" is adapted from Dr. Jim Wilson.

The "write-ups" for EMAT 3500 represent your synthesis and presentation of a mathematics investigation you have done -- usually under the direction of one of the assignments. The major point is that it convincingly communicates what you have found to be important from the investigation.

The hypothetical audience might be your students, your classmates, or classroom mathematics teachers. You should present your topic in a reasonable amount of space, emphasizing the essential and eliminating the irrelevant (though sometimes interesting) side issues.

Due: 09/11

Rubric

Criteria	Exemplary (5 pts)	Proficient (4 pts)	Partially Proficient (3 pts)	Incomplete (2 pts)	Not Working (1 pt)	Missing Work (0 pts)

GSP Sketch (50%)	Working GSP sketch with 3 different dynagraphs and at least 3 different compositions of 2 or more functions organized on different pages	Working GSP sketch with 3 different functions and 2 different compositions of 2 or more functions.	Working GSP sketch but functions are not from different families or are the ones provided by the downloaded sketch. Only one or two working compositions.	GSP sketch with 3 functions but no compositions.	GSP sketch does not function properly.	No GSP sketch.
Write-Up (50%)	Functions and their compositions are fully described and surprising results are explained in terms of the properties of the composed functions, including domain and range.	Functions and all compositions are fully described with reference to domain and range.	Functions are listed and one or two compositions briefly described	Write up describes the functions but not the compositions.	Write-up does not describe the situation.	No write-up.

Return to Assignments

#7. Reflection on Dynagraphs (portfolio)

Dynagraphs were very probably a new way of representing and playing with functions for you. In what ways did they enhance your own concepts and ideas about functions? Would you use these dynamic representations with your students? Why or why not? (1-2 pages)

Due: 09/13

Return to Assignments

#8. Reading and Reflection (portfolio)

Chazan, D. (1999). On teachers' mathematical knowledge and student exploration: a personal story about teaching a technologically supported approach to school algebra. *International Journal for Mathematics Learning*, **4**: 121-149.

Reflect on how the author's approach to teaching algebra was influenced by the use of technology. Think about the role of function in the two different approaches. How might the use of GSP enhance the functions approach? Be prepared to discuss your ideas in class.

There is at least one mathematical error in this paper. See if you can find it.

Due: 09/18

Return to Assignments

#9. Dynamic Transformations of the Quadratic Function (15pts)

Complete the three Challenges on page 94 (Assignment 7.5) of *Transforming Mathematics with the Geometer's Sketchpad* and turn in a completed GSP sketch via **email or file transfer**. An extra 5 points will be possible for successfully completing the Extra Challenge.

Due: 09/25

Rubric

Criteria	All 3 complete (15 pts)	2 of 3 complete (10 pts)	1 of 3 complete (5 pts)	Attempted (3 pts)	No Attempt (0 pts)
GSP Sketch (100%)	Completed all three challenges with correctly working GSP sketch	Completed 2 of the 3 challenges with correctly working GSP sketch	Completed 1 of the 3 challenges with correctly working GSP sketch	Attempted the challenges but was not successful in generating a correct function for any of the challenges.	Did not attempt any of the challenges
Extra Credit			Successfully completed the extra credit challenge	Attempted the Extra Credit but not successful	Did not attempt the Extra Credit Challenge

Return to Assignments

#10. Review of the NCTM Algebra Standards (portfolio)

Review the Algebra Standards for grades 6-12 in the NCTM *Principles and Standards*. Write a 1-2 page report on the approach to *Functions* taken in the *Standards* document.

Due: 09/27

Return to Assignments

#11. Sorting Functions (10pts)

Sort the 28 function cards into a 7 x 4 array based on the four different kinds of representations (graph, data table, algebraic expression and verbal description) and seven distinct categories of functions that you must determine. Each function CATEGORY will have an example from each of the four different representations (but each representation will be of a different function in that category). Label each function category. Turn in a 7x4 table with rows and columns labelled appropriately and the NUMBERS of the appropriate function cards in each of the 28 cells (one card per cell). Write a one-page explanation for how you determined your seven function categories and the placement of the cards. Email your Table and explanation to Dr. Olive and the TA's.

This activity is adapted from Cooney, T. (1996). **Developing a topic across the curriculum: Functions** . In Cooney, T. J., et. al. (Eds.), Mathematics, Pedagogy, and Secondary Teacher Education. (**pp. 27-43**). Portsmouth, VA: Heinemann.

Due: 10/02

Rubric

Criteria	Complete (10 pts)	10% errors (9 pts)	20% errors (8 pts)	30% errors (7 pts)	40% errors (6 pts)	50% errors (5 pts)	60 % errors (4 pts)	80% errors (2 pts)	90% errors (1 pt)	No attempt (0 pts)
Table entries (80%)										
Explanations (20%)										

Return to Assignments

Mid-Term Exam on Functions : 10/09 (60pts)

#12. Data Investigations (10pts)

Use Fathom to create a data collection of all the data given in the table on page 82 of Unit 2 of Core-Plus Mathematics, Course 1.

Complete all parts of activities 8 & 9 on pages 82 and 83.

Also complete the three parts of the "Check Your Understanding" section on page 83.

You can use a Word file for your written answers or use Text Windows in your Fathom file to answer each question.

Upload your completed Word and/or Fathom files to Dr. Olive's computer or attach to an email message.

Due: 10/16

Rubric

Return to Assignments

#13. Report on visit to GCTM Annual Meeting at RockEagle (portfolio)

Identify sessions on Mathematical Modeling and/or Functions using technology and attend as many as you can. Write a 2-page reflection on one of these sessions, indicating the most important things you learned from it.

Due: 10/23

Return to Assignments

#14. Laboratory Preparation (Portfolio)

Click here for a list of the labs.

For Tuesday 10/30 - Discuss with your group how you intend to conduct your lab activity. Make a list of needed equipment and make plans to obtain the equipment (some equipment is available from our Departmental closets). Come to class with equipment and instructions for your group's lab activity. Set up your lab activity before the beginning of class.

Due: 10/30

Return to Assignments

#15. Lab Reports from the 5 Labs (10 points)

Each individual will turn in their own results for the 5 labs and provide these results to the appropriate group along with a brief (paragraph) conclusion they made from the group results for each lab. Your results and conclusions for each group should be emailed to Dr. Olive and the TA's.

Due: 11/06

Rubric

	5 labs (10 pts)	4 labs (8 pts)	3 labs (6 pts)	2 lab (4 pts)	1 lab (2 pts)	No results (0 pts)
Results (50%)	Submits results from all 5 labs	Submits results from only 4 labs	Submits results from only 3 labs	Submits results from only 2 labs	Submits results from only 1 lab	No results submitted
Conclusions (50%)	Brief conclusions written up for all 5 labs	Brief conclusions written up for 4 labs	Brief conclusions written up for 3labs	Brief conclusions written up for 2 labs	Brief conclusions written up for 1 lab	No conclusions

Return to Assignments

#16. Approximating Best Fit Lines ~ (10pts)

Using your *Pennies* set of data from the *Experimental Labs*, create a line of best fit using Fathom. Using the equation of your best-fit line, calculate the signed deviation (Collected - Predicted), absolute deviation |Collected - Predicted| and squared deviation (Collected - Predicted)^2 of each collected data point from the predicted value given by the line of best fit. Using a Fathom *Summary Table*, show the sums of each of these different deviations.

The more interesting part of this assignment lies in thinking about what these summed deviations tell us about the 'best fit line." How can we know if we have chosen the **best** fit line? Which is a better predictor, the sum of the signed deviations, the sum of the absolute deviations, or the sum of the squared deviations? The following is a sketch that I created; it could be helpful in facilitating your thinking. Click here for the gsp sketch.

Write a brief explanation (with examples) for why you would choose to use one of the following methods for calculating the best line of fit for your data: signed deviations, absolute deviations, squared deviations. Upload your paper and any example files to the EMAT3500 folder or attach to an email to Dr. Olive and the TA's.

Due: 11/08

Rubric

	Exemplary (4 pts)	**Proficient (3 pts)**	**Partially Proficient (2 pts)**	**Incomplete (1 pt)**	**No Attempt**
Data (66%)	Has complete data set with AUTOMATICALLY CALCULATED values for Predicted data based on line of best fit, signed deviations, absolute deviations, and squared deviations	Has complete data set with values for Predicted data based on line of best fit, signed deviations, absolute deviations, and squared deviations entered manually.	Has complete data set with values for Predicted data based on line of best fit, but signed deviations, absolute deviations, and squared deviations are not shown, however, their sums are given	Has only the collected data. Has not calculated the predicted data nor the different deviations.	Has not turned in any data.

Explanation (33%)	Has a rational explanation for choosing either sum of absolute or squared deviations	Has chosen sum of absolute or squared deviations but does not provide a rationale	Chooses signed deviations based on rationale that the sum can be very small or even zero	Chooses signed deviations with no explanation	Does not choose a best error method and does not give any explanation

Return to Assignments

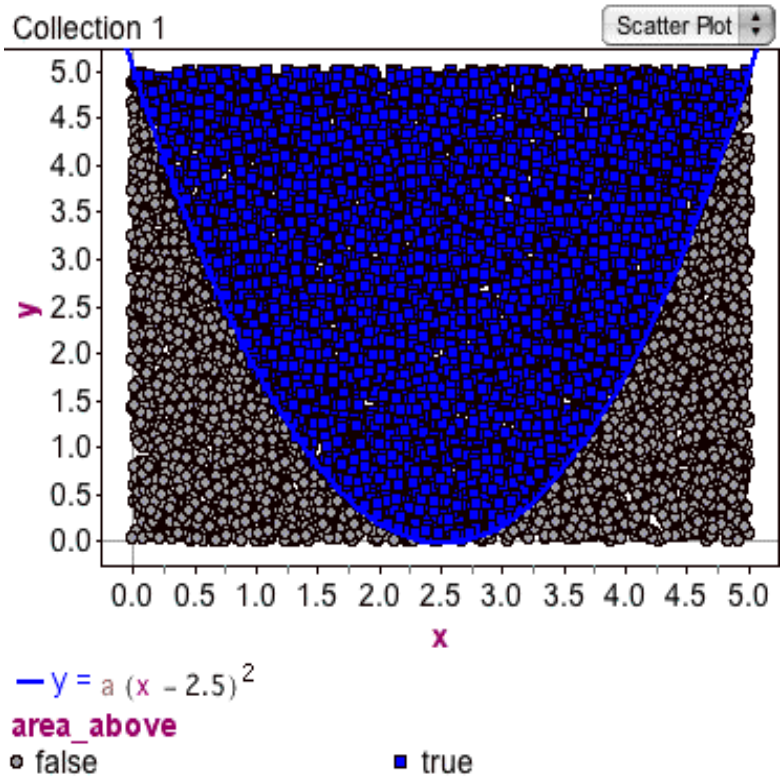
#17. Modeling Probability (10pts)

Complete the "Geometry by Probability -- Monte Carlo Methods" activity on your handout from class. This is based on activity 7.4 from *Exploring Algebra 1 with Fathom* (Key Curriculum Press, 2006).

Your grade for this assignment will be based on your completion of Part B of the activity:

Part B: Investigating the area enclosed by a parabolic curve inscribed in a square.

1. Create a new scatterplot of y against x, where both attributes x and y have the formula random (5)
2. Add the following function to this scattterplot: $y=(x-2.5)^2$
3. Create a new attribute (area_above) for the area above the parabola using your existing x and y attributes.
4. Drag your area_above attribute into the middle of your new scatter plot. You should see the area above the parabola in blue.
5. Create a summary table showing the count() of the whole collection, the count (area_above) and the ratio count(area_above)/count().
6. Create a slider and label it "*a*". Set *a* to 1.00 to start and use *a* to edit the function for the parabola: $y=a(x-2.5)^2$.
7. Double click on the slider and set its lower limit to 0.5 and its upper limit to 1.5. Adjust the value of *a* using your slider until your function plot passes through the upper two corners of your square region -- points (0,5) and (5,5).
8. Now edit your area_above formula to also use *a* so that the area is the area above your new function plot (see following screen shot from Fathom).



What do you notice about the proportion of the area of the square that is above this new parabola?

Successful completion of the above will earn you 8 out of the 10 points.

For the full 10 points:

Use your knowledge of integral calculus to compute the area bounded by the parabola and the top edge of the square. Does this calculation verify your experimental results? Turn in your mathematical explanations (including details of any integration), together with your Fathom files via email attachment or upload to the EMAT 3500 folder on Dr. Olive's Mac.

For two bonus points:

Can you generalize this result for a parabola inscribed in any square (i.e. passing through the two upper corners of the square with its vertex at the midpoint of the bottom of the square)?

Can you generalize the result for any rectangle (i.e. passing through the two upper corners of the rectangle with its vertex at the midpoint of the bottom of the rectangle)? Use Fathom sliders for the dimensions of your rectangle and edit your formulas so that the above conditions are satisfied.

Due 11/15

Rubric

	Target (10 pts)	Acceptable (8 pts)	Partially acceptable (6 pts)	Incomplete (4 pts)	No Attempt
Fathom Activities (100%)	Completed all of the activities with appropriate data sets, tables, graphs, appropriate functions or formulas for the different models and summary statistics	Completed all of the activities but may not have used summary statistics or formulas in the data tables when appropriate.	Completed some of the activities but did not find appropriate functions or formulas for the models	Attempted but did not complete any of the activities.	No attempt at the activities
Extra Challenge	Completed the extra challenge and found a generalization! (2 points)	Completed the extra challenge but did not find a generalization! (1 point)			Did not attempt the extra challenge

Return to Assignments

#18. The Biggest Box Problem (10 pts)

Construct a working GSP sketch for the biggest box problem. Your sketch should include a square with variable squares cut from each corner to form the template of your box. You should link the varying size of these squares to a calculation for the volume and plot the size of cut out square (x) against volume (y) in your sketch. Derive an algebraic solution for the size of the cut-out square (as a fraction of the side-length of your square) that gives you the maximum volume. Click here to download a sophisticated GSP sketch that illustrates the problem (do not use this sketch for your assignment). Upload your GSP sketch with explanations to the EMAT 3500 folder or email it as an attachment to Dr. Olive and the TA's.

Due: 11/27

Rubric

	Exemplary (3 pts)	Proficient (2 pts)	Incomplete (1 pt)	No attempt

GSP Simulation (20%)	Construction for the square and the cutout corners works correctly. Both size of square and size of cutout can be varied. The point for varying the cutout is on one half of one side of square. Size of cutout and side of square are measured.	Construction works but size of square is fixed or extra objects are used for the construction to work (e.g. an extra segment to control size of square and moveable point) or moveable point goes past the midpoint of a side. Measurements are correct.	Missing measurements or measurements are not dynamic. Some aspect of the construction does not work properly.	No attempt to construct the GSP simulation or just used instructor's sketch.
GSP Plot (20%)	Correctly plotted the two dynamic measurements and used plot to estimate the size of the cutout for maximum volume.	Correctly plotted the two dynamic measurements.	Made a plot but it was not with dynamic measurements or incorrect measurements	No plot created.
Algebraic Solution for fraction of side of square (40%)	Created a correct algebraic expression for the Volume based on the length of cutout and length of square. Used this expression to find the maximum using calculus and factoring of a polynomial. Determined the fraction of the side that gives the maximum volume.	Created a correct algebraic expression for the Volume based on the length of cutout and length of square. Used this expression to find the maximum using calculus. Used an algorithm rather than factoring to find a solution or did not express solution as a fraction of the side length.	Incorrect expression for the volume or errors in finding the maximum based on faulty calculus or arithmetic errors. Fraction of side is oncorrect.	No attempt at an algebraic solution.
Algebraic function for the plot (20%)	Creates a function in GSP based on the length of the original square that coincides with the GSP plot of cutout against volume. The function still matches the plot when the size of the square is changed.	Creates a function in GSP based on the length of the original square that coincides with the GSP plot of cutout against volume, but the function does not match the plot when the size of the square is changed.	Function expression is not correct or does not match the plot.	No attempt to create a GSP function.

Return to Assignments

#19. The View-Tube with GSP (10 pts)

Construct a working GSP sketch that represents the variables in the View-Tube experiment: Length of tube, diameter of tube, distance of tube from the screen, height of viewable portion of the screen. Use height of viewable portion of the screen as your DEPENDANT variable and plot this against each of the other variables. Derive functions for each of these relations. Copy your construction onto three pages in your GSP document and plot one function on each page, using the data generated by your sketch. Check that your functions match your data plots. Click here to download a starter GSP sketch for the view tube problem with 3 pages already created. Upload your edited version of this GSP file with explanations to the EMAT 3500 folder or email it as an attachment to Dr. Olive and the TA's.

Due: 11/29

Rubric

	Target (3 pts)	Acceptable (2 pts)	Incomplete (1 pt)	No attempt
Page 1 (33%)	Plots independent variable against dependent variable correctly. Creates the correct function by editing the existing f(x) to match the locus of the plotted point. Uses the other measurements in the sketch as the parameters in this function. Correctly labels this page in terms of the independent variable.	Creates the correct plotted point and function but may not use the existing f (x) or does not label the page.	Correct plot but incorrect function.	Does not attempt to plot the independent variable against dependent variable. No attempt to create a matching function. May turn in the starting sketch unchanged.

Page 2 (33%)	Plots independent variable against dependent variable correctly. Creates the correct function by editing the existing f(x) to match the locus of the plotted point. Uses the other measurements in the sketch as the parameters in this function. Correctly labels this page in terms of the independent variable.	Creates the correct plotted point and function but may not use the existing f (x) or does not label the page.	Correct plot but incorrect function.	Does not attempt to plot the independent variable against dependent variable. No attempt to create a matching function. May turn in the starting sketch unchanged.
Page 3 (33%)	Plots independent variable against dependent variable correctly. Creates the correct function by editing the existing f(x) to match the locus of the plotted point. Uses the other measurements in the sketch as the parameters in this function. Correctly labels this page in terms of the independent variable.	Creates the correct plotted point and function but may not use the existing f (x) or does not label the page.	Correct plot but incorrect function.	Does not attempt to plot the independent variable against dependent variable. No attempt to create a matching function. May turn in the starting sketch unchanged.

Return to Assignments

#20. Reflection and Feedback on EMAT 3500 (evaluation form)

Your assignment is to complete the evaluation form that can be downloaded as a MS Word document from the above link. You can type on the form and then print it out. This will be completely anonymous. Jaehong will collect the forms and cross your name off his list as you place it in the envelope before the presentations of your Final Project on your Final Exam morning. This is your chance to reflect on YOUR contribution to EMAT 3500, the effort you put into it, the results you got out of it, how it was taught, offer suggestions, point out assignments, technologies or readings that were helpful to you, say something nice, be critical etc... Your feedback is very valuable to us and to this department!!

Due: Final Exam Day, Thursday, December 13, 2007

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Final Project (60pts)

Click here for details on this final assignment

Post first draft by 5:00 p.m. on Monday December 10
Presentation on Final Exam Day, Thursday December 13 at 8:00 a.m. in room 111/113 Aderhold Hall.

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EMAT 3500

Exploring Concepts (with Technology) in Secondary School Mathematics

Prerequisites for EMAT 3500 & 4680

MATH 2200, 2210 & 3000 and one of the following: MATH 3200, 2500 or 2700.
If you have not studied differential and integral calculus, and linear algebra you will not be able to enroll in these courses.

Course Overview

Students in EMAT 3500 will have the opportunity to:

- engage in mathematical, epistemological, curricular, and pedagogical investigations (and read and discuss relevant research and literature);
- address and investigate basic concepts in the secondary mathematics curriculum, focusing on algebraic concepts: particularly functions, statistics, and mathematical modeling;
- become familiar with the NCTM *Principles & Standards* and relate secondary mathematics concepts to the *Standards*;
- become familiar with the *Georgia Performance Standards* (GPS) for mathematics in grades 6-12 and relate the activities in this course to these standards;
- reflect on becoming a mathematics teacher;
- communicate and reason mathematically, solve problems, investigate different representations, and make mathematical connections as discussed in the NCTM *Principles & Standards*;
- become familiar with and operational with using technological tools in doing mathematics;
- use general tools such as word processing, paint and draw programs, spreadsheets, and the Internet to facilitate mathematical investigations and to communicate about mathematical investigations;
- use application software to solve mathematical problems;
- use application software to create mathematical demonstrations;
- use application software to construct new ideas of mathematics for yourself;
- explore mathematics using a variety of technologies including graphing calculators, computer software, and textbooks;
- communicate mathematical ideas using various techological tools.

Required Textbooks and Resources

Texts

Title: Principles and Standards for School Mathematics (with CD-ROM).
Also available via the NCTM web site (click here for link).
Authors: National Council of Teachers of Mathematics
Publisher: NCTM

Title: Transforming Mathematics with *The Geometer's Sketchpad*
Authors: John Olive & Nicholas Oppong
Publisher: Not yet published.

> Available on Monday, August 20, as a course packet from
> Bel-Jean Copy and Printing, 163 E. Broad Street, Athens.
> Cost: approximately $10.

Software and Technology

1. Access to the Internet and Email

2. Geometers' Sketchpad Version 4, Student Edition
The student edition includes:

- The Geometer's Sketchpad software CD-ROM - works on both Windows and Macintosh computers.
- The Geometer's Sketchpad Learning Guide - in addition to a comprehensive reference section, includes 11 guided tours designed to introduce students to the program using fun, interesting and mathematically relevant activities.
- 101 Project Ideas for The Geometer's Sketchpad - a great source of ideas for Sketchpad projects at all levels, ranging from simple perspective drawings to complex animated calculus sketches.

3. Fathom 2: Dynamic Statistics Software, Student Edition

NOTE: Items 2 and 3 are available in a bundle from the UGA Bookstore under EMAT 3500

4. TI-83 Plus or 84 Graphing Calculator (or equivalent)

You should be able to purchase this calculator for under $100.00
Price compare at Best Buy, K-mart, Staples, Sam's, etc...
For more information go to: http://education.ti.com/

5. (Optional) Graphing Calculator 3.2 for Mac or Windows
Order on-line from http://www.pacifict.com/StudentDiscount.html
The student discount price is $40. Make sure to order the correct version for your operating system (Mac or Windows).

Assignments

Weekly assignments will be provided. They will be discussed in class and due dates will be provided. **One point will be deducted for each day that an assignment is turned in late** (maximum point totals for each assignment are indicated on the class web-page).

Weekly assignments will consist of a variety of readings, writings, and mathematical & technological investigations.

The class will use fully ethernet networked computers in Aderhold Hall. All assignments will be given via the class web-page and turned in via upload to Dr. Olive's G5 computer via the local area network, or as an email attachment to Dr. Olive or his assistant(s). We will have access to and learn to use various network tools.

Portfolios

Each student will be required to create a portfolio of work completed for this course. This portfolio will include selected readings, assignments, reflections and your final project. This portfolio will be reviewed and graded at the end of the semester.

Time on computers

You can not expect to accomplish what you should from this course without time on the computers that is in addition to the time we have in class. The usual expectation of 2 hours study outside of class for every hour in class is probably a minimum. There are several MacIntosh laboratories available in this building and across campus.

We are scheduled to hold this class in Aderhold Hall, room 111/113 (the Mathematics Education Macintosh Computer Lab) and also in room 112. In addition to the G5 computers in the Macintosh lab, a set of PowerBook G4 Macintosh computers will be available for use during class time. You may also bring your own laptop computer. Web access for the laptops is via the COE wireless network. For work outside of class, there are some additional PowerPC Macintosh computers in Room 233, Room 616, and in the EMAT Library. The Mathematics Education Macintosh Computer Lab (room 111/113) is also available when no classes are scheduled in it.

In general, the application programs we will use in this class will run on any of the Macintosh computers except the oldest machines. There are distinctions such as operating systems and hard disk drives that have to be accounted for. If you have your own Mac, or access to one, I will help you get set up to run these programs on it (if it is possible).

Most Macs today run with operating system 10.0 or higher. In general, as operating systems have improved over time, most people move to the newest system. Our machines in Room 111/113 and the laptops use System 10.4 (Mac OS X).

Most of our software is also available for Windows machines. The functionality of some other Windows software is similar to what we use. Certainly the Windows environment could be used for implementing this course. Students can work at home on a Windows computer and transport to these Macintosh machines via removable media (e.g. CD or USB drives) or the network (e.g. via email attachments).

Attendance Policy

As part of being a professional teacher, regular participation in all course activities is required. On-time completion of assignments and arrival to class is expected. If at all possible, please notify me before missing a class meeting. All absences will be documented and attendance records will be used in calculating your final grade. Class

attendence and participation will count a total of 30 points (one point per class period). Tardies will receive only half a point for each late attendance. Unexcused absentees will receive zero points. Excused absentees will receive half a point. Excused medical absences require documentation (a note) from your doctor or the Student Health Center. Other unavoidable absences must be approved by me BEFORE the time you will be absent. I may require written verification of the conflict.

Academic Honesty Policy

This course adheres to the honesty policy which states, “I will be academically honest in all of my academic work and will not tolerate academic dishonesty by others”. (UGA honor code) Details are available at http://www.uga.edu/ovpi/honesty/acadhon.htm

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Grades and Requirements

It is my intention to base grades on performance in meeting the requirements of the course. This performance includes the following:

Class Attendance and Participation.....10% (30 points)

Assignments .....40% (120 points)

Midterm Exam .....20% (60 points)

Portfolio.....10% (30 points)

Final Exam Project.....20% (60 points)

Percentages will be based on a 300 point total for the course.

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EMAT 3500, Fall 2007
Exploring Concepts (with Technology) in Secondary School mathematics
Outline (Subject to adjustments as needed)

Week 0: (08/16)

Thinking about being a mathematics teacher

Setting up electronic communications (email and network)

Introduction and discussion of NCTM *Principals & Standards*

Introduction to the new *Georgia Performance Standards for Mathematics 6-12*.

Georgia Department of Education Resource page for GPS Mathematics

Georgia DOE On-Line training Materials for HS Mathematics GPS

Week 1: (08/21 & 08/23) ***Number and Operations***

Sharing e-Examples from the NCTM *Principles & Standards*
Introduction to *GSP4* and *Excel*
Choose two of these Excel spreadsheet activities to explore!

Chapter 6 from *Transforming Mathematics with GSP*

The Slide Rule (download GSP Slide Rule)
Constructing a product of two numbers on a number line using dilation (connecting with transformational geometry) (download GSP sketch)
(Download Numberline Tool)
Investigating arithmetic relations dynamically: Mystery Machines
Mystery Combinations

Week 2: (08/28 & 08/30) ***Characteristics of Functions***

Chapter 7 from *Transforming Mathematics with GSP*

Dynamic algebraic functions using transformations
Constructing a linear function through dilation and translation
Constructing powers of x through dilation
Comparing Functions on parallel number lines

Exploring the behavior of functions with *Dynagraphs*
Composing functions using a sequence of *Dynagraphs*

Week 3: (09/04 & 09/06) ***Exploring Functions with GSP***

Click on the following links to download GSP sketches for these activities:
Click here to download a starting dynagraph sketch
From *Dynagraphs* to Rectangular Coordinates.

Investigating different functions using both *Dynagraphs* and Rectangular Coordinates

Operations on functions using multiple coordinate systems

Week 4: (09/11 &09/13) ***Further Explorations of Functions with GSP***

Activity 7.4 from *Transforming Mathematics with GSP:*
Transformations of the quadratic function
Using GSP4 as a function-grapher

Week 5: (09/18 & 09/20) ***Trigonometry of the unit circle with GSP***

Chapter 9 from *Transforming Mathematics with GSP*

Week 6 (09/25 & 09/27) ***Investigating Functions***

Sorting Functions
Conic functions through paper folding
GSP Simulation of paper folded conics

Week 7: (10/02) **Midterm Practice Exam**

Click here to download Dynagraphs_5.gsp

(10/04) **Midterm Practice Review**

Week 8: (10/09) **Mid-Term Exam on Functions**

(10/11) ***Example Data Investigations from Core-Plus, Course 1, Unit 2.***
An introduction to *Fathom*

Week 9: (10/16) Continue investigation from ***Core-Plus, Course 1, Unit 2.***

(10/18) ***Visit to GCTM Annual Conference at Rock Eagle***

Week 10: (10/23) Reports of Visit to GCTM Conference
Discussion of Experimental Labs

(10/25) Fall Break

Week 11: (10/30) ***Experimental Labs***
Collecting data from lab experiments
Finding lines of best fit for your data from your lab experiments

(11/01) ***Representing and Analyzing Data from Experimental Labs***
Activities from*:*
Learning to Teach Mathematics with Technology: An Integrated Approach
We shall be using activities from Section 3, Analyzing Data with Fathom of a new curriculum resource being developed by *Hollylynne Lee & Karen Hollebrands*
Download the PDF document for Section 3 here.
Download the Fathom data set: 2006_Vehicles.ftm here.

Line of best fit for a set of data pairs: Signed, Absolute and Squared deviations
Discussion of implications of labs for teaching

Week 12: (11/06 & 11/08) ***Data Explorations & Probability***
More Activities from

Learning to Teach Mathematics with Technology: An Integrated Approach

Activity from Unit 7 of *Exploring Algebra 1 with Fathom*
An example Integrated Mathematical Exploration
Geometric Probability and Curve Fitting using Fathom

Week 13: (11/13 & 11/15) ***Modelling with GSP***

Chapter 8 from *Transforming Mathematics with GSP*
Using *GSP* to model physical situations and generate data:

The Biggest Box Problem
The Cardboard View-Tube Problem

Week 14: (11/20) ***Modelling with GSP*** *(continued)*

Discussion of simulations from the Biggest Box and View-Tube experiments

Proposals for Final Projects due

Week 15: (11/27 & 11/29) ***Work on final projects***
Week 16: (12/06) ***Work on final projects***

Final Projects due on Monday, December 10 before 5:00 p. m.

Final Exam (Project Presentations): Thursday, December 13, 8:00-11:00 am in room 111/113

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LINKS TO MATH WEBSITES

Michael de Villiers

Kindly please notify me at profmd@mweb.co.za of any links below
that or not working properly or any good links you may want to suggest.

Acknowledgement: Thanks to my student Jyothi Rugbeer for her assistance in some typing and organising of the sites into the categories below.

Access the *Principles and Standards* 120-Day Free Trial

You must sign in here to access the *Principles and Standards* 120-Day Free Trial.

User ID:

(Your E-Mail Address)

Password:

Submit

NCTM Members

NCTM Members have full access to the online *Principles & Standards* through Members Only.

Forgot Password? Enter your E-mail address here.

Submit

Register for 120-Day Free Trial of *Principles and Standards*

Please complete this one-time required registration. Once registered, you gain access to the full online *Principles and Standards* document for 120 days. Login information for this Web site will be sent to the E-mail address you provide below.

*Fields marked with an asterisk are required.

*E-Mail Address

*First Name

*Last Name

*School/Institution

*Address

*City *State *Zip

*Country

United States

*Primary Role

*Grade Level Interest

*Years Teaching

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Create Account

GPS WEBSITE FINDER

- Monthly Resources
- Professional Learning
- Unit Design Builder
- Projects and Programs
- Partners in Education
- Online Teacher Resources

CONTACT INFORMATION

Math Staff Contacts

For General Information:

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Staff Contacts

Help Desk
(Technical Assistance)
(800) 869-1011

Report Problems with this Page

Mathematics Standards

Introduction to Mathematics Performance Standards

- Executive Summary
- Math Frameworks
- Online Training, Phase III Day 1: 3-5
- GPS Training Materials
- Math Support Class
- Math GPS High School Research and Resource Manual

Middle School Math Course Transition

- GPS Course Transition
- Paths for GPS

GPS Revisions

- Mathematics Revisions Approved on 7/13/2006

Grades K-5

- Grades K-2 Mathematics Standards
- Grades 3-5 Mathematics Standards

Grades 6-8

- Grades 6-8 Mathematics Standards

Grades 9-12

- Mathematics 1
- Mathematics 2
- Mathematics 3
- Mathematics 4

- Core Mathematics 1
- Core Mathematics 2
- Core Mathematics 3
- Core Mathematics 4

- Accelerated Mathematics 1
- Accelerated Mathematics 2
- Accelerated Mathematics 3

EMAT 3500 - Final Course Project
Presentations on Thursday, December 13, 2007 8:00 - 11:00am

The purpose of the course project is to synthesize what you have learned about secondary school curriculum topics, teaching mathematics, learning mathematics, and the appropriate use of technology to enhance these topics and processes. The following project and presentation will serve as your cumulative final exam and are worth **60** points of your final grade.

An Overview of the Project

The project will be a group effort. You will form into 6 groups of 4 and one group of 5 based on your chosen mathematics topic. You and your partners will plan and create a 2-3 day (assume 60-70 minute class periods) investigation of a mathematics topic that utilizes at least two technology tools explored in this course. This project will include a clearly written lesson plan and student materials, if needed. In addition to the investigation, you will need to write a paper (one per group) that supports the methods used in teaching the topic and how technology is extending or enhancing the learning of this topic. You should use the *Georgia Performance Standards*, the NCTM *Principles and Standards* document and, if appropriate, any other readings from books or journals to support your methods. Your paper will also include a reflections section about what you learned in creating your course project.

Each group of students will share the investigation in a **25** minute class presentation. Approximately 10 minutes of that presentation should engage your classmates in a "glimpse" of the 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. Each member of your group should have a role in the presentation.

Suggestions for Getting Started:

Choose a "big idea" related to the topics studied in this course that interests you (e.g., arithmetic operations, functions, modeling, conics, statistics, trigonometry, data analysis, probability, etc.). 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 2-3 day investigation at the grade level of your choice.

Look through the websites supporting the *Georgia Performance Standards* and the NCTM *Principles and Standards* for suggestions related to your topic of study, including the NCTM Illuminations site and the Electronic Examples. You will need to cite which of the 6 Principles and 10 Standards you address in your investigation. You should also link your project activities to the relevant Georgia Performance Standards (GPS). A topic that provides opportunities for an *integrated* approach to mathematics, as indicated in the GPS will be especially important.

Do a search on your topic both on the internet and / or in print journals such as Mathematics Teacher, Mathematics Teaching in the Middle School, and Learning and Leading with Technology (we have these journals in the math education library). Look for suggested ways to teach your topic. Look through textbooks and workbook materials for suggested activities that address your topic (look in Room 111 / 113 and the 2nd floor curriculum library) . You are required to reference at least 2 sources from which you found ideas, examples, etc.

And, most importantly, keep asking yourself critical questions about HOW and WHY technology enhances or extends the teaching and learning of your topic. Remember, you need to formulate a solid rationale in support of the teaching methods and technology you will use in your 2-3 day investigation of this mathematics topic.

Guide and Rubric for Project Assessment

I. Lesson Plans, Rationale, and Reflections

Section	Points Possible
1. Describe your "big idea", the important concepts and skills related to that big idea, and the focused topic for your investigation. For whom is this unit designed? Describe the grade level and course where your investigation could be taught (grades 6, 7 or 8, Math 1, 2 3 or 4). Also describe the prerequisite skills and concepts that are essential for students to be successful in your investigation. (1 page max)	6 pts
2. List and briefly discuss the NCTM Principles and Standards and the Georgia Performance Standards that are addressed in your investigation and that support the methods and technology used. (2 pages max)	6 pts
3. Provide a lesson plan that includes classroom procedures, guiding questions for students, and an outline of what you and the students will be doing throughout the investigation. The format of this plan is flexible. Be sure to also include samples of any worksheets or handouts that would be used by students. (4 to 8 pages depending on number of worksheets or handouts included)	12 pts
4. 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, GPS, textbooks, and literature, as well as other sources you may have referenced. (1-3 pages)	12 pts
5. Write a reflection on developing the investigation. What did you and your partners learn about the mathematics topic? What did you learn about teaching this topic and students' understandings of this topic? What did you learn about the use of technology for this topic? (1 page from EACH member of the team)	6 pts
TOTAL POINTS	**42 pts**

II. 25-minute class presentation

Part of Presentation	Points Possible
Provide a clear "glimpse" at the investigation that includes an overview of the unit and actively engages the class in a sample activity using the technology. (~15 minutes)	8 pts
Provide a clear concise summary of your rationale for the methods and technology used. (~5 minutes)	6 pts
Provide a brief "glimpse" at your personal reflections on developing this investigation. (~5 minutes)	4 pts
TOTAL POINTS	**18 pts**

III. Assessment of Individual Contributions to the Group Effort.

One issue with group work is determining the contributions that individual members made to the group project. We shall use an anonymous rating sheet where each member of the group will assign a percentage to each group member that indicates that member's contribution to the group project (including their own contribution). I shall then sum these percentages for each member of the group. Ideally these summed percentages would add to 100% for each member. This anonymous procedure allows group members to assess their own contribution relative to the others in the group. Some people may feel that they did the lion's share of the work, while others may realize that they didn't pull their weight. I shall use these summed percentages as scale factors for each member of the group when assigning individual points. For example, if the group project results in a total of 60 points, and the summed percentages across the four members of the group are as follows: student A - 110%, student B - 90%, student C - 100%, and student D 100%, then A would receive 60x1.1=66, B would receive 60x0.9=54 and C and D would receive 60 points each.

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