MATH 4201, MATHEMATICAL TOPICS FOR TEACHERS
Fall Semester, 2014
Mathematics Department, Dr. Evelyn Potter, Department Chair

COURSE DESCRIPTION

A review of mathematical topics of special interest to students obtaining teacher certification in mathematics, including material from algebra, geometry, probability, statistics, linear algebra, discrete math, and others. This course includes instruction on technology used in teaching mathematics, both graphing calculators and computer software. Required for the mathematical studies major but may not be counted as part of a mathematics major.

COURSE SEQUENCE IN CURRICULUM

This course is required for all students majoring in mathematical studies. It may not be used to satisfy the requirements for a major or minor in math. It is recommended for students who already have a degree but are seeking teacher certification in math under a deficiency plan. It is not a prerequisite for any other course.

PRE-REQUISITE INFORMATION

15 hours of mathematics and junior or senior standing.

INSTRUCTOR INFORMATION

Name: Dr. Jared Painter
E-mail: jpainter@hbu.edu
Office Phone: 281-649-3215
Office Location: S107A
Office Hours: TBA
Web Page Address, Web Board, ListServ: Blackboard

LEARNING RESOURCES

Course Text: None
Laboratory Text   None
Supplementary Text: None
Other Required Materials: TI Nspire CX CAS Graphing Calculator

COURSE OBJECTIVES

Purpose of the course:

This course is intended to show students who will become mathematics teachers how to use graphing calculators and commercially available software to solve mathematical problems at the middle school and high school levels, to assist them in developing methods for using such technology to teach mathematics classes at those levels, to show them how to use computer software to develop tests and handouts, to refresh their knowledge and give them a better understanding of mathematics at this level, and to enhance their chances for success on the state teacher certification test for mathematics.

Aims for the course:

Students will learn how to use a TI- Nspire graphing calculator to solve problems in algebra, trigonometry, precalculus, calculus, and statistics; how to transfer programs and data between two calculators and between a calculator and a computer; and how to

enter, edit, and run programs on graphing calculators. They will also learn how to solve problems in algebra, geometry, trigonometry, statistics, and precalculus using commercially available software packages, such as Geometer's Sketchpad; and how to use commercially-available software such as MathType, Microsoft Word, PowerPoint, and Excel to develop tests, overheads, and handouts containing mathematical symbols and imported graphics.

<u>On completion of this course, students should be able to:</u>

1. Perform basic algebraic operations with a TI-Nspire graphing calculator.
2. Perform operations on complex numbers in rectangular or polar form using a TI Nspire graphing calculator.
3. Perform algebraic operations with matrices and determinants using a TI-Nspire graphing calculator.
4. Solve systems of linear equations using matrices and determinants by using a TI-Nspire graphing calculator.
5. Compute basic statistics and draw statistical plots such as histograms, dot plots, and scatter plots using a TI- Nspire graphing calculator.
6. Construct interval estimates of population parameters using a TI- Nspire graphing calculator.
7. Enter, edit, and run a program on a TI- Nspire graphing calculator.
8. Transfer programs and data between two TI- Nspire graphing calculators.
9. Transfer programs and data between a TI- Nspire graphing calculator and a computer.
10. Construct figures involving lines, polygons, and circles using the Geometer's Sketchpad.
11. Measure angles, distances, areas, and perimeters using the Geometer's Sketchpad.
12. Carry out translations, rotations, reflections, and dilations using the Geometer's Sketchpad.
13. Simulate elementary and advanced Euclidean constructions using the Geometer's sketchpad.
14. Write scripts to automate repetitive tasks using the Geometer's Sketchpad.
15. Find the maximum and minimum values of a linear function in two variables subject to linear constraints using the graphical method of linear programming. 16.
16. Write a mathematical paper in Microsoft Word using MathType to construct mathematical formulas and equations while importing graphic images from Geometer's Sketchpad.
17. Prepare a PowerPoint presentation containing mathematical symbols constructed by using MathType.
18. Compute basic statistics and draw statistical plots such as histograms, dot plots, and scatter plots using Microsoft Excel*.
19. Perform matrix operations using Microsoft Excel*.
20. Solve problems in mathematics of finance involving simple, compound, or continuous interest, including simple annuities using Excel and/or a TI- Nspire graphing calculator.

*Some or all of these topics may be omitted due to time constraints.

RELATION TO DEPARTMENTAL GOALS AND PURPOSES

The Mathematics/Physics Department "…will offer an academically rigorous, undergraduate curriculum in classical and modern mathematics. The curriculum will prepare students majoring in mathematics and mathematical studies for careers and further education in mathematics and will encourage a lifetime of learning."

"…will provide academically rigorous and modern courses in mathematics to support other programs at the University."

"…will offer courses to enable all graduates of the University to become mathematically literate and develop useful skills in mathematics."

"…will provide the appropriate administrative processes, facilities, research experiences, and faculty to achieve the goals stated above."

RELATION TO COLLEGE GOALS AND PURPOSES

"…to prepare students for careers and further education in the natural sciences and mathematics in a nurturing Christian environment. The College will also serve the HBU community by providing science and mathematics classes that empower HBU students to meet the goals and requirements of their field of study and enrich their liberal arts education."

RELATION TO THE PURPOSE STATEMENT OF THE UNIVERSITY

University mission and purpose statement from the Houston Baptist University Catalog, 2009-2010: "…to provide a learning experience that instills in students a passion for academic, spiritual, and professional excellence as a result of our central confession, "Jesus Christ is Lord"

"…Committed to providing a responsible and intellectually stimulating environment that:

- fosters spiritual maturity, strength of character, and moral virtue as the foundation for successful living

- develops professional behaviors and personal characteristics for life-long learning and service to God and to the community

- meets the changing needs of the community and society

- remains faithful to the **'Nature of the Institution'** statement"

"…Promotes learning, scholarship, creative endeavor, and service".

ATTENDANCE

Please see the official Attendance Policy in the HBU Classroom Policy on Blackboard. Students missing more than 25% of the class will be given a failing grade.

In this course, two penalty points will be assessed for each unexcused absence after the third and one penalty point for each time you are late after the third time. In addition, you may earn up to 20 points for perfect or near perfect attendance and punctuality. Specifically, ten points will be deducted from the 20 point bonus for each unexcused absence and five points for each time you are late. Bonus points will be added to and penalty points subtracted from the 100 points possible from tests, lab, presentations, and papers before the total is divided by 10 to determine your numerical average for the course.

ACADEMIC ACCOMMODATIONS

Students needing learning accommodations should inform the professor immediately and consult the Academic Accommodations section of the HBU Classroom Policy posted on Blackboard.

COURSE REQUIREMENTS & GRADE SCALE

Course requirements:

Each student will be required to complete regular homework assignments, take two tests and a final exam which will cover primarily material presented by students during their oral presentations, make an oral presentation, and write a short research paper. Regular class attendance and class participation are required.

WORKSHEETS Students will be given regular assignments in the form of worksheets. Each worksheet will provide background information for solving related types of mathematical problems using a TI-Nspire graphing calculator, Geometer's Sketchpad, Word, or Excel, along with a list of problems and/or activities to be solved or completed and handed in one week after the worksheet is distributed.

ORAL PRESENTATION Each student will be required to give one oral presentation to the class on a mathematical topic, usually one that utilizes a graphing calculator and/or some of the computer software used in this course. If the topic requires a graphing calculator, then TI-Smartview should be used to demonstrate the procedures used. Students should prepare and use presentation-quality handouts, **short homework assignments** for their classmates along with answer keys, and **PowerPoint slides**. At least some of these should be prepared using MathType. Handouts should generally include statements (not necessarily proofs) of important definitions and theorems, an explanation of the notation used, step-by-step summaries of some or all of the mathematical procedures used, and examples. Students may use notes for oral presentations but **should not read from them or PowerPoint slides extensively**. Historical information and applications may be included but should not take up a large percentage of time. The final exam will cover primarily topics presented by students during their oral presentations, so it is imperative that students ask questions and seek further explanation of topics which are not clear to them.

Grades for presentations will be based on mathematical content and accuracy, organization, completeness, style of presentation, and how well instructions were followed. **They will also be based in part on how other students do on the final exam on the topic which was presented.**

RESEARCH PAPER Each student will write a short paper on the same topic as his/her oral presentation. The paper should be written in a more rigorous style and provide more mathematical details than the oral presentation, including proofs where appropriate. (A presentation on *How Children Learn Mathematics* would not be expected to contain proofs.) It should be a minimum of four typewritten, double-spaced pages, not including figures and tables, and be written in proper grammatical style with a title page and bibliography containing at least two references (not including websites on the Internet). The title page and bibliography should not be included when computing the length of the paper. The paper will be due on the same day as the oral presentation.

TOPICS FOR ORAL PRESENTATIONS AND RESEARCH PAPERS Each student should select one topic from those listed below. All of the concepts listed for each topic should be covered, both in the oral presentation and in the research paper, but not necessarily in the order they are listed. Each student should decide how to organize and arrange the topics to enhance the presentation or paper. Other concepts may be included besides those listed, subject to time and space limitations. Additional topics may be added to this list after the course begins. Students may also make suggestions for other topics, which must be approved by the instructor.

How Children Learn Mathematics
Research and discuss how children learn mathematics and how teachers plan, organize
and implement instruction using their knowledge of students, subject matter and the statewide curriculum in mathematics (TEKS). Note: This is competency 20 from Domain 6 (Mathematical Learning, Instruction, and Assessment) on the TEKS for

grades 8-12. For ideas, refer to NCTM (National Council of Teachers of Mathematics) articles, textbooks on educational psychology, or Scholar Google. If you need further assistance, consult your professors in the School of Education for help.

The Ambiguous Case of the Law of Sines
Derive the Law of Sines and discuss the cases in which it can be used (ASA, SSA, etc.) and the ones which require the Law of Cosines. Give examples illustrating the various cases, but focus on the ambiguous case. Explain how you can determine if there will be 0, 1, or 2 triangles that satisfy the given conditions. Use Sketchpad to construct examples to illustrate the various possibilities.

Period, Amplitude, and Phase Shift for Sine and Cosine
Show how to determine the period, amplitude, vertical shift, and phase shift for a graph of an equation of the form $y = k + A\sin(bx+c)$ or $y = k + A\cos(bx+c)$. Then show how to draw the graph of such a function by plotting the five key points corresponding to the points at the beginning and end of the primary cycle as well as the points one-fourth, one-half, and three-fourths of the way through the cycle. Discuss the significance of the sign of A and how it affects the graph. Explain how to determine from the graph of such a function the values of the four parameters, k, A, b, and c. Use Sketchpad to construct examples to include in your paper, your oral presentation, and your homework assignments.

Mathematical Operations Using Microsoft Excel
Show how to use Microsoft Excel to plot graphs of functions, plot statistical graphs such as histograms and box plots, make statistical calculations (such as means, medians, and standard deviations), sort numbers or text in columns, enter and perform operations with matrices, compute interests and annuities.

Grading standards:

Course grading is as follows:

Grades will be based on homework assignments, two tests, oral presentations, research papers, and a final exam using the weights shown below. The lowest two homework assignment grades will be dropped and the others averaged to determine the homework grade. The final exam will not be comprehensive but will cover primarily material presented by students during their oral presentations.

Item	Points
Homework	300
Two Tests (200 points each)	400
Final Exam	200
Written Paper	100
Oral Presentation	100

Note: You may count your lowest test grade, your final exam grade, or your homework grade (but only one of these) for 100 points less than the original value so the maximum number of points possible not including bonus points is 1000.

The grading scale is:

Grade	Range
A	90-100
B	80-89
C	65-79
D	50-65

| F | Below 50 |

PROFICIENCIES:

Technology component:

Students will use TI- Nspire graphing calculators and selected computer software, including The Geometer's Sketchpad, Microsoft Word, Microsoft PowerPoint and Microsoft Excel to solve a variety of mathematical problems. They will also use MathType to create documents and PowerPoint slides containing mathematical symbols and TI Smartview to demonstrate calculator procedures to the entire class.

Designated essay/writing component:

Each student will write a short research paper and prepare handouts for an oral presentation.

Reading component:

Each student must read articles and/or portions of mathematics books to prepare for an oral presentation and a short paper.

Oral communication component:

Each student will make at least one oral presentation to the remainder of the class.

Mathematics component:

Entire course.

Critical thinking component:

Students are required to read, understand and analyze problems, develop solution strategies, implement these strategies to solve the problems, then interpret and verify their results.

LATE WORK & TEST POLICY

Late work:

There will be a 10% penalty for each late assignment, unless the assignment is late due to an excused absence. No papers will be accepted more than one week after the date due unless there are extenuating circumstances.

Missed tests:

A grade of 0 will be assigned for any test missed because of an unexcused absence. **All absences will be assumed to be unexcused unless written evidence, such as a note from an attending physician, is presented to demonstrate otherwise.**

EVALUATION

Method of student appraisal of faculty:

Students will be given an opportunity to appraise the professor by completing the IDEA Faculty Evaluation Questionnaire, and/or the COSM course evaluation at the end of the semester. The instructor, the department chairman and dean will review the responses of the students after the completion of the course.

Students will be given an opportunity to describe their response to the course by completing the IDEA Faculty Evaluation Questionnaire and/or the COSM course Evaluation at the end of the course. The instructor, the department chairman and dean will review the responses of the students after the completion of the course.

LABORATORY DRESS CODE

Students may be asked in advance to wear closed-toed shoes and long pants during certain experimental procedures.

LABORATORY CONDUCT AND SAFETY

Not applicable.

TOPICAL OUTLINE - *include table, calendar, or topical outline with dates*

Topics Covered:

Week	MONDAY	WEDNESDAY
1	Course Introduction Math Type and the Equation Editor (Word and PowerPoint)	MathType (cont.) TI-Smartview
2	Introduction to TI-Connect	Using TI-Connect to Connect a TI Graphing Calculator and a Computer
3	**Labor Day Holiday September 1, 2012**	Graphing Calculators—Operations with Complex Numbers
4	Graphing Calculators—Roots and Powers of Complex Numbers; DeMoivre's Theorem	Graphing Calculators—Matrices and Determinants
5	Graphing Calculators—Solving Systems of Linear Equations (The Gauss-Jordan Method and Cramer's Rule)	Descriptive Statistics and Statistical Plots
6	**Test 1 (September 22, 2012)**	Graphing Calculators—Linear Correlation and Regression, Confidence Intervals
7	Graphing Calculators—Compound Interest and Annuities	Graphing Calculators—Writing and Executing Simple Programs
8	Graphing Calculators—Writing and Executing Simple Programs (cont.)	Graphing Calculators—Writing and Executing Simple Programs (cont.)
9	Graphing Calculators: Using a TI-89 Graphing Calculator*	Introduction to the Geometer's Sketchpad
10	Creating Custom Tools in Geometer's Sketchpad	Euclidean Constructions using Geometer's Sketchpad
11	Tables, Transformations, and Animations Using Geometer's Sketchpad	More on Geometer's Sketchpad (Students may be asked to present a short lesson for a middle school or high school class using Sketchpad)
12	**Test 2 (November 3, 2012)**	The Graphical Method of Linear Programming
13	The Graphical Method of Linear Programming (cont.)	Using Microsoft Excel to Manage a Gradebook*
14	**Student Projects**	**Student Projects** Thanksgiving is Thursday, Nov. 28
15	**Student Projects**	**Student Projects**

*This topic may be omitted due to time constraints.

The content of this outline and the attached schedule are subject to change at the discretion of the professor.

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Student Signature – I have read and understand the syllabus for this class. I understand that the content of this syllabus and the topical outline are subject to change at the discretion of the professor. I have read and understand the HBU Classroom Policy posted on Black Board. **I promise to uphold the Code of Academic Integrity at Houston Baptist University and will not tolerate its violation by others**.