Course Goals and Course Objectives, as of Fall 2015

Math 102: Intermediate Algebra

Course Goals:
- Interpret mathematical models such as formulas, graphs, tables, and schematics, and draw inferences from them.
- Represent mathematical information symbolically, visually, numerically, and verbally.
- Use arithmetical, algebraic, and statistical methods to solve problems.
- Estimate and check answers to mathematical problems in order to determine reasonableness, identify alternatives, and select optimal results.
- Recognize that mathematical and statistical methods have limits.

Course Objectives: Students will be able to:
- Plot points and equations and interpret information using the rectangular coordinate system. (This would include finding equations of lines, parallel lines, and perpendicular lines.)
- Solve linear and rational equations in one variable.
- Use mathematical equations to model real-life problems.
- Perform operations with real and complex numbers.
- Solve quadratic equations by factoring, completing the square, and by the quadratic formula.
- Solve radical equations, equations with rational exponents, and equations involving absolute value.
- Use function notation and identify the domain and range.
- Solve systems of linear equations in two or three variables.
- Solve systems of inequalities and graph the solutions.

Math 109: Foundations of Mathematics

Course Goals
- Interpret mathematical models such as formulas, graphs, tables, and schematics, and draw inferences from them.
- Represent mathematical information symbolically, visually, numerically, and verbally.
- Use arithmetical, algebraic, and statistical methods to solve problems.
- Estimate and check answers to mathematical problems in order to determine reasonableness, identify alternatives, and select optimal results.
- Recognize that mathematical and statistical methods have limits.

Course Objectives: Students will be able to:
- Gain familiarity of personal finances including budgets, bank accounts, and loans.

- Use and interpret numbers in many forms including percentages and index numbers
- Solve problems using unit analysis and conversions between standardized units.
- Understand and apply fundamental principles of probability and statistics.
- Model real world problems using both linear and exponential equations.
- Apply mathematical concepts to the investigation of political practices.

Math 108: Finite Mathematics

Course Goals:
- Interpret mathematical models such as formulas, graphs, tables, and schematics, and draw inferences from them.
- Represent mathematical information symbolically, visually, numerically, and verbally.
- Use arithmetical, algebraic, and statistical methods to solve problems.
- Estimate and check answers to mathematical problems in order to determine reasonableness, identify alternatives, and select optimal results.
- Recognize that mathematical and statistical methods have limits.

Course Objectives: Students will be able to:
1. Master the skills of reasoning, estimating, and problem solving
2. Use ratios, rates, and proportional reasoning in context (real world data sets)
3. Understand the basics of set theory, number theory, and logic
4. Operate within and between different measurement scales including unit conversion and dimensional analysis
5. Model real world problems using linear equations & inequalities, quadratic equations, and systems of equations
6. Understand and apply fundamental principles of counting, probability and statistics.

Math 110: Introduction to Statistics

Course Goals:
- Teach students to think and analyze critically, armed with statistical savvy, to validate and/or question data uncovered through various means in daily life.
- Show students a purpose and relevance present in statistical analysis, particularly in the field of social sciences.
- Introduce students to the scope and usefulness of an understanding of statistics with practical and relevant real life examples and data, both given to and collected by the students.

Course Objectives Students will be able to:

- Recognize important differences between descriptive and inferential statistics; distinguish between different types of variables and data; summarize, organize, tabulate and graph statistical data; read and understand statistical data present in various forms of the media; find and analyze measures of center and variation for quantitative data.
- Apply normal distributions in solving real-world problems involving percentages and percentiles; understand the importance of sampling distributions and the Central Limit Theorem.
- Determine if a correlation exists between two variables and interpret the strength of the correlation; use regression equations in order to predict the value of one variable given the value of another.
- Apply the basic concepts of probability theory.
- Use StatCrunch to carry out statistical analysis.

Math 123: Pre-Calculus

Course Goals:
- Prepare and motivate students with the skills necessary for success in calculus
- Develop and hone skills for graphing and solving problems involving a variety of functions including polynomials, trigonometric functions, exponentials, and logarithms
- Create a solid foundation for trigonometric functions, with an emphasis on the unit circle

Course Objectives: Students will be able to:
- Distinguish between the function forms of linear, quadratic, polynomial, rational functions, and composite functions
- Find roots of quadratic functions and polynomial functions of various degrees
- Understand functional relationships as well as inverse relationships
- Use a variety of graphing techniques to sketch functions (shifts, inverses, reciprocals)
- Apply the unit circle approach to understanding the fundamental properties of trigonometric functions and their applications, as well as graphs of these functions
- Define and derive properties of exponential and logarithmic functions
- Solve equations involving exponential and logarithmic expressions
- Analyze a wide variety of real world problems using these theoretical concepts of functions

Math 125: Calculus with Analytic Geometry I

Course Goals:
- Enhance students' knowledge of a variety of functions (trigonometric, exponential, logarithmic, polynomial, and rational)
- Introduce and apply fundamental ideas of calculus (limits, continuity, differentiation, integration).

Course Objectives: Student will be able to:
- Demonstrate knowledge of a wide variety of functions, including trig, exponential, and logarithmic (in part through graphing of functions)
- Define and use fundamental concepts of calculus including limits, continuity, derivatives, and integrals
- Apply the fundamental concepts of calculus to a variety of real-world applications

Math 210: Statistical Inference

Course Goals:
- Expand students' abilities to validate and/or question data
- Use a variety of statistical inference methods to analyze data and draw meaningful conclusions.
- Introduce statistical software often used in the field of social sciences.

Course Objectives: Student will be able to:
- discuss the importance of sampling distributions
- discuss the basic theory of hypothesis testing
- perform and analyze a variety of statistical inference procedures (Confidence intervals, hypothesis tests for one population, hypothesis tests for two populations, Chi Square, Regression, Correlation)
- discuss when particular procedures can be applied, and how to choose the most appropriate test
- demonstrate how SPSS statistical software can be utilized to perform a variety of procedures and interpret the output
- apply procedures and methods to a variety of real-world applications

Math 225: Calculus with Analytic Geometry II

Course Goals:
- Provide students intending to major in mathematics, natural sciences, and engineering with a second course in calculus

- Extend the concept of integrals to a variety of applications, establishing several integration techniques
- Provide an introduction to sequences and series.

Course Objectives: Students will be able to:
- Use a variety of mathematical techniques to evaluate integrals
- Develop problem solving skills through diverse applications of the integral
- Analyze the parametrization of curves and the polar coordinate system
- Broaden understanding of certain transcendental functions
- Define the notions of sequences and series, approximations of functions and the concept of convergence

Math 301: Linear Algebra:
Course Goals:
- Develop methods and problem solving skills in solving systems of linear equations
- Learn theory of matrices, determinants, vector spaces, linear transformations, eigenvalues and eigenvectors
- Apply the knowledge and skills in natural and social sciences

Course Objectives: Student will be able to
- Model and systematically solve systems of linear equations using matrix notation
- Demonstrate factual knowledge of the fundamental concepts of spanning, linear independence, and linear transformations
- Use matrix algebra to analyze and solve equations arising in many applications that require a background in linear algebra
- Utilize vector space terminology and describe how closely other vector spaces resemble R^n
- Dissect the action of a linear transformation into elements that are easily visualized using the basic concepts of eigenvectors and eigenvalues.

Math 315: Mathematical Probability and Statistics
Course Goals
- Develop problem solving skills in probability, random variables, probability distributions, and sampling distributions
- Gain a solid foundation in the theory of probability, which provides the foundation for modern statistical inference,
- Learn to read and understand mathematical/statistical results and proofs as well as formulate his/her own proof to various problems
- Apply knowledge and skills in probability and statistics related sciences

Course Objectives: Student will be able to:

- Distinguish between discrete and continuous random variables and give examples of each,
- Define the mean and the variance for a random variable and calculate the expected values and variances of discrete and continuous random variables,
- Define the probability distribution for discrete and continuous random variables and list examples of distributions of some common random variables, and
- Define the concepts of joint, marginal, and conditional distributions essential to finding the probabilities of various sample outcomes.

Math 325: Multi-Variable Calculus

Course Goals:
- Understand how to mathematically describe physical and abstract quantities that have both magnitude and direction
- Gain experience with the properties of functions whose domain consists of real numbers and whose range consists of vectors (vector-valued functions), including differentiation and integration
- Extend earlier techniques of integration and differentiation of scalar functions to the field of vector-valued functions
- Broaden students' understanding of the concepts of extrema for functions of more than one variable

Course Objectives: Student will be able to:
- Find the length of a vector, the unit vector in the direction of a given vector and the cosine of the angle between two vectors in three-space.
- Calculate scalar product, vector product of two vectors and scalar triple product of three vectors; find the area of the parallelogram determined by two vectors and the volume of the parallelepiped determined by three vectors.
- Write a vector equation, parametric equations, and symmetric equations for a line and a vector equation and a scalar equation for a plane; find the distance from a point to a line, from a point to a plane.
- Determine the domain and the component functions of a vector-valued function, sketch the curve traced out by vector-valued functions, explain the limit and continuity of such functions and find the derivative and integral of such functions.
- Find the tangential and normal components of a vector function; write a formula for curvature, identify surfaces with the given vector equation and find a parametric representation for surfaces.
- Describe a function of two variables, a function of three variables and methods of visualizing these functions; understand concepts related to partial derivatives.

Math 327: Differential Equations

Course Goals:
- Classify ordinary differential equations
- Introduce calculus-based techniques to solving ordinary differential equations and related application problems.

Course Objectives: Student will be able to:
- Model with first-order differential equations (DE) and identify initial value problems,
- Solve scalar differential equations, homogeneous and nonhomogeneous, using methods including separation of variables, integrating factors, eigenvalues, LaPlace transformations
- Model with systems of first-order DEs and higher-order DEs
- Solve systems of linear differential equations using matrices and eigenvalues

Math 331: Introduction to Abstract Mathematics

Course Goals:
- Gain the necessary foundation for more advanced mathematics courses
- Learn to study almost any mathematical subject on your own
- Explore the ways in which creativity, intuition, and experience enhance their mathematical abilities

Course Objectives: Students will be able to:
- Read and understand a written proof by identifying the techniques that are used
- Communicate her own proofs of known mathematical proofs
- Use newly acquired skills and language to discover and communicate previously unknown mathematical truths

Math 371: History of Mathematics

Course Goals:
- Demonstrate how social, cultural, and historical factors influenced the development of mathematics
- Help students to understand how mathematical ideas have developed over time
- Improve students' ability to explain mathematics in written and oral forms.

Course Objectives: Students will:
- Gain an understanding of the historical and biographical context of several of the most important theorems and mathematicians in mathematics history
- Appreciate the creative aspect of mathematicians' work

- Study the proofs of important theorems in the history of mathematics
- Learn how the theorems and mathematicians studied in this course influenced future mathematicians
- Present, write, and think about mathematics in new and/or different ways.

Student Learning Outcomes: Students who successfully finish the course should be able to:
- Identify and describe a variety of theorems and mathematicians that shaped the history of mathematics
- Explain complicated mathematical topics clearly and concisely in both written and oral formats
- Participate in and lead discussions about mathematical concepts
- Research a mathematician and mathematical concept, drawing on historical accounts, in order to present findings that illustrate the ways in which social contexts shaped important thinkers and their ideas.

Math 403: Abstract Algebra I

Course Goals:
- Develop capabilities with an axiomatic treatment of mathematics
- Develop an understanding of the structure of sets with operations on them
- Acquire knowledge of the language and basic properties of these algebraic structures
- Read and understand mathematical results and proofs as well as formulate his/her own proof to various problems
- Enhance communication of mathematical findings in writing and through oral communication

Student Learning Outcomes: Student will be able to:

- Define a *group*, give examples of groups, list properties that hold in every group and state definitions of particular features of groups
- Define a *ring*, give examples of rings, list properties that hold in every ring and state definitions of particular features of rings
- Define a *field*, give examples of fields, list properties that hold in every field and state definitions of particular features of fields
- Prove statements about these mathematical structures

Math 431: Real Analysis I

Course Goals:
- Develop an in-depth mathematical understanding of the theory of calculus
- Read mathematical results and proofs as well as formulate her own proofs to various problems.

- Use and explain the importance of
  - the axioms of real numbers
  - the definition of convergent and divergent sequences
  - the definition of the limit of a function at a point
  - the definition of continuity
  - the definition of the derivative
  - the definition of the Riemann integral

Course Objectives: Students will be able to:
- Prove statements involving the properties of the real number system,
- Prove statements related to the convergence of sequences and series,
- Prove statements about the limits and continuity of functions,
- Prove statements about the differentiability of functions, and related to the integrability of functions
- Use a variety of proof techniques

Math 435: Geometry

Course Goals:
- To provide education majors with a strong geometrical background which will enable them to have a deep understanding of the math they will eventually teach
- To provide math majors with a rigorous course which will enhance their proof-writing skills and allow them to fully develop their understanding of geometry
- To help the students learn to study almost any mathematical subject on their own
- To allow students to explore the ways in which creativity, intuition, and experience enhance their mathematical abilities

Course Objectives: Students will be able to:
- Construct a variety of geometrical objects
- Understand the importance of undefined terms, definitions, and axioms,
- Use a variety of proof techniques to prove theorems using axioms, definitions, and previous results
- Understand and utilize the concept of congruence
- Understand and explain the differences between Euclidean and Non-Euclidean geometry
- Demonstrate knowledge of several types of transformations
- Understand the historical significance of the development of geometry
- Communicate her mathematical findings in writing and through oral communication