COURSE OUTLINE

Math 103H (C-ID Number: MATH 211)
Honors Calculus and Analytic Geometry (C-ID Title: Single Variable Calculus I Late Transcendentals)

Catalog Statement

MATH 103H is the first of a sequence of three courses combining the subject matter of analytic geometry and calculus. Functions and their graphs are studied with special attention to differentiation, limits, rules and integration using various techniques. Applications of both differentiation and integration are covered. The honors section of this course features more theory and proof, and one or more projects related to the topics of the course.

Total Lecture Units: 5.0
Total Laboratory Units: 0.0
Total Course Units: 5.0

Total Lecture Hours: 80.0
Total Laboratory Hours: 0.0
Total Laboratory Hours To Be Arranged: 0.0
Total Faculty Contact Hours: 80.0

Prerequisite: Placement is based on a composite of test scores and academic background or satisfactory completion of MATH 110, or MATH 110B, or both MATH 100 (prior to Fall 2016) and MATH 102 (prior to Spring 2017).

Course Entry Expectations

Prior to enrolling in the course, the student should be able to:

- demonstrate understanding of review material including solving and graphing linear and quadratic equations and inequalities in both one and two variables;
- solve exponential and logarithmic equations;
- graph the following types of functions: polynomial, rational, exponential, logarithmic and trigonometric;
- apply the fundamental theorem of algebra and related theorems to find the roots of a polynomial;
- prove various trigonometric identities;
- solve trigonometric equations;
- apply the basic definitions of trigonometry to solve right triangle application problems;
- apply the laws of sines and cosines to solve application problems;
- graph both polar coordinates and parametric equations;
- use mathematical induction to prove formulas.

Course Exit Standards

Upon successful completion of the required coursework, the student will be able to:

- find limits of functions at points and at infinity;
- determine and prove continuity of a function at a point;
- use the derivative for rate of change problems;
- implicitly differentiate and apply the technique of implicit differentiation;
- find derivatives of composite functions;
- determine relative and absolute maximum and minimum points of functions and points of inflection;
- evaluate the area under a curve using Riemann sums;
- apply the mean-value theorem for integrals and demonstrate an understanding of the Fundamental Theorem of Calculus;
- use substitution to integrate;
- determine the area between curves and the average value of a function;
- determine the volumes of solids of revolution using the disk method, the cylindrical shell method, and the cross-section method;
- determine work done in applications involving liquids and springs.

Course Content **Total Faculty Contact Hours = 80.0**

Review and Preview **(6 hours)**
- Four ways to represent a function
- Mathematical models
- New functions from old functions
- Graphing calculators and computers (optional)

Limits and Rates of Change **(14 hours)**
- The tangent and velocity problems
- The limit of a function
- Calculating limits using the limit laws
- The precise definition of a limit
- Continuity
- Tangents, velocities, and other rates of change

Derivatives **(16 hours)**
- Derivatives
- The derivative as a function
- Differentiation formulas
- Rates of change in the natural and social sciences
- Derivatives of trigonometric functions
- The chain rule
- Implicit differentiation
- Higher derivatives
- Related rates
- Linear approximations and differentials

The Mean Value Theorem and Curve Sketching **(16 hours)**
- Maximum and minimum values
- The mean value theorem
- How derivatives affect the shape of a graph
- Limits at infinity; horizontal asymptotes
- Curve sketching summary

Graphing with calculus and calculators (optional)
Optimization problems
Applications to economics
Newton's method
Antiderivatives

Integrals **(14 hours)**
Areas and distances
The definite integral
The fundamental theorem of calculus
Indefinite integrals and the net change theorem
The Substitution Rule

Applications of Integration **(14 hours)**
Areas between curves
Volume by disks and cross sections
Volume by cylindrical shells
Work
Average value of a function

Methods of Instruction

The following methods of instruction may be used in this course:
- lecture and discussion;
- computer or graphing calculator demonstrations;
- group work;
- guided computer explorations.

Out of Class Assignments

The following out of class assignments may be used in this course:
- group assignments and projects (e.g. models of volumes of revolution);
- computer or graphing calculator assignments;
- homework (e.g. problem sets related to course content).

Methods of Evaluation

The following methods of evaluation may be used in this course:
- quizzes;
- four or more chapter examinations are required;
- a comprehensive final examination is required.

Textbooks

Stewart, James. *Calculus.* 8th ed. Boston: Cengage Learning, 2016. Print.
10th Grade Textbook Reading Level. ISBN: 978-1-285-74062-1

Student Learning Outcomes

Upon successful completion of the required coursework, the student will be able to:

- graph functions using first and second derivative analysis;
- determine the volume of solids using integration;
- assess limits;
- use the Fundamental Theorem of Calculus to evaluate integrals;
- demonstrate the ability to solve applications using derivatives.