

**Carthage Mathematics Department**  
**Course Summary for MTH 1070 Functions, Graphs, and Analysis**

1. Credits: 4 credits
2. Semesters Offered: Fall, Spring
3. Text(s): Functions Modeling Change: A Preparation for Calculus, Fourth Edition by Connelly, Hughes – Hallett, Gleason, ET AL., 2011
4. Topics Covered:
  - a. Linear functions, definition of functions and rates of change.
  - b. Quadratic functions and concavity, domain and range, and inverse functions.
  - c. Exponential functions and the number  $e$ .
  - d. Logarithmic functions to base 10 and  $e$ .
  - e. Transformation of quadratic functions-shifting, reflecting, and stretching and their graphs.
  - f. Trigonometric functions: the sine, cosine, tangent, secant, cosecant, and cotangent along with the inverse of trigonometric functions.
  - g. Compositions, inverses, and combinations of functions
5. Skills Enhanced:
  - a. Technical writing
    - i. At instructor's discretion, approximately 6 pages of written work applying various functions to student's life experiences.
    - ii. Complete sentences, use of third person, clear exposition, and correct notation emphasized.
    - iii Revisions based on instructor feedback are encouraged
  - b. Computer skills
    - i. Excel-fitting data to linear functions, defining functions, graphing.
    - ii. Word- basic document preparation skills.
6. Sample Syllabus:
  - a. Chapter 1 sections 1-6 and all tools.
  - b. Chapter 2, sections 1-6 and all tools
  - c. Chapter 3, sections 1-4 and all tools
  - d. Chapter 4 sections 1-4.
  - e. Chapter 5, sections 1-5 and all tools
  - f. Chapter 6, sections 1-6 and all tools
  - g. Chapter 7 sections 1-5.
  - h. Chapter 8 sections 1-3.
7. Miscellanea:
  - a. The central theme of the course is functions as models of change with algebra integrated throughout the course
  - b. The rule of four is used meaning each function is represented symbolically, numerically, graphically, and verbally.

8. Course Goals: By the end of the course, students should be able to do the following.
- a. Define a function and give a numerical, graphical, and symbolic example and explain the vertical line test.
  - b. Describe and compute the average rate of change of a function over an interval, describe increasing and decreasing functions, and rate of change in function notation.
  - c. Describe linear functions with constant rates of change, construct a linear model, describe slope and the y intercept of a linear function.
  - d. Describe and explain geometric properties of linear functions such as parallel and perpendicular lines and the intersection of two lines.
  - e. Fitting data functions to regression line, correlation, and explaining causation.
  - f. Defining input and output using standard function notation and explaining the effect on a function of changing the input variable versus changing the output variable.
  - g. Explain the domain and range of a function and how to find the range and domain of a function.
  - h. Explaining a piecewise function and absolute value functions.
  - i. Explaining composite and inverse functions and finding the composition of a function using algebra.
  - j. Describing the relationship between the rate of change of a function and the concavity of the function's graph.
  - k. Understanding quadratic functions and their formulas and finding the zeros of a quadratic function and their concavity.
  - l. Understanding exponential functions including growth factors and rates and decay factors and rates and the difference between exponential and linear functions.
  - m. Understanding the number e and continuous growth rates in a function.
  - n. Understanding logarithms and their properties and scales, using logarithms to solve exponential functions and the inverse relationship between  $\log(x)$  and 10 to x power.
  - o. Understanding vertical and horizontal shifts, stretches, compression and reflection on a graph and developing a formula for a shifted graph in terms of the origin.

- p. Understanding periodic functions including amplitude, midline, and period and applying trig functions of sine, cosine, tangent and cotangent as they relate to right triangles and unit circle.
- q. Understanding radian and arc length on a unit circle including positive and negative angles, radian measures of an angle and converting between degrees and radians.

9. Assessment:

The course goals will be assessed by comprehensive cumulative examinations on each chapter covered. Along with a cumulative final examination which will assess all the goals in the course.

An understanding of each function taught in the course will be assessed by written papers produced by each student and explained verbally to the class.

8. Course Goals: By the end of the course, students should be able to do the following:
- a. Define what a function is and give numerical, graphical, and symbolic examples and explain the vertical line test.
  - b. Represent the various functions with words, a graph, a formula, or by a table of numbers.
  - c. Represent and describe the properties and notation common to all functions.
  - d. Apply and explain algebra, geometry, and trigonometry concepts in solving problems involving various functions.
  - e. Apply mathematical tools to analyze every family of functions (Linear, Exponential, Logarithmic, Quadratic, and Trigonometric) so as to transform these functions into others by shifting, flipping, and stretching their graphs
  - f. Describe and compute the average rate of change of a function over an interval, describe increasing and decreasing functions and rate of change in