

MATH 01205-1 Technological Tools for Discovering Mathematics (2 s.h.)

Fall 2008: M 3:15 pm – 4:55 pm, Robinson 325 Computer Lab

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Office: Rowan University Mathematics Department
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Office Hours: by appointment, W 2:00 pm – 4:30 pm

Required Technology

*Email will be used as a communication tool between Dr. Herman and students. Email from Dr. Herman will be sent to students' Rowan email accounts throughout the semester.

*Graphing Calculator (TI-83/84 or TI-89)

*Silver USB cable for Windows/MAC (\approx \$14)

http://education.ti.com/educationportal/sites/US/productDetail/us_connectivitycable_silverusb.html

*TI-Nspire handhelds and software will be provided for use in class

*TI-Connect and TI-Nspire Computer Link software and link cords will be provided for use in class

*Access to computer software will be provided on campus. Reduced package rates for *Geometer's Sketchpad*, *Fathom*, and *Tinkerplots* are available at http://keycollege.com/catalog/software_bundle/index.html

Required Texts

* readings saved on course CD (provided in class)

* Goldberg, Kenneth P. 2007. *Using Technology for Problem Solving in Middle and High School Mathematics: Investigations Using Scientific and Graphing Calculators, Spreadsheets, and The Geometer's Sketchpad*. Upper Saddle River, NJ: Pearson. ISBN-10: 0131181815, ISBN-13: 9780131181816

* Ameis, Jerry A., and Ebenezer, Jazlin V. 2006. *Mathematics on the Internet: A Resource for K-12 Teachers* (3rd Ed). Upper Saddle River, NJ: Pearson. ISBN-10: 0131715828, ISBN-13: 9780131715820

Catalog Description of Course

This course will use mathematics-specific technologies to help students discover mathematics and to develop a better understanding of new content. Throughout the course students will become aware of the broad range of mathematics-specific technologies available to mathematicians, become proficient in the use of these, and pursue the advantages, disadvantages, and limitations of such technologies. Students will solve problems and advance their understanding of topics in the areas of pre-calculus, calculus, geometry, and statistics.

(Prerequisites: Intro to Scientific Programming and Calculus I)

Course Objectives

Students will use graphing calculator handhelds and software (TI-73, TI-83/84, TI-89, TI-Nspire), and data collection devices (CBR, CBL), and software and resources on computers to investigate and develop deep mathematical understanding of various topics. Software may include programs and applications (APPS) on graphing calculators, *TI-Connect*, *TI-Nspire Computer Link*, *TI-Interactive*, *TI-Navigator*, *Excel* spreadsheets, *PowerPoint*, *Equation Editor (Math Type)*, *Geometer's Sketchpad*, *Cabri Geometry*, *Tinkerplots*, *Fathom*, *SPSS*, *Mathematica*, and applets and other resources for mathematicians available on the Internet.

Objectives for using the mathematics-specific technologies introduced in the course include problem solving, data collection and analysis, simulation of real-world events, mathematical modeling, logical thinking, programming, use of Computer Algebra Systems, construction and manipulation of geometric figures, and communication of mathematical ideas via word processing. Students will also evaluate and compare capabilities of the various technologies.

Class Participation -- Attendance and Punctuality

Students are expected to arrive on time and attend class regularly, and will sign an attendance sheet at the beginning of class on a daily basis. The course is highly hands-on with technology and involves numerous in-class activities designed as learning experiences. Each class meeting will include some time for students to complete mathematical investigations using technology, and student participation is required during every class meeting. Students are expected to turn in responses to each assignment during the same class meeting, and there will be **no make-ups** for missed work.

Class participation will count in course grades. That is, missing class will negatively affect a student's grade, including a drop of one-third of a letter grade for each class missed (e.g., A to A-). Acquiring missed notes will not suffice in terms of catching up on work, and the course instructor will not re-teach activities to students who miss class. Any graded assignments turned in late as a result of an absence will result in a grade of zero (0) up to a maximal score of **half** the credit of the completed work.

Disabilities and Special Needs

Disabilities and special needs are documented at the Office of Disability Resources in the Academic Success Center in Savitz Hall (x4233 or x4234). Students who wish for special services must provide a Notification of Accommodation letter from the Office of Disability Resources to the instructor as soon as possible at the beginning of the semester. The instructor is not responsible for providing accommodations until she receives the notification letter.

Withdrawal Policy

Students will be updated on their overall course grade after each midterm exam and any time by request (typically on email). Dates and policies regarding withdrawal from the course will follow Rowan University protocol, including the three deadlines for withdrawal during the semester. Note that the university's policy on course withdrawals during the last four weeks of the semester is that a student may withdraw only if there are circumstances beyond his/her control which prevent him/her from completing the course requirements.

Academic Honesty

All work on individual assignments must be your own. The penalty for a cheating offense will minimally be an automatic zero (0) on the related assignment, up to an automatic F in the course with a report to the Provost's Office. Procedures regarding dishonesty will follow Rowan University policies, as outlined in the Academic Honesty portion of the Student Information Guide available online.

Grading Procedures

Quizzes (Individual):	13 * 40 = 520 points
Project 1 (Partners): Calculus Activity using Technology (TI-Nspire, TI-83/84, TI-89)	240 points
Project 2 (Partners): Technology-Enhanced Investigation -- Written Project and Presentation	240 points

Total: 1000 points

Grading Scale Cut-Offs

A	A-	B+	B	B-	C+	C	C-	D+	D	D-
93 %	90 %	87 %	83 %	80 %	77 %	73 %	70 %	67 %	63 %	60 %

Grading Procedures

Quizzes (Individual):

13 * 40 = 520 points

At the end of each class meeting, students will take home an assignment (math problems, readings, software reviews, website reviews) that is due at the **start** of the following class meeting.

Math Problems: Students are expected to complete each problem and turn in a detailed solution showing all captured screens from technology (e.g., graphing calculator images) if applicable.

Readings: Students are expected to read each distributed article and turn in a written critique of the article that includes (1) a brief overview of the author's main points in the article and (2) an opinion statement about the article.

Software Reviews: Students are expected to experiment with software and turn in a written summary and critique of the software, at times comparing the functions of one type of software to another. Students are to list each software program along with a summary that includes (1) a description of the software program's main purpose and features and (2) an opinion statement regarding the usefulness of the software program in a K-12 mathematics classroom setting.

Website Reviews: Students are expected to visit each given website and turn in a written summary and critique of the website. (See what to include in software instructions above.)

Project 1 (Partners): Calculus Activity using Technology (TI-Nspire, TI-83/84, TI-89) 240 points

Students are expected to develop a classroom activity that utilizes TI-Nspire graphing calculator handheld or software features to enhance a lesson on a **calculus** topic (get topic approved by course instructor). Students will turn in the activity in both hardcopy paper and electronic form, which the course instructor will copy to share with the whole class. The activity should include at least 2 pages of **student worksheets** with instructions as well as 2 pages of **teacher notes**, following the format of activities posted on TI's Activities Exchange website. Both the student and teacher pages should include **screen captures** of work done with the handheld or software. An accompanying **TI-Nspire document (tns)** should include at least 2 **problems** related to the calculus topic. Finally, a (brief) written description of how the same lesson could be taught using features of the TI-83/84 or TI-89 as compared to TI-Nspire should be provided.

Project 2 (Partners): Technology-Enhanced Investigation – Written Project and Presentation 240 points

Students are expected to pick a project topic (get topic approved by course instructor) and then work on projects and use resources outside class to go beyond what was learned in class. Students should use guidelines for the development of technology-enhanced problem-solving investigations in mathematics presented in K. Goldberg's book (pp. xiii-xiv) and E. Glazer's article (2003). Students will present projects and provide handouts to the whole class. Along with presenting projects, each student will evaluate other students' presentations. Some sample project ideas follow:

- Mathematical investigation of any problem or data of interest to the group using various technologies
- Further exploration and use of any software mentioned in syllabus and/or class
- Investigation of at least three mathematical software programs other than those listed in this syllabus such as educational software for classroom use or test preparation software
- At least two activities and/or lessons using mathematics software suitable for grades 6-12
- Evolution of development and use of TI graphing calculators (e.g., TI-83 family now includes TI-84)
- Research on the development and use of graphing calculators other than TI brand (e.g., Casio, HP, RadioShack)
- Development and/or use of applets
- Test preparation software

Total:

1000 points

Technological Tools for Discovering Mathematics Guidelines for Written Reports

The written reports that each group will submit for your project(s) this semester should contain, at a minimum, the following elements, depending on the type of project your group is completing.

Elements of a Lesson Plan for a Classroom Activity

Instructional Goals and Objectives

Rationale

Associated State and/or National Standards

Audience/Grade Level

Prerequisites

Subject Matter/Content

Instructional Plan/Strategies

Resources (ex: textbook)

Materials

Technology

Assessment/Evaluation of Student Understanding

Appendices (ex: copies of worksheets)

Overall professional organization and presentation will count in the grade, as well.

Elements of a Mathematical Investigation of a Problem or Data

Executive Summary/Abstract: Every report should begin with a brief description of the problem under investigation, along with a brief summary of the results of the study. This section of the report is intended to give the reader (who may or may not be an expert in the field) a general idea of both the purpose and the main results of the study. It should be written so that interested people who are not necessarily experts in the field can understand the intent and main findings of the investigation.

Problem Description and Method of Solution: This section of the report should describe in detail the problem under investigation. It should include some motivation for the study, along with specific description of any variables of interest. Additionally, this section should describe what modeling methods and technologies are used to generate any meaningful results, along with why these methods and technologies are being used over any competing methodologies.

Computations and Results: This section of the report should contain any analytical and numerical analysis of the study, along with any detailed calculations that were used in generating these results. Any output from mathematical software packages or other technologies should be included here, along with a detailed description of what the output means.

Conclusions and Recommendations: Any conclusions drawn from the results of the investigation should be included. Recommendations based on these conclusions should be made in light of the original problem formulation. An indication and description of any future studies, which may be warranted, should also be included.

The report of a mathematical investigation will be graded on the relevancy of the problem studied, the accuracy of the mathematical modeling employed, the effective use of technology, and the quality of the final product. Generally speaking, reports on interesting mathematical investigations that exhibit thoughtfully developed mathematical models, prudent use of available technologies, and appropriate analysis of results will receive the highest grades.

Elements of Software Evaluation

Complete Citation: Author(s), Year, Title, Publisher/Manufacturer, Current Version

Summary: Is the source “shareware,” “public domain software,” or “free software”? How can you acquire the software? What is the cost? Is a site license available, or is the software only available for individual users? Are the objectives of the software clearly defined? What is the author/manufacturer’s intended purpose of the software? What exact mathematical ideas are incorporated? Is there a wide range of mathematics, or is the program based specifically on one subject/topic? Appropriate grade level? Is the software designed for students to work individually or together? What prior knowledge do students need to know?

How long has the software been around? How often is the software updated? What is the current version? Are updates free, or must an updated version be purchased again? Is the source/company reliable, trustworthy, well-known? Do computers have to have certain system requirements to run the software? What platform / operating system is required? Can the software operate on several different systems? Can the software be installed remotely or over a network, or must each machine be installed separately? What type of support is offered by the maker/company? Are students able to access the program at home (or must they be at school)?

Does the software program provide help upon user request? If so, what type of help? Does the program offer a tutorial? Is a "tool tip" or "help menu" available throughout use of the program? Does the software program provide for user self-pacing? How does the software respond to student answers? Will students be able to see what they have done wrong at the end of the program? Does the software program provide feedback on results? Is feedback immediate? Can the software be adjusted to different levels of difficulty? Does difficulty level automatically change when a student uses the program, or must the difficulty level be chosen manually? Can the scope and sequence of content be modified within the program? Are activities timed? Does the program stop after a certain amount of time? Can teachers set the amount of time permitted to complete an activity?

Does the software contain practice exercises? Will students be able to print out problems for later use? Can students go back to problems? Can students change work/answers? after feedback is provided? Does the software assess student performance? Is there a rating system? How does the software track student performance? Does the software produce a record of student progress? Is assessment of student activities made readily accessible to teachers?

Assessment/Reflection (overall critique of software): What is your overall impression? How would you rate the software as a tool for students? for teachers? Are the benefits of using the software worth the cost? How will students benefit from its use? Does the program encourage students to use higher-order thinking skills? Is the software age/grade/maturity level appropriate? Is the software school appropriate? Any problems with content? Will it provide equal challenge for different level students? Are there any flaws in the program, such as incorrect mathematics or computations?

Do the functions of the software meet their intended purpose? Are there any correlations between the software and state/national standards? Are there any correlations between the software and core curriculum? How would you specifically use the software program? What do you especially like about the software? What, if anything, do you dislike about the software? Is the software program user friendly? Is it easy to navigate? Are directions clear? Is the given “help” actually helpful? What do you think about the physical appeal of the software (use of graphics, sound and color)? Do video, audio, and links load quickly? Do video, audio, and links enhance student learning, or cause distraction?

Elements of an Annotated Bibliography

An annotated bibliography is a list of citations to books, articles, and documents related to a particular topic. Each citation is followed by a brief descriptive paragraph and an evaluative paragraph, called the annotation. The purpose of the annotation is to inform the reader of the relevance, accuracy, and quality of the sources cited.

Topic: What topic(s) are you interested in? What did you investigate so as to learn more about your topic? How did you find resources to read (internet, library)?

Complete Citation: Author's Last Name, Authors First Name. (year.) Title of article. *Name of Journal*, Volume Number (Issue Number), page numbers. Associated webpage url.

Summary: What do you think the author(s) provide or communicate to readers? What are the main ideas/arguments? What is the point of the article? What topics are covered? If someone asked what this article is about, what would you say?

Assessment/Reflection (evaluation): What did you learn from reading the article? Was it useful? How can you use this source? Has it changed how you think about your topic? How does it compare with other sources in your bibliography? Is the information reliable? Is it this source biased or objective?

Elements of a Research Report

Research reports should follow general formats taught in writing and English courses. See the rubrics such as those provided at the following websites for appropriate content to include in a research report.

<http://www.home.duq.edu/~millerjeff/rubric.htm>

http://www.coe.fsu.edu/cerds/programs/draft_Comp_Rubric.doc

<http://www.uwstout.edu/soe/profdev/rubrics.shtml#reports> (Click on Research Report link.)

Tech Tools Rubric for Class Presentation of Final Project

Group Members Names: _____

Date of Presentation: _____

1 Introduction

0	1	2	3
Purpose/objectives of project not described; audience not engaged; poor introduction	Vague description of purpose of project; little attempt to engage audience	Somewhat clear introduction about purpose/direction of project provided to audience	Focused and clear purpose/direction of project described; good attention grabber

2 Instructions Followed

0	1	2	3
Appropriate grade level is not mentioned; project seems almost exactly like things already done in class	Grade level is mentioned, but is not appropriate to project topics; project seems very similar to things already done in class	Appropriate grade level is provided; project seems somewhat similar to things already done in class	Appropriate grade level is provided; project goes well beyond +/- or is different from what has been done in class

3 References and Resources

0	1	2	3
No reference/resource information is provided to audience; audience is not made aware of where presenters got their information	Presenters seem to have found all their information from only one reference/resource; or citations are not current and accurate	Presenters used a variety of references/resources, but citations are not provided to the audience; or citations are incomplete	Presenters used a variety of references/resources; complete citations, including any webpages, are provided to audience

4 Organization

0	1	2	3
Lack of logical sequence of information; unorganized; not focused; very difficult to follow	Content is loosely connected; transitions lack clarity; some skipping/jumping between topics	Content is fairly organized; not difficult to follow; fairly smooth flow; no jumping between topics	Clear organization; smooth transitions; easy to follow; interesting sequence of information; not too technical

5 Content

0	1	2	3
Presenters do not have a good grasp of information; presenters not knowledgeable about topics; little understanding exists; incorrect content	Presenters do not appear to fully understand information; some difficulty +/- or discomfort with providing explanations; some mistakes in content	Presenters seem to be at ease with content, but fail to elaborate +/- or fully explain topics; content is correct, but perhaps unclear to audience	All presenters demonstrate full knowledge with explanations and elaborations; content is correct

6 Group Participation

0	1	2	3
One person dominates the presentation +/- or seems to have done most of the work; little or no evidence of outside research and preparation	A couple group members lead the presentation, leaving one person very little to show/explain to the audience; seems like one person is "off the hook" from doing work	All group members participate in the presentation, but vary in the amount of information they provide; amounts of research and preparation seem to differ between group members	Group work seems balanced; all group members took part in the presentation; clear evidence of effort related to research and preparation from all group members

7 Delivery

0	1	2	3
Presenters mumble, speak too quietly or too fast, use incorrect pronunciations, talk to themselves instead of out to the audience, do not make eye contact with audience, do not exhibit enthusiasm	A couple group members speak too quietly, too fast, +/- with incorrect and improper language; little eye contact with audience; little evidence of confidence +/- enthusiasm	Most presenters speak clearly with proper pronunciation and complete sentences/thoughts; good eye contact; some evidence of confidence +/- enthusiasm	All presenters use clear and loud enough voices, proper pronunciation of words, and appropriate technical terms; good eye contact; presenters are calm, confident, and enthusiastic

8 Handout and other presentation aids

0	1	2	3
Nonexistent OR vague; no connection to presentation; not helpful to audience; improper grammar and spelling	Appears somewhat related to presentation, but presenters do not make the connection(s) clear to audience; confusing; not easy to follow, not useful to audience; some mistakes in grammar and spelling	Appears related to presentation, but connections made by presenters are unclear/fuzzy to audience; easy to read and follow; correct grammar and spelling	Clearly related to presentation topic(s); easy to read and follow; ready to use in the future (such as in a teacher's classroom); correct grammar and spelling; involves creative features other than just text

9 Conclusion / Summary / Questions

0	1	2	3
No summary is provided to audience; audience wonders about main points/features of presentation	Summary seems weak; not related to presentation; vague; too long or too short	Main points/features are summarized, but questions from audience are not addressed clearly	Main points/features are summarized clearly for audience; questions are answered with good explanations

10 Timing of Presentation

0	1	2	3
Presentation goes more than 5 minutes over or under allotted 15 minutes	Presentation goes 5 minutes over or under allotted 15 minutes	Presentation stays within 5 minutes of allotted 15 minutes	Presentation is kept to 15 minutes (including Q&A time)