Texas A&M University
Core Curriculum

Initial Request for a Course Addition to the Fall 2014 Core Curriculum

Foundational Component Area: Mathematics

In the box below, describe how this course meets the Foundational Component Area description for Mathematics. Courses in this category focus on quantitative literacy in logic, patterns, and relationships. Courses involve the understanding of key mathematical concepts, and the application of appropriate quantitative tools to everyday experience.

The proposed course must contain all elements of the Foundational Component Area. How does the proposed course specifically address the Foundational Component Area definition above?

This course is focused on quantitative literacy in mathematics found in the natural and social sciences and everyday life. Upon successful completion of this course, students will be able to:

- Logically formulate mathematical variables and equations to quantitatively create mathematical models representing problems in everyday life.
- Recognize and construct graphs of basic functions, including polynomials, exponentials, logarithms, and trigonometric functions and use them to model real-life situations.
- Identify patterns in numeric data to calculate limits and derivatives of functions numerically.
- Compute limits of functions numerically, graphically, and algebraically.
- Justify whether a function is continuous or not using the mathematical definition of continuity.
- Compute derivatives using the limit definition of the derivative.
- Understand the derivative as a rate of change in order to quantitatively apply it to everyday life. For example, recognize that derivatives can be used to find the velocity and acceleration of an object given its position function.
- Compute derivatives of polynomials, rational, trigonometric, exponential, and logarithmic functions.
- Apply the product rule, quotient rule, and chain rule to take derivatives of compositions of functions.
- Compute the linear approximation of a function and use it in applications of approximation and error estimation.
- Investigate the relationship between a function and its first and second derivatives, and use the information obtained from its derivatives to identify pertinent information about the function.
- Find the local and absolute extrema of functions, including optimization applications such as minimizing the cost of fencing in a particular area of land.
- Compute antiderivatives and understand the concept of integration as it relates to area.
- Apply the definite integral to quantitatively determine solutions to problems in everyday life including areas between curves, average value of a function, and total distance traveled.
- Recognize and appreciate the derivative (rate of change) and the definite integral (accumulation of change) and utilize the Fundamental Theorem of Calculus as the bridge between the two.
- Apply the substitution method to compute integrals.

Core Objectives

Describe how the proposed course develops the required core objectives below by indicating how each learning objective will be addressed, what specific strategies will be used for each objective and how student learning of each objective will be evaluated.

The proposed course is required to contain each element of the Core Objective.

Critical Thinking (to include creative thinking, innovation, inquiry, and analysis, evaluation and synthesis of information):
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The following critical thinking skills will be assessed on various assignments which may include homework, quizzes, and/or exams:

- Students will analyze a function and justify whether or not it is continuous using the definition of continuity.
- Students will use inquiry to determine the best method for taking derivatives of complicated functions.
- Students will identify and categorize information about a function in order to construct a graph of its derivative.
- Students will apply calculus to find innovative ways to graph complicated functions without the aid of technology.
- Students will analyze and synthesize data and think creatively to develop mathematical models for optimization purposes.
- Students will examine how the Fundamental Theorem of Calculus connects differential and integral calculus.

Communication (to include effective development, interpretation and expression of ideas through written, oral and visual communication):

The following communication skills will be assessed on various assignments which may include homework, quizzes, and/or exams, as well as during lecture:

- Students will symbolically relay mathematical information and concepts by creating variables and writing equations.
- Students will recognize, construct, and interpret graphs of basic functions.
- Students will write mathematical information symbolically to describe the behavior of functions.
- Students will justify results that use mathematical definitions such as the definition of continuity.
- Students will explain verbally in class the connection between derivatives, rates of change, and slopes of tangent lines.
- Students will explain (both in writing and verbally) mathematical solutions to problems.

Empirical and Quantitative Skills (to include the manipulation and analysis of numerical data or observable facts resulting in informed conclusions):

The following empirical and quantitative skills will be assessed on various assignments which may include homework, quizzes, and/or exams:

- Students will evaluate limits numerically and use the information to draw conclusions about the behavior of a function.
- Students will calculate a derivative numerically and explain the result in the context of the problem.
- Students will manipulate empirical data to develop a mathematical model to use in an optimization problem and then apply calculus to find and interpret the optimal solution.
- Students will apply the Fundamental Theorem of Calculus to quantitatively compute the accumulated change of a quantity.

Please be aware that instructors should be prepared to submit samples/examples of student work as part of the future course recertification process.