

# Mathematics Assessment Plan

## Mission Statement for Academic Unit:

Georgia Perimeter College transforms the lives of our students to thrive in a global society.

As a diverse, multi-campus two-year college, we provide relevant, responsive, learner-centered higher education that facilitates the achievement of academic, professional and personal goals.

We embrace excellence, teamwork, and quality service that link the college's human capital with our communities to enhance economic, social and cultural vitality.

As a key point of entry for students into higher education in Georgia and as the major provider of associate degrees and student transfer opportunities, Georgia Perimeter College supports the Strategic Plan of the University System of Georgia.

## Program Goals:

The mathematics program, which offers two-year college instruction for both majors and non-majors, emphasizes teaching and learning mathematics while incorporating the effective use of technology with special attention to the applications of mathematics.

## MATH 0096

### Expected Outcomes for Course, Including Student Learning Outcomes:

As a result of completing this course, the student will be able to do the following:

- Solve application problems involving the four basic operations with
  - whole numbers
  - integers
  - fractions
  - decimals
  - percents
- Interpret results displayed in bar, line, and circle graphs
- Simplify numerical exponential expressions
- Convert numbers from standard to scientific notation and vice-versa
- Evaluate square roots which
  - involve perfect squares
  - involve estimation or approximation
- Classify real numbers as integers, rational, or irrational
- Determine the absolute value and the opposite of a numerical expression

- Perform the four arithmetic operations with signed numbers, including integers, fractions, and decimals.
- Evaluate and simplify numerical expressions involving order of operations
- Determine whether a given value is a solution to a given algebraic equation
- Translate an English phrase into a mathematical expression and a mathematical expression into an English phrase
- Apply and recognize the commutative, associative, distributive, identity and inverse properties
- Identify and combine like terms
- Given two sides of a right triangle, find the third side by applying the Pythagorean Theorem
- Find the area and perimeter of geometric shapes including squares, rectangles, circles,
  - triangles, and irregular shapes. Find the volume of a rectangular solid
- Recognize and apply angle relationships for triangles and quadrilaterals, vertical angles, alternate interior angles, complementary angles, and supplementary angles
- Plot points, identify the quadrants in the Cartesian System, and graph linear equations in two variables
- Apply laws of exponents for integral exponents
- Add, subtract, multiply, divide by a monomial, and factor polynomials
- Solve the following types of equations and their applications:
  - Linear
  - Factorable quadratic
  - Linear fractional
  - Linear literal
- Solve linear inequalities and write the solution set in set-builder and interval notation and graph the solution set on a number line
- Add, subtract, multiply, and divide rational expressions
- Use the calculator as appropriate, including square roots, scientific notation, order of operations, and exponential expressions

### **Procedures for Assessing Outcomes:**

This course will be assessed according to the college wide/mathematics department schedule. The assessment instrument will be designed by a college-wide Mathematics Learning Support committee. A test will be written to assess the expected educational results of the course. The assessment instrument may include the departmental final exam.

### **Plans for Use of Assessment Results:**

The Math 96 Committee is trying to improve the pass rates for students who started MATH 0096. We are using several strategies to meet this goal. This year we are encouraging instructors to rearrange topics. Strategies we are considering include the following:

We noted that the analysis that was done of the comparison between pass rates before and after the establishment of the Math 96 course do not show the increases we had hoped for. We feel that this can be improved. Some suggestions for improving the course are listed here.

- We would like to see learning support math classes divided into three classes instead of two, one of which is the 6 hour Math 0096 class which puts such a burden on our weakest students.
- We would like to increase the cutoff placement scores for Math 0096 so that fewer of the weaker students will be placed into the Math 0097 class.
- Rearrange topics in this course so that the algebra topics are covered sooner in the course.
- We will look into creating an optional MyMathLab mastery type quiz package over the topics in the Akst/Bragg text for the instructors to use if they so desire.
- We would like to have a note added to the class schedule indicating that it is not recommended that students sign up for this class if they are working full time and taking other classes.

**Schedule of Planned Assessment Activities:**

This year we will join with the Math 97 committee and share information gathered from the fall 2008 final. We will also obtain more information from Institutional Research and Planning on the pass rates of Math 96, 98 and college level classes for students who started in Math 0096.

**Review of Past Assessment Activities (2003 to Present):**

**Math 0096 Assessment Results for the Pre-Algebra Exam Spring 2008**

The Pre-Algebra Exam covered basic arithmetic and geometry. (See the test below.) There were two parts to this test. The first part was to be taken without the use of calculators. The second part allowed the use of calculators.

Exam average	65%
Number of students taking the test	329
Number of questions	40
Average number of questions correct	26
Most missed questions	10, 13, 18, 23, 25, 26, 29, 30
Areas of difficulty	Fractions, reading the problem, order of operations, Pythagorean Theorem

The single topic that gave the students the most trouble is fractions. The students scored lowest on the problems that contained fractions. The next issue seems to be reading the questions. Two of the questions were missed by a large number of students because they didn't read the question carefully enough. This included question #1 which asked for the perimeter of a rectangle not its area and question # 30 which asked for the number of drivers that drove at least 41 miles, not exactly 41 miles. Other topics that gave the students trouble included the order of operations problem number 7 that needed to be solved left to right and the Pythagorean Theorem problem number 29.

**Recommendations:**

- Spend more time on fractions. Have students work with fractions as much as possible on other sections in the pre-algebra part of the course. Also include some fractions in the algebra part of the course.
- Include section 1.1 of the Lial text as part of the review for the Pre-Algebra Exam. (This section covers fractions.)
- Include more fraction problems on the Pre-Algebra department review.
- Percent problems also caused students some trouble although not as much trouble as fractions. In the Pre-Algebra department review, we should include more percent problems.
- Because the Pythagorean Theorem is the last topic in the pre-algebra course and because we cover it again in the Lial text, I recommend that it not be included on the Pre-Algebra Exam.
- On exam day before the exam starts, emphasize to students the need to read the problems carefully.

### Fall 2006 Math 97 (includes Math 96) and Math 98 Assessment

Collectively, 15.7% of the MATH 96 students answered 70% or more of the final examination questions correctly; while, 28.8% of the students in Math 97 met the 70% benchmark.

Fall

2006

Assessment of MATH 97 and

MATH 96

Student Performance

by Course

STUDENT PERFORMANCE BY COURSE												
	Total Students	Students with 90% to 100% Correct	Percentage	Students with 80% to 89% Correct	Percentage	Students with 70% to 79% Correct	Percentage	Students with 60% to 69% Correct	Percentage	Students with below 60% Correct	Percentage	70% or more Correct
MATH 97 across all campuses	1337	48	3.6%	108	8.1%	229	17.1%	293	21.9%	659	49.3%	28.8%
Math 96 across all campuses	191	2	1.0%	9	4.7%	19	9.9%	31	16.2%	131	68.6%	15.7%

Note (s):

Data includes information from Alpharetta, Clarkston, Decatur, Dunwoody, Lawrenceville, and Rockdale campuses as well as Distance Learning courses.

## MATH 0097

Expected Outcomes for Course, Including Student Learning Outcomes:

- As a result of completing this course, the student will be able to do the following:
- Apply or recognize properties of real numbers.

- Classify real numbers as integers, rational, or irrational
- Perform the four arithmetic operations with signed numbers
- Determine the absolute value of a numerical expression
- Construct correct expressions using algebraic symbols and notations from statements
- Solve applications whose mathematical models are linear or factorable quadratic
- Add, Subtract, multiply, divide by a monomial, and factor polynomials
- Solve the following types of equations: linear, factorable quadratic, linear fractional, and linear literal
- Solve linear inequalities and write the solution set in interval notation. Graph the solution set on a number line
- Graph linear equations in two variables
- Add, subtract, multiply, and divide rational expressions
- Solve problems involving square roots, order of operations, and scientific notation with the aid of a calculator.
- Apply laws of exponents for integral exponents
- Solve problems involving the Pythagorean Theorem, area, perimeter, and volume formulas for triangles, rectangles, squares, circles, and trapezoids
- Recognize and apply angle relationships within triangles, quadrilaterals, vertical, and alternate interior angles.

#### **Procedures for Assessing Outcomes:**

Each of the outcomes listed above will be assessed by appropriate questions on a standard final exam.

#### **Plans for Use of Assessment Results:**

The assessment results will provide the curriculum committee with documented information to identify topics that should receive special attention.

#### **Schedule of Planned Assessment Activities:**

Standard final exams will be administered to every Math 0097 class at the end of every semester. Course-based assessments are done once every five years.

#### **Review of Past Assessment Activities (2003 to Present):**

A course-based assessment was done in 2003. The assessment report was written in 2003. The report states the Georgia Perimeter College achieved its goal by having at least 50% of the students answer correctly 30 out of the 40 multiple choice questions on the assessment instrument. The results were pleasing but recommendations were made to improve instructor service delivery and increase students' opportunities for learning. It is proposed to delete rational expressions and rational equations from the Math0097 curriculum.

## MATH 0098

### Expected Outcomes for Course, Including Student Learning Outcomes:

As a result of completing this course, the student will be able to:

- Use algebraic symbols and notation to make meaningful statements
- Solve applications for which linear equations, quadratic equations, and systems are mathematical models
- Solve the following equations: Quadratic with real and non-real solutions:
  - Absolute value of the form:  $|ax + b| = \text{constant}$
  - Rational leading to a quadratic
  - Polynomial of degree higher than two by factoring
  - Radical leading to linear or quadratic
- Solve inequalities, write the solution set in interval notation, and graph the following types:
  - Factorable quadratic
  - $|ax + b| < \text{or } > \text{constant}$
  - Factorable polynomial of degree higher than two
- Solve a system of two linear equations in two variables (having no, one, or many solutions) by graphing, substitution, or elimination
- Perform operations with complex numbers (excluding division)
- Apply properties of exponents with integral and rational exponents
- Perform the four basic operations with radicals (excluding rationalizing)
- Solve problems where students have to display comprehension of basic geometric concepts including the Pythagorean Theorem, area and perimeter
- Perform the following activities with lines:
  - Use the distance and midpoint formula
  - Graph equations in standard form and slope-intercept form
  - Find the slope of a line
  - State if lines are parallel or perpendicular
  - Write the equation of a line
- Use a graphing calculator
- Understand function notation
- Graph parabolas

### Procedures for Assessing Outcomes:

This course will be assessed Spring of 2009. The members of the Math 98 committee are editing a current Math 98 Final. The forty question final exam is going to be divided among the committee members to see which objective each question is evaluating. If the committee member thinks the question needs changing they will suggest an alternate question. From these suggestions a Final Math 0098 exam will be written. This exam will be distributed Spring and green scantrons will be used.

### **Plans for Use of Assessment Results:**

Recommendations resulting from the assessment will be reflected in the teaching guides. These results will be used with the recommendations already in process to move Rational Functions from Math 97 to Math 98.

### **Schedule of Planned Assessment Activities:**

The editing of the current Final that will be used for the assessment should be completed by Jan. 2009. Copies of the Final Exam and scantrons will be given to each campus by March 2009. Results will be reviewed after the final is given and recommendations will follow.

### **Review of Past Assessment Activities (2003 to Present):**

This course was assessed in 2003. The 2001-02 Learning Support Course Committee developed the assessment instrument consisting of a 40 multiple-choice question final exam. It was given Spring 2002. The assessment criteria set an acceptable performance level for MATH 98 students at "75% of the 40 questions on the assessment instrument having 50% or more students answering it correctly." Each question was evaluated on % correct. It was concluded that 32 out of 40 questions (80%) on the assessment tool that 50% or more students answered correctly. Therefore, based on the committee's criteria, the data support that GPC Learning Support Math 0098 students are performing at acceptable standards.

The assessment suggested Course Modifications/Changes/Improvements which included handouts to improve certain concepts.

## **MATH 1101**

### **Expected Outcomes for Course, Including Student Learning Outcomes:**

As a result of completing this course:

- Students will be able to identify and represent functions verbally, numerically, graphically, and symbolically, and to convert from one representation to another as appropriate.
- Students will become familiar with linear, quadratic, exponential, and logarithmic functions. Most functions will be introduced in application settings, on domains natural to the application.
- Students will use functions to answer questions related to the application.
- Students will not only learn the standard forms of linear, quadratic, exponential, and logarithmic functions and methods of graphing them, but will also find exact or approximate equations to fit these relationships.
- Students will identify appropriate input values (domain) and output values (range), determine inputs for which the function values increase, decrease or remain constant, find inputs resulting in a maximum or a minimum output value, and when needed, identify inputs which result in outputs that are less than or greater than a given value.
- Through applications, students will learn to build piecewise-defined functions.

- Students will be presented with applications that involve more than one function and will be able to identify appropriate input values for which the functions are equal, as well as, identify an appropriate interval of values for which one function is greater than the others.
- Students will be able to investigate patterns in the information given. Numerical and graphical may be used to identify patterns.
- Students will use patterns to predict values, discuss long-term behavior, and develop intuition about rates of change.
- Extensive use of technology, especially graphing calculators, is an integral part of this course.
- Students will become familiar with the use of technology to explore mathematical relationships.

### **Procedures for Assessing Outcomes:**

The present policy is to administer a college-wide final exam assessment component every 5 years, either fall or spring semester. The outcomes will continue to be assessed using the final exam. However, the course committee is considering more frequent assessment as well as using an entire final exam as an assessment instrument rather than using a set of standardized questions as part of a final exam.

An assessment was given in spring 2008 to all Math 1101 students. Fifteen questions matching Expected Educational Outcomes were added to every instructor's final exam.

### **Plans for Use of Assessment Results:**

The Math 1101 committee will target questions which had incorrect answers from more than 30% of the students. The results will be used to inform faculty of concepts that are not being mastered by students so that special attention may be given to those topics. They will also be used to identify problems and inconsistencies in the course stemming from the use of multiple texts and teaching methods. Future assessment questions will be modified based on the results as will the TG and CCO. The results may point out the need to better train faculty to teach the course. Also, integration of the calculator in the course may need to be more specified. Suggested homework will be reviewed and changes made where needed. Better advising and placement of students may also be indicated by the assessment results.

### **Schedule of Planned Assessment Activities:**

The committee plans to distribute the assessment results and their observations/suggestions about those results to the faculty. The committee may recommend more frequent assessment of the course. The committee is considering an entire final exam assessment during the next evaluation period

### **Review of Past Assessment Activities (2003 to Present):**

An assessment was administered spring 2006. However, the results were lost and recently found again so no course action was taken based on those results.

In spring 2008 an assessment was given to all Math 1101 students. There were 15 questions that assessed students' knowledge of the Expected Educational Outcomes. The results of this assessment have just be reviewed and analyzed. More than 30% of the students gave incorrect answers for eight questions. A report was sent to all Math instructors for the purpose of making recommendations for improvements in content coverage.

## MATH 1111

### Expected Outcomes for Course, Including Student Learning Outcomes:

#### EXPECTED EDUCATIONAL RESULTS

- As a result of completing this course, students will be able to:
- Understand the definition of a function.
- Determine the domain, range, and where a function is increasing, decreasing or constant for each type of function studied in the course.
- Students will be able to interpret the slope and y-intercept of a line as an average rate of change and an initial amount, respectively. Students will be able to interpret and apply these ideas in applied settings.
- Model linear and non-linear functions from data.
- Graph transformations (vertical and horizontal shifts, vertical stretching and compressions, and reflections) of basic functions.
- Graph quadratic functions of the form  $y = ax^2 + bx + c$  by determining the vertex and intercepts. Students will be able to interpret and apply these ideas in applied settings.
- Identify and graph power functions, transformations of power functions, and polynomial functions where the polynomial is factorable. Students will be able to describe the end behavior of polynomials and the relationship between end behavior and the degree of the polynomial. Students will be able to determine intercepts of factorable polynomials exactly. Students will be able to use technology to approximate x-intercepts and turning points of polynomials.
- Identify and graph transformations of  $y = 1/x$  and  $y = 1/x^2$ . Students will be able to recognize and determine vertical and horizontal asymptotes, end behavior, and behavior near vertical asymptotes.
- Relate algebraic solutions to the following types of equations to the graphs of corresponding functions and applications:
  - Linear
  - Quadratic
  - Factorable polynomial
  - Rational
  - Radical (involving only one radical)
  - Equations of the form  $x^n = k$
- Graph piece-wise defined functions.

- Students will be able to determine the symmetry of functions algebraically and graphically
- Compose two functions and determine the domain of the composite function.
- Define an inverse function, get a rule for an inverse function, and graph an inverse function.
- Graph exponential functions of the form  $y = a^x$  and their transformations. Students should also be able to graph the inverse function of  $y = a^x$ .
- Solve simple exponential equations both graphically and using logarithms.
- Apply exponential functions to problems involving exponential growth or decay.
- Define a logarithm, convert between logarithmic and exponential form, and understand the inverse relationship between logarithmic and exponential functions.
- Use properties of logarithms to solve logarithmic equations and use logarithms in application problems.
- Use function graphs to determine solutions to the following types of inequalities and apply these solutions to concepts related to functions and other applications:
  - Linear
  - Quadratic
  - Factorable Polynomial
  - Rational
  - Exponential
- Solve non-linear systems of equations analytically and graphically.
- Solve linear systems of equations using Gaussian elimination and matrices.
- Graph parabolas and circles whose equations are given in general form by completing the square.

#### GENERAL EDUCATION OUTCOMES

- This course addresses the general education outcome relating to communication by providing additional support as follows:
  - Students improve their listening skills by taking part in general class discussions and in small group activities.
  - Students improve their reading skills by reading and discussing the text and other materials. Reading mathematics requires skills somewhat different from those used in reading materials for other courses, and these are discussed in class.
  - Unit tests, examinations, and other assignments provide opportunities for students to practice and improve mathematical writing skills. Mathematics has a specialized vocabulary that students are expected to use correctly.
- This course addresses the general education outcome of demonstrating effective individual and group problem-solving and critical skills as follows:
  - Students must apply mathematical concepts to non-template problems and situations.
  - In applications, students must analyze problems, often through the use of multiple representations, develop or select an appropriate mathematical model, utilize the model, and interpret results.
- This course addresses the general education outcome of using mathematical concepts to interpret, understand, and communicate quantitative data as follows:

- Students must demonstrate proficiency in problem solving including applications of linear, quadratic, exponential, and logarithmic functions.
- Students must be familiar with simple data analysis tools for building linear and non-linear models.
- This course addresses the general education outcome of organizing information through the use of computer software packages as follows:
  - Students are required to use a graphing calculator to graph functions, determine intercepts, and determine turning points of graphs.
  - Students will use simple data analysis tools for building linear and non-linear models.

### **Procedures for Assessing Outcomes:**

In the past, the overall percentage of problems answered correctly by students on the assessment portion of their final exams was calculated, and the percentage of correct student responses per item was tallied. The committee is presently in the process of analyzing data collected Spring 2008 and should be able to draw more extensive conclusions from the specialized statistics produced through our college OIRP department analysis of each test item.

### **Plans for Use of Assessment Results:**

The committee plans to summarize data analysis from the Spring 2008 assessment. Initial findings seem to suggest that some questions may have been worded poorly and may not have tested what was intended. Other results suggest that more emphasis should be placed on teaching certain concepts. There is some discussion among committee members of producing worksheets on topics of particular concern. However, this is a preliminary report and the committee's findings are still very much inconclusive.

### **Schedule of Planned Assessment Activities:**

The committee plans to present a summary of their findings to the mathematics discipline by the end of fall semester 2008. If practical, the committee will possibly design further assessment to be done in Spring 2009.

### **Review of Past Assessment Activities (2003 to Present):**

Fall 2005 Assessment – 12 questions, based on 12 selected EERs in the course, given as a portion of the final exam in every individual MATH 1111 course. The questions used, the results obtained, and the resulting recommendations presented to the Mathematics Discipline are attached as Addendums A & B.

Spring 2008 Assessment – 12 questions, based on 12 selected EERs in the course, given as a portion of the final exam in every individual MATH 1111 course. The questions used and the results obtained are attached as Addendums C, D, and E.

## MATH 1113

### Expected Outcomes for Course, Including Student Learning Outcomes:

As a result of completing this course, the student will be able to:

- Graph polynomial, rational, root, exponential, logarithmic and split-domain functions
- Use concepts including domain and range, intercepts, asymptotes, even or odd definitions, and intervals of increase and decrease to describe the behavior of functions
- Graph variations of functions using translations, reflections and stretches
- Write and graph the inverse function for a given function.
- Define and apply composition of functions
- Recognize and graph ellipses and hyperbolas from their equations in standard and shifted form.
- Define and investigate rates of change including average rates of change
- State and apply the unit circle definitions of the six trigonometric functions
- Graph and apply functions of the form  $f(x) = a \sin(bx + c) + d$ ,  $g(x) = a \cos(bx + c) + d$ , and  $h(x) = a \tan(bx + c) + d$
- Graph the six standard trigonometric functions
- State and apply the definitions of the inverse trigonometric functions
- Graph the basic inverse trigonometric functions
- Apply the reciprocal, quotient, Pythagorean, cofunction, even-odd, addition and double-angle identities
- Prove trigonometric identities
- Solve equations involving trigonometric functions
- Solve problems using triangle trigonometry
- Represent complex numbers in trigonometric form
- Describe vectors both geometrically and algebraically
- Solve problems involving vectors
- Expand sequences, write and find the value of series
- Solve application problems involving exponential growth and decay

### Procedures for Assessing Outcomes:

An assessment instrument covering the objectives will be created and administered to all sections of the course as part of the final exam.

### Plans for Use of Assessment Results:

Results of the assessment will be analyzed to determine inadequate coverage, and the teaching guides and course outline will be amended as necessary.

### Schedule of Planned Assessment Activities:

The assessment will be administered once a year, in the Fall. It will be analyzed and any changes made to course documents in the Spring.

### **Review of Past Assessment Activities (2003 to Present):**

Math 1113 (Precalculus) was assessed in spring semester 2006. The assessment instrument consisted of a 30 question multiple-choice exam that was administered in all sections of Math 1113.

A total of 808 students took the final exam. The mean score was 19.15 out of 30 or 63.83%. The committee found that seven problems on the assessment were either harder than typical homework problems on that topic, focused on more “obscure” topics in the course, or had potential confusion in the wording of the question or answers. Adjusting for these issues, the committee finds that student performance on the assessment was satisfactory. However, there is significant room for improvement.

Students had significant difficulty on the following topics:

- Graphing the inverse of a function, given the graph of the original function.
- Determining whether a function is even, odd, or neither
- Finding vertices and asymptotes of hyperbolas
- Finding the average rate of change of a function
- Simplifying complicated trigonometric expressions
- Solving more difficult types of trigonometric application problems
- Converting complex numbers from trigonometric form to standard form
- Finding the components of a vector given the magnitude and direction

Instructors should be aware of these difficulties and spend more time on these topics.

One of the approved books does not directly address finding the average rate of change of a function over an interval. The committee is modifying the teaching guide to let instructors know that they need to address this topic.

The committee is modifying the teaching guide to streamline the treatment of exponential and logarithmic functions. The committee is also making the topic of trigonometric form of complex numbers an optional topic. In addition, the committee is developing pacing guides to assist faculty in developing their schedules. The committee hopes that these modifications will allow more classroom time for the difficult trigonometry topics in the course and for the material at the end of the course (conics, vectors) where student performance suffered.

## **MATH 1431**

### **Expected Outcomes for Course, Including Student Learning Outcomes:**

As a result of completing this course, the student will be able to:

- Analyze statistical problems using critical thinking skills, such as deciding on appropriate statistics to measure and suitable tests to be performed;
- Support statistical analyses using the course-required calculator whenever possible;
- Define basic descriptive and inferential statistical terms;
- Select a random sample;
- Construct frequency and relative frequency tables and histograms, stem-and-leaf diagrams, boxplots, and scatter diagrams;
- Determine the mean, median, mode, standard deviation, range, and quartiles for a set of data;
- Interpret and apply z-scores;
- Compute regular and conditional probabilities of events from a contingency table;
- Using contingency tables, determine the probability of the compound event A and B, and the probability of the compound event A or B.
- Determine the mean and standard deviation for a discrete probability distribution;
- Make appropriate checks for normality of distributions and apply the properties of normal and standard normal distributions;
- Use the standard normal distribution to determine probabilities.
- Interpret the Central Limit Theorem and compute the standard error of the mean and its standard deviation;
- Determine confidence intervals for the mean and proportion of one population for large samples or normally distributed populations;
- Apply the basic model of hypothesis testing and select the appropriate distribution to make inferences about a population mean and proportion or the difference between two population means and proportions, including the use of z-, t-, statistics;
- Test experimental results against known distributions (goodness-of-fit) and the statistical independence of two variables in experiments where results are organized in contingency tables;
- Write a regression line equation which best represents data relating two variables and interpret and/or make predictions from the line;
- Compute the linear correlation coefficient for a regression line and interpret its significance;
- Identify components of Statistical Design.

### **Procedures for Assessing Outcomes:**

A new assessment instrument will be designed. These will reflect the new EERs if the changes pass the Senate.

### **Plans for Use of Assessment Results:**

After the new assessment instrument is given, the results will be analyzed.

Any areas that show considerable deficiency will be addressed by the MATH 1431 Course Committee.

This may include, but is not limited to the following:

- Development of course materials to give faculty extra help for teaching the specific areas
- Faculty meetings to discuss the deficient areas and plans to rectify them
- Requesting funding for faculty development opportunities in the specific area

- Retesting the deficient areas in successive assessments to gauge the effectiveness of any corrective actions that may be taken.

**Schedule of Planned Assessment Activities:**

The course will be assessed in the spring semester of every even calendar year.

**Review of Past Assessment Activities (2003 to Present):**

In Fall 2007, a ten question assessment was given to all Statistics classes except for one instructor’s online course. After the results of the assessment were analyzed, the committee felt that some of the questions covered too many outcomes. This caused difficulty in making instructional changes to improve assessment results. The results of this assessment are shown below.

(The last assessment prior to 2007 was in 2001.)

In the Fall Semester of 2007, a 10 question assessment was administered to all Math 1431 sections. A total of 742 assessments (717 in class and 25 online) were given. The results are summarized in the table below.

Question #	EER tested	Number Correct out of 717	Number Correct out of 25	Total Number Correct out of 742	Percent Correct
1	#6 Understand resistance of Descriptive Measures	357	18	375	50.54%
2	#6 Interpret Descriptive Measures	469	23	492	66.31%
3	#12	406	24	430	57.95%
4	#8	638	12	650	87.60%
5	#13	280	20	300	40.43%
6	#1, 14	296	19	315	42.43%
7	#1, 15	459	18	477	64.29%
8	#14 Interpreting Confidence Interval	123	12	135	18.19%
9	#3	529	22	551	74.26%
10	#18	390	21	411	55.39%

The Math 1431 Committee should investigate the results of questions 1, 3, 5, 6, 8 and 10.

## MATH 1433

### Expected Outcomes for Course, Including Student Learning Outcomes:

As a result of completing this course, the student will be able to:

- Locate and describe discontinuities in functions.
- Evaluate limits for polynomial and rational functions.
- Compute and interpret the derivative of a polynomial, rational, exponential, or logarithmic function.
- Write the equations of lines tangent to the graphs of polynomial, rational, exponential, and logarithmic functions at given points.
- Compute derivatives using the product, quotient, and chain rules on polynomial, rational, exponential, and logarithmic functions.
- Solve problems in marginal analysis in business and economics using the derivative.
- Interpret and communicate the results of a marginal analysis.
- Graph functions and solve optimization problems using the first and second derivatives and interpret the results.
- Compute antiderivatives and indefinite integrals using term-by-term integration or substitution techniques.
- Evaluate certain definite integrals.
- Compute areas between curves using definite integrals.
- Solve applications problems for which definite and indefinite integrals are mathematical models.
- Solve applications problems involving the continuous compound interest formula.

### Procedures for Assessing Outcomes:

This course was assessed with a set of twenty-nine common final exam questions administered in fall, 2006.

A similar assessment instrument will be used in spring 2009. This course is only taught once per year, so the sample size for any assessment will be very small.

### Plans for Use of Assessment Results:

Recommendations resulting from the assessment will be reflected in the teaching guides. These might include comments on areas that need special emphasis or could result in changes in suggested homework problems. It should be noted that the basic curriculum for the course cannot be substantially altered because of transfer issues.

### Schedule of Planned Assessment Activities:

The final exam for spring 2009 will be used for assessment. Only one section of this course is taught each year.

### **Review of Past Assessment Activities (2003 to Present):**

The course was assessed in fall 2006. Because of the low enrollment in this course, only 11 students took the assessment.

The assessment contained 29 multiple-choice questions. The high score was 26/29 (90%) and the low score was 17/29 (59%). Five of the eleven students scored at least 70% on the final. One student scored below 60%. There were three questions on the assessment that eight of the eleven students answered incorrectly. One question was finding the limit of a rational function that first required algebraic simplification. Another question required students to interpret the meaning of marginal revenue in the context of the given problem. The third question required students to determine the break-even point when given a cost and revenue function. So, the committee recommends that more focus be given on these topics when covered. All of the students correctly answered two questions; one question required students to specify the intervals where a function was continuous and the other question required students to evaluate a definite integral. Few questions requiring the setup or use of a definite integral were answered incorrectly.

## **MATH 2008**

### **Expected Outcomes for Course, Including Student Learning Outcomes:**

- Understand numbers, ways of representing numbers, relationships among numbers, and number systems.
- Understand meanings of operations and how they relate to one another.
- Compute fluently and make reasonable estimates.
- Apply multiple problem solving strategies and understand how approaches to solutions relate to one another.
- Use Venn Diagrams to illustrate the set operations union, intersection, and complement.
- Represent and interpret functions verbally, numerically, graphically and symbolically.
- Distinguish between deductive and inductive reasoning and valid and invalid arguments.
- Understand the role of place value and notation in various numeration systems.
- Use mental arithmetic to perform basic calculations.
- Use tests for divisibility and determine prime factorization, GCF and LCM.
- Use integers and rational numbers to demonstrate concepts of order and equivalence.
- Use rational and irrational numbers in problem-solving settings.

### **Procedures for Assessing Outcomes:**

A question or two was written to measure each of the 12 Expected Educational Results. The committee established a pass rate of 75% as an acceptable level of competency. Ten of the fifteen questions met this criterion. The committee found that students' overall performance on the assessment instrument was satisfactory, however there is need for improvement in the delivery and comprehension of five of the EERs (numbers 2, 3, 7, 9, & 12).

## **Plans for Use of Assessment Results:**

### **Recommendations:**

- EER #2: The committee decided that question #2 on the assessment instrument did not fully address EER #2. Therefore, the committee agreed to rewrite question #2 on the assessment instrument to better reflect the Expected Educational Result.
- EER #3: More time and instruction should be given to making estimates and the types of estimation techniques.
- EER #7: Written definitions of the four types of reasoning should be given along with 2-3 examples of each.
- EER #9: A clear comparison of estimation and mental computation should first be established. Instructors should give several examples of the different types of mental computation.
- EER #12: Problem solving analysis and techniques should be emphasized and practiced throughout the semester. Both group and individual practice should be used on an ongoing basis.
- The committee is investigating the possibility of giving a similar 15 question assessment every semester to aid in assessing the course and the topics being covered.
- The committee will create critical thinking questions to include on all future assessment instruments.
- The committee will include some assessment questions that address the use of manipulatives.
- The committee will inform instructors of the areas of difficulty so that they can spend more time on these topics.

## **Schedule of Planned Assessment Activities:**

Please see recommendations 6, 7, and 8.

## **Review of Past Assessment Activities (2003 to Present):**

This was the first assessment of Math 2008.

## **MATH 2420**

### **Expected Outcomes for Course, Including Student Learning Outcomes:**

As a result of completing this course, the student will be able to do the following:

- Use critical thinking skills to solve problems by modeling the problem as an instance of the finite mathematical structures studied in the course;
- Demonstrate understanding of the concept of a finite mathematical structure based on experience with various examples of mathematical structures, especially those with application to computer science;

- Construct and understand proofs based on direct or indirect reasoning, mathematical induction, or the pigeonhole principle;
- Apply the basic operations for sets, namely, union, intersection, complement, and subset formation;
- Construct, interpret, and evaluate logical statements involving and, or, negation, and implication;
- Describe similarities and differences in the mathematical structures of sets and logical statements in terms of properties for the basic operations in each;
- Classify a relation as one-to-one, onto, or functional;
- Determine if a relation is an equivalence relation, a partial order, a permutation, or a tree;
- Given a finite relation, construct its incidence matrix, graph/digraph, and inverse;
- Compose two sets given as ordered pairs, incidence matrices, or graphs;
- Determine if a partial order is a Boolean algebra;
- Represent a Boolean function as a circuit;
- Traverse a tree in preorder, inorder, or postorder;
- Describe the language of a phrase structure grammar;
- Classify a grammar as Type 0, 1, 2 (context-free), or 3 (regular);
- Represent a context-free or regular grammar with syntax diagrams or in BNF notation.

#### General Education Outcome:

- This course addresses the general education outcome relating to communication by providing additional support as follows:
  - Students develop their listening skills through lecture and through group problem solving.
  - Students develop their reading comprehension skills by reading the text and by reading the instructions for text exercises, problems on tests, or on projects.
  - Reading mathematics text requires recognizing symbolic notation as well as analyzing problems written in prose.
  - Students develop their writing skills through the use of problems that require written explanations of concepts.
- This course addresses the general education outcome of demonstrating effective individual and group problem-solving and critical-thinking skills as follows:
  - Students must apply mathematical concepts previously mastered to new problems and situations.
  - In applications, students must analyze problems and describe problems through pictures, diagrams, or graphs, then determine the appropriate strategy for solving the problem.
- This course addresses the general education outcome of using mathematical concepts to interpret, understand, and communicate quantitative data as follows:
  - Students must demonstrate proficiency in problem-solving skills including applications of finite mathematical structures, functions and relations, graphs, combinatorics and logic.
  - Students must write functions to describe real-world situations and interpret information from both the function (relation) rule and the graph of the function (relation).

- Students must solve problems in combinatorics, graph theory and logic that often arise in modeling numerical relationships.

### **Procedures for Assessing Outcomes:**

#### **COURSE GRADE**

The course grade will be determined by the individual instructor using a variety of evaluation methods. A portion of the course grade will be determined through the use of frequent assessment using such means as tests, quizzes, projects, or homework as developed by the instructor. Some of these methods will require the student to demonstrate ability in problem solving and critical thinking as evidenced by explaining and interpreting solutions. A comprehensive final examination is required which must count at least one-fifth and no more than one-third of the course grade.

#### **DEPARTMENTAL ASSESSMENT**

This course will be assessed every five years. The assessment instrument will consist of a set of free response questions that will be included as a portion of the final exam for all students taking the course.

A committee appointed by the Executive Committee of the Mathematics Academic Group will grade the assessment instrument.

### **Plans for Use of Assessment Results:**

The Math 2420 Committee, or a special assessment committee appointed by the Executive Committee of the Mathematics Academic Group, will analyze the results of the assessment and determine implications for curriculum changes. The committee will prepare a report for the Academic Group summarizing its finding.

### **Schedule of Planned Assessment Activities:**

An assessment of Discrete Math in the Spring of 2009 was discussed during the course committee meeting of September 19, 2008. The assessment tool will be developed and presented to the committee by April 8, 2009.

### **Review of Past Assessment Activities (2003 to Present):**

2003-2004

2004-2005

2005-2006 Not assessed. Planned assessment for 2006-07

2006-2007

2007-2008

2008-2009 An assessment is planned for this year during Spring-2009

## **MATH 2431**

### **Expected Outcomes for Course, Including Student Learning Outcomes:**

As a result of completing this course, the student will be able to:

- Investigate limits using algebraic, graphical, and numerical techniques.
- Investigate derivatives using the definition, differentiation techniques, and graphs. The classes of functions studied include algebraic, trigonometric, inverse trigonometric, exponential, logarithmic, hyperbolic and implicit.
- Apply the derivative as a rate of change, optimize functions, use Newton's Method, and sketch curves.
- Define the definite integral and use Riemann sums to approximate definite integrals.
- State and apply the Fundamental Theorem of Calculus.
- Graph and use parametric equations.

### **Procedures for Assessing Outcomes:**

This course was assessed with a set of ten multiple-choice common final exam questions administered in fall, 2006.

Based on this assessment, the committee will identify three or four focus areas for improvement in spring 2009. Instructors will be informed of these focus areas and assessment items on these focus areas will be administered over the course of spring, 2009.

### **Plans for Use of Assessment Results:**

Recommendations resulting from the assessment will be reflected in the teaching guides. These might include comments on areas that need special emphasis or could result in changes in suggested homework problems. It should be noted that the basic curriculum for the course cannot be substantially altered because of transfer issues.

### **Schedule of Planned Assessment Activities:**

Assessment items on the focus areas will be administered in spring 2009. The committee anticipates follow-up in 2009-10 based on the results from spring 2009.

### **Review of Past Assessment Activities (2003 to Present):**

The course was assessed in fall, 2006; however, there was a delay in getting the results from OIRP so the committee did not receive the results until fall, 2007. The overall mean score on the assessment was 49.11%; however, an analysis of incorrect answers showed that low scores on three questions were the result of minor mistakes. A report for Math 2431, 2432, and 2633 was written in spring, 2008.

Based on this report, a note will be added to the teaching guide advising instructors to spend more time on application problems and will encourage instructors to use two part tests if a computer-algebra system is used on tests.

The committee will identify three or four focus areas for improvement that will be communicated to instructors and reassessed in spring, 2009.

The assessments given over the course of spring 2009 will allow the committee to allow graphing calculators and computer-algebra systems on some assessments and not allow technology on other assessment items. The 2006 assessment did not allow technology use – which may have contributed to the disappointing results.

## **Math 2432**

### **Expected Outcomes for Course, Including Student Learning Outcomes:**

As a result of completing this course, the student will be able to:

- Evaluate integrals using techniques of integration.
- Approximate the definite integral using the Trapezoid Rule and Simpson's Rule.
- Use integrals to solve application problems.
- Solve separable differential equations and apply to elementary applications.
- Investigate the convergence of series and apply series to approximate functions and definite integrals.
- Apply polar representations including graphs, derivatives, and areas.

### **Procedures for Assessing Outcomes:**

This course was assessed with a set of ten multiple-choice common final exam questions administered in fall, 2007.

Based on this assessment, the committee will identify three or four focus areas for improvement in spring 2009. Instructors will be informed of these focus areas and assessment items on these focus areas will be administered over the course of spring, 2009.

### **Plans for Use of Assessment Results:**

Recommendations resulting from the assessment will be reflected in the teaching guides. These might include comments on areas that need special emphasis or could result in changes in suggested homework problems. It should be noted that the basic curriculum for the course cannot be substantially altered because of transfer issues.

### **Schedule of Planned Assessment Activities:**

Assessment items on the focus areas will be administered in spring 2009. The committee anticipates follow-up in 2009-10 based on the results from spring 2009.

### **Review of Past Assessment Activities (2003 to Present):**

The course was assessed in fall, 2007. The overall mean score on the assessment was 60.06%. An assessment report for Math 2431, 2432, and 2633 was written in spring, 2008.

Based on this report, a note will be added to the teaching guide advising instructors to spend more time on application problems and to be sure to allow enough time for infinite series.

The committee will identify three or four focus areas for improvement that will be communicated to instructors and reassessed in spring, 2009.

The assessments given over the course of spring 2009 will allow the committee to allow graphing calculators and computer-algebra systems on some assessments and not allow technology on other assessment items. The 2007 assessment did not allow technology use – which may have contributed to the disappointing results.

## **MATH 2633**

### **Expected Outcomes for Course, Including Student Learning Outcomes:**

As a result of completing this course, the student will be able to:

- Find equations of lines and planes in three dimensions.
- Find arc length, curvature, and the moving trihedral for vector functions and space curves.
- Calculate and apply partial derivatives.
- Calculate and apply double and triple integrals.
- Calculate line integrals.

### **Procedures for Assessing Outcomes:**

This course was assessed with a set of five free response questions common final exam questions administered in fall, 2007. The assessment was graded in spring 2008 using a grading rubric determined by the committee.

The course will be reassessed in fall, 2008 with a set of five free response questions on the final exam.

### **Plans for Use of Assessment Results:**

Recommendations resulting from the assessment will be reflected in the teaching guides. These might include comments on areas that need special emphasis or could result in changes in suggested homework problems. It should be noted that the basic curriculum for the course cannot be substantially altered because of transfer issues.

### **Schedule of Planned Assessment Activities:**

Five common questions will be used on the fall, 2008 final exam.

### **Review of Past Assessment Activities (2003 to Present):**

The course was assessed in fall, 2007, but there were problems with the data because different instructors weighted the assessment differently resulting in students not applying equal effort across all sections.

The course will be reassessed in fall, 2008 with a specification that the assessment must count 40% of the exam grade. This should prevent the type of data problems in the 2007 assessment.

## **MATH 2641**

### **Expected Outcomes for Course, Including Student Learning Outcomes:**

As a result of completing this course, the student will be able to do the following:

- Use Gauss-Jordan Elimination to solve systems of linear equations and identify those with one solution, no solution, or an infinite number of solutions.
- Perform operations with matrices, namely,
  - Matrix addition and subtraction,
  - Scalar multiplication,
  - Transposition,
  - Matrix multiplication,
  - Matrix inversion, and
  - Calculation of rank and determinant.
- Solve problems that require that the student demonstrate comprehension of fundamental properties of the above operations including, but not limited to,
  - Axioms for matrix addition and scalar multiplication,
  - Laws for transposes of matrix sums, products, and scalar multiples,
  - Laws for inversion of matrix transposes, products, and scalar multiples,
  - Laws for determinants of matrix products, inverses, and transposes,
  - Significance of the determinant of a matrix yielding zero, and
  - Significance of the product of two matrices yielding the identity.
- Demonstrate comprehension of fundamental definitions used in the study of linear algebra by determining whether or not
  - A subset is a subspace of a given vector space,
  - A vector lies in the span of a given set of vectors and, if so, express that vector as a linear combination of the others,
  - A set of vectors is linearly independent,
  - A set of vectors forms a basis of a given vector space or subspace,
  - A vector function is a linear transformation, and

- A linear transformation is on-to-one, onto, or an isomorphism.
- Actively use the above definitions to obtain
  - A basis for and calculation of the dimension of a given vector space or subspace,
  - A linear transformation that satisfies given properties and a computation of the action of that transformation on a given vector,
  - A basis for the kernel, a basis for the image, the nullity, and rank of a given linear transformation,
  - The action of the composition of two given linear transformations (in either order) on a given vector, and
  - The inverse transformation of a given isomorphism and its action on a given vector.
- Using an appropriate inner product, obtain
  - The norm of a given vector,
  - The unit vector that is a scalar multiple of a given vector,
  - A basis for and calculation of the dimension of the orthogonal complement of a given subspace,
  - The projection of a given vector onto a given subspace,
  - An orthogonal basis for a given inner product space or subspace, and
  - An orthonormal basis by normalizing an orthogonal basis.
- Obtain the characteristic polynomial, eigenvalues, eigenvectors, diagonalization, and a basis for each eigenspace for a given square matrix.
- Use least-squares methods to approximate solutions for inconsistent systems.
- Apply the basic definitions for quadratic forms.

## GENERAL EDUCATION OUTCOMES

- This course addresses the general education outcome relating to communication by providing additional support as follows:
  - Students develop their listening and speaking skills through participation in class and through group problem solving.
  - Students develop their reading comprehension skills by reading the text and by reading the instructions for text exercises, problems on tests, or on projects. Reading mathematics text requires recognizing symbolic notation as well as analyzing problems written in prose.
  - Students develop their writing skills through the use of problems that require written explanations of concepts.
- This course addresses the general education outcome of demonstrating effective individual and group problem-solving and critical-thinking skills as follows:
  - Students must apply mathematical concepts previously mastered to new problems and situations.
  - In applications, students must analyze problems and describe problems with either pictures, diagrams, or graphs, then determine the appropriate strategy for solving the problem.
- This course addresses the general education outcome of using mathematical concepts to

interpret, understand, and communicate quantitative data as follows:

- Students must demonstrate proficiency in problem-solving skills including applications of linear systems, linear transformations and vector space methods.
- Students must write linear systems to describe real-world situations and interpret information about the number of solutions as well as the solution of the systems themselves.
- Students must solve systems of linear equations which often arise in modeling numerical relationships.

### **Procedures for Assessing Outcomes:**

#### **COURSE GRADE**

The course grade will be determined by the individual instructor using a variety of evaluation methods. A portion of the course grade will be determined through the use of frequent assessment using such means as tests, quizzes, projects, or homework as developed by the instructor. Some of these methods will require the student to demonstrate ability in problem solving and critical thinking as evidenced by explaining and interpreting solutions. A comprehensive final examination is required which must count at least one-fifth and no more than one-third of the course grade.

#### **DEPARTMENTAL ASSESSMENT**

This course will be assessed every three years. The assessment instrument will consist of a set of free response questions that will be included as a portion of the final exam for all students taking the course.

A committee appointed by the Executive Committee of the Mathematics Academic Group will grade the assessment instrument.

### **Plans for Use of Assessment Results:**

The Math 2641 committee, or a special assessment committee appointed by the Executive Committee of the Mathematics Academic Group, will analyze the results of the assessment and determine implications for curriculum changes. The committee will prepare a report for the Academic Group summarizing its findings.

### **Schedule of Planned Assessment Activities:**

An assessment of Linear Algebra was done during Spring 2008. The Committee discussed the Linear Algebra Assessment from Spring and Summer 08 and suggested that the use of technology be more heavily emphasized:

#### **Linear Algebra Assessment information (Spring-2008)**

Total number of classes: 5 (4 Spring, 1 Summer)

Total number of students: 109

First Problem (Eigenvalues): 70.4% correct

Second Problem (Vector Spaces): 58.1% correct

Third Problem (Least Squares): 44.4% correct

These results were within our expectations for the first two questions and relatively close for the third question.

One Important note is that one of the sections did not cover Least Squares and nearly everyone in that section got the third problem completely incorrect.

Another important thing to note is that three of the five sections made heavy use of technology and the other two sections made minimal use of technology. Just taking the three sections that did emphasize either calculator or computer use the results become:

First Problem (Eigenvalues): 85.7% correct Second Problem (Vector Spaces): 63.1% correct Third Problem (Least Squares): 80.2% correct.

There is a significant improvement in the first two questions but an even more striking improvement in the last problem. One suggestion is to add a line to the teaching guide further emphasizing that students should be able to use either a computer or calculator for row reduction and this is a requirement for the course.

One other note, the second problem (which was more conceptual than the other questions) was only marginally within our expectations and this was only slightly helped with the use of technology. If any area really needs work I think it is in understanding abstract vector spaces.

### **Review of Past Assessment Activities (2003 to Present):**

2003-2004	Assessment done Spring 2004. .
2004-2005	Assessment done Fall-04, Spring-05, and Summer-05.
2005-2006	An assessment. is planned for Spring 2006
2006-2007	No assessment
2007-2008	An assessment was done during Spring & Summer 2008
2008-2009	No assessment planned

## **MATH 2652**

### **Expected Outcomes for Course, Including Student Learning Outcomes:**

As a result of completing this course, the student will be able to do the following:

- Analyze problems using critical thinking skills.
- Use functions and their derivatives to construct mathematical models.
- Solve application problems for which differential equations are mathematical
- Solve the following kinds of first order, ordinary differential equations:
  - Separable
  - Homogeneous
  - Exact
  - linear, and
  - Bernoulli

- Solve second order linear ordinary differential equations:
  - Homogeneous and non-homogeneous equations with constant coefficient
  - Power series solutions about ordinary and regular singular
- Solve initial value problems using Laplace transforms.
- Solve systems of linear differential equations
- Approximate a solution to a differential equation with a numerical method
- Use some basic commands of a computer algebra system, and solve differential equations with them
- Determine the stability of linear systems
- Analyze almost linear systems.
- Use the Energy Method to describe nonlinear systems.
- Be able to identify the basic forms of bifurcation.

## GENERAL EDUCATION OUTCOMES

- This course addresses the general education outcome relating to communication by additional support as follows:
  - Students develop their listening and speaking skills through participation and through group problem solving.
  - Students develop their reading comprehension skills by reading the text and the instructions for text exercises, problems on tests, or on projects. Reading mathematics text requires recognizing symbolic notation as well as problems written in prose.
  - Students develop their writing skills through the use of problems requiring written explanations of concepts.
- This course addresses the general education outcome of demonstrating effective individual and group problem-solving and critical thinking skills as follows:
  - Students must apply mathematical concepts previously mastered to new problems and situations.
  - In applications, students must analyze problems and describe problems with their pictures, or diagrams, or graphs, then determine the appropriate strategy for solving the problem.
- This course addresses the general education outcome of using mathematical concepts to interpret, understand, and communicate quantitative data as follows:
  - Students must demonstrate proficiency in problem-solving skills including applications of differential equations and systems of differential equations.
  - Students must write differential equations to describe real-world situations and interpret information from the solution of differential equations and systems of differential equations.
  - Students must solve equations and systems of equations (both linear and which often arise in modeling numerical relationships).

## Procedures for Assessing Outcomes:

## COURSE GRADE

The course grade will be determined by the individual instructor using a variety of evaluation methods. A portion of the course grade will be determined through the use of frequent assessment using such means as tests, quizzes, projects, or homework as developed by the instructor. Some of these methods will require the student to demonstrate ability in problem solving and critical thinking as evidenced by explaining and interpreting solutions. A comprehensive final examination is required which must count at least one-fifth and no more than one-third of the course grade.

## DEPARTMENTAL ASSESSMENT

This course will be assessed every three years. The assessment instrument will consist of a set of open-ended questions, which will be included as portion of the final exam for all students taking the course.

A committee appointed by the Academic Group will grade the assessment material.

### **Plans for Use of Assessment Results:**

The MATH 2652 committee, or a special assessment committee appointed by the Academic Group will analyze the results of the assessment and determine implications for curriculum changes. The committee will prepare a report for the Academic Group summarizing its finding.

### **Schedule of Planned Assessment Activities:**

An assessment of Differential Equations this Fall 2008 was discussed during the course committee meeting of September 19, 2008. The assessment tool will be developed by November 8, 2008. The course will be reassessed again during Spring 2009.

### **Review of Past Assessment Activities (2003 to Present):**

2003-2004	An assessment done Spring 2004. .
2004-2005	An assessment done Fall 2004.
2005-2006	An assessed. is planned for Spring 2006
2006-2007	No assessment
2007-2008	An assessment is planned for 2008-2009
2008-2009	An assessment will be done this year.