



GOSHEN COLLEGE
MATHEMATICS DEPARTMENT
MATH 170 FUNCTIONS, DATA, AND MODELS – SPRING 2019

Motivation

Business, economics, psychology, physics, chemistry, biology, medicine, engineering, and many other disciplines use mathematics to describe phenomena of interest. Often we are interested in how one quantity is dependent upon another quantity: the price of corn depends on the amount grown, the profitability of a company may depend on the tax rate, the number of cancer cells killed depends on the radiation dosage, and so forth. A function is the mathematical way of describing such dependencies, data are the measurements obtained via observation or experiment, and symbolic models summarize data in a way that helps us to better understand phenomena and make predictions.

Learning Objectives

By the end of the course, students will be able to do the following.

Problem Solving

- Solve problems presented in the context of real world situations by creating, manipulating, and interpreting function models.
- Possess a personal framework of problem solving techniques (e.g., read the problem at least twice, define variables, sketch and label a diagram, list what is given, restate the question asked, identify variables and parameters, use analytical, numerical and graphical solution methods as appropriate, and determine plausibility of and interpret solutions).

Functions and Equations

- Identify, describe, and use functions and rates of change.
- Effectively use and translate among symbolic, numeric, graphic, and verbal representations of functions.
- Recognize and use symbolic, numeric, graphic, and verbal representations of linear, quadratic, exponential, power, polynomial, logarithmic, and periodic functions.
- Recognize and use standard transformations (i.e., translations, dilations, contractions, and reflections) with symbolic, numeric, graphic, and verbal representations of functions.
- Use algebraic techniques and manipulations necessary for problem-solving and modeling (e.g., applying the same operation or function to both sides of an equation, factoring quadratic polynomials, completing the square, using the quadratic formula, solving system of linear equations, and using trigonometric identities).

Data Analysis

- Collect (in scientific discovery or activities, or from the Internet, textbooks, or periodicals), display, summarize, and interpret data in various forms.
- Apply algebraic transformations to linearize data for analysis.
- Fit an appropriate curve to a scatter plot and use the resulting function for prediction and analysis.
- Determine the appropriateness of a model via scientific reasoning.

Technology

- Use software to explore concepts and solve problems (e.g., graph functions, graph parametrically defined relations, investigate standard transformations, solve equations and inequalities, and fit function models to data).
- Recognize when software may provide incorrect, misleading, or incomplete results.

Learning

- Learn mathematics by anticipatory reading, listening, conversing, asking and answering questions, exploring, critical thinking, completing exercises, solving problems, reviewing, and assessing self and others.

Attitudes and Beliefs

- View the learning of mathematics as important, interesting, enjoyable, collaborative, and a sense making process.

Instructor David Housman, SC 117, dhousman@goshen.edu, 574-535-7405 (office), 612-7185 (cell). See office door or Moodle for availability.

Class Time MWF 2:00pm - 2:50pm in SC 107 and T 11:00am - 12:15pm. in GL 102.

Required Resource WileyPLUS course: *Functions Modeling Change: A Preparation for Calculus*, 5th Edition by Eric Connally, Deborah Hughes-Hallett, Andrew M. Gleason, *et. al.*, ©2015, <https://www.wileyplus.com>. Use a browser to visit www.WileyPLUS.com. Enter your course ID, 685065. You can use the materials and do the assignments free for two weeks. You can purchase a registration code from the Goshen College Bookstore or directly from WileyPLUS.

The above electronic resource contains an electronic version of the textbook, mini-lecture videos, student solutions manual, student study guide, assignments, and other resources. Hardcover, paperback, and binder ready versions of the textbook are available for purchase or rental for those students who would like to have a physical book.

On-line WileyPLUS (www.wileyplus.com/class/685065) contains the text, mini-lecture videos, student solutions manual, student study guide, assignments, and other resources.
Moodle (<https://moodle.goshen.edu>) contains the schedule, class slides, documents, surveys, and grades.

Technology Sage (sagemath.org) and its collaborative notebook interface CoCalc (cocalc.com) will be used for computation. Free basic private server access will be provided. WolframAlpha (wolframalpha.com), and graphing calculators are also useful tools for computation, visualization, and exploration.

Notebook A one-inch three-ring binder with loose-leaf lined and graph paper is recommended so that you can keep printed copies of course resources and a written record of problem solving attempts, questions, math concept and technique discoveries, and skill assessments.

Activities The study of mathematics is not a spectator sport! Reading, listening, solving problems, writing explanations, reflecting upon ideas, assessing skills, and receiving feedback are essential to learning mathematics. A student with average preparation (B grades in high school algebra and geometry and 550 Math SAT) can obtain an average grade (C to B) with an average of 12 hours each week (including class and lab time) devoted to this course—adjust if you are not average or desire a grade that is not average.

For each section, start by reading the text and/or viewing the videos (mini-lectures) in an anticipatory fashion. This means for each example (1) cover the solution, (2) think and write your own solution, and only then (3) read or view the authors' solution focusing on the parts you did not already obtain on your own. As much as possible, try to recreate the key ideas, solve problems, and write proofs without looking at the book or notes.

If you do not understand some aspect of the text or video, write a question that is as specific as

possible. Sometimes writing the question is enough to spark the insight needed for you to answer your own question. Otherwise, you will be compiling a list of useful questions to ask peers, the student teaching assistant, and/or the instructor.

While or after reading a section, try some of the odd-numbered exercises. These have accessible answers in the book and complete solutions in the *Student Solutions Manual*.

During class, actively listen, engage in activities, ask your unanswered questions, and share your understandings with peers.

After reading the text in an anticipatory fashion, doing some practice exercises, and engaging in class activities, you should be ready to complete the assignment for a grade. For the first time through the assigned exercises, treat it like an exam with the goal of obtaining at least a 90% without referring to the text, notes, or another person. Afterwards, seek assistance from the text, solutions manual, peers, the student teaching assistant, and/or the instructor. Throughout these activities, try to articulate your concept discoveries and assess your skills by describing strengths, improvement areas, and insights.

As you accumulate conceptual knowledge and acquire skills over several days, you will be asked to synthesize and apply those concepts and skills by completing labs and taking exams.

Grading

Course grades will be based on performance on assignments (15%), labs (20%), three midterm exams (15% each for a total of 45%), and a comprehensive final exam (20%). If helpful, the final exam score will replace the lowest of your assignments and midterm exam scores. The course grade will be translated into letter grades in the following manner.

Minimum Percentage	93	90	87	83	80	77	73	70	67	60	0
Letter Grade	A	A-	B+	B	B-	C+	C	C-	D+	D	F

Assignments

Achieve and exhibit understanding by completing exercises daily. Almost all assignments will be assigned and completed through WileyPLUS. Solve each exercise on paper before submitting your answer online. Determine the error in your thinking if marked incorrect and then submit a revised answer without penalty. It can be beneficial to collaborate but make sure you could solve similar problems on your own.

Before the deadline for an assignment, you have unlimited attempts to answer a question without penalty. Of course, you should not just randomly guess! Follow the suggestions in the previous paragraph. There may be a link to an appropriate part of the text; however, the use of that link will reduce your score by 5%. There may be a link to obtain a hint; however, the use of that link will reduce your score by 5%. After five attempts, there should be a link to show the entire solution; however, use of that link will reduce your score by 20%. You can work on an assignment after its deadline; however, this work will be reduced by 30%. Thus, there is an incentive to complete assignments on time; however, it is always beneficial to work on assignments even if the deadline is not met.

Extra Credit

Receive extra credit toward your homework grade by doing one or more of the following: (1) find errors in the text or posted course materials and describe the error in writing; or (2) attend a quantitative presentation (e.g., Science Speakers) or participate in a quantitatively based activity and describe in writing some interesting mathematical aspect of the presentation or activity. The description should be a substantive paragraph or two and be submitted to the instructor.

Labs

Apply your understanding to more open ended and applied exercises. Make effective use of software to explore concepts and solve problems. Practice communicating quantitative ideas in writing. Some class time will be devoted to labs but they will require time outside of class to complete. Lab reports will be completed by groups of one to three students.

Exams	Exhibit your mastery of the learning objectives without assistance or collaboration. There may be both in-class and take-home portions for each exam.
STA and Tutoring	Ebtihal Mostafa will be the Student Teaching Assistant for this course. She will have regularly scheduled study sessions open to every student in this class. This is a great time and place to work on exercises, share your ideas with other students, ask questions, and try to answer questions. The Academic Success Center provides limited tutoring and writing support for free to all undergraduate students. Make an appointment at goshen.edu/asc .
Disability Services	Goshen College is committed to providing all students equal access to programs and facilities. Students who need accommodations based on disability should contact the Director of the Academic Success Center (ASC). Students must register with ASC before faculty are required to provide reasonable accommodations. For more information or to register, please contact the Director of the ASC, Judy Weaver, Good Library 112, jweaver@goshen.edu or 574-535-7560. To ensure that learning needs are met, contact the director of the ASC the first week of classes.
Collaboration and Academic Integrity	<p>You are encouraged to use all available resources in order to learn the concepts and techniques discussed in this course. In particular, conversations with other students and the instructor can be an effective learning method. Reading other books and web pages can be another effective learning method. However, copying someone else's work subverts the learning process.</p> <p>For assignments and labs, you may look at and discuss another student's work, but any written work developed during collaboration with another student should be destroyed before writing your own solutions. You should give written acknowledgement to people with whom you have had discussions and to any written materials (other than the text) that were helpful.</p> <p>For exams, you may <i>not</i> use any resources unless a specific exception is stated by the instructor.</p> <p>Failure to observe the above rules will result in a zero on the assignment, lab, or exam. Any violation of academic integrity will be reported to the Associate Dean.</p> <p>Observation of the above rules will help you learn the material well and give you the satisfaction of knowing that you have earned your grade.</p>
Placement Advice	All students need to meet the quantitative literacy requirement. This can be done with a sufficiently high SAT or ACT mathematics score, college credit in a 100 or higher level mathematics course, a passing score (60% or higher) on the Goshen College quantitative literacy competency exam, or passing Math 105. Math 170 will meet this requirement and is especially useful for students who want to understand how mathematics is used to model the world, plan to take calculus, and/or plan to major in the natural or social sciences.
Due Date Policy	Assignments, labs, and exams can only be rescheduled or made up if (1) there is a serious medical problem, a death in the immediate family, or an irreconcilable conflict with another official Goshen College activity; (2) there is written documentation signed by proper authorities; and (3) the instructor is notified prior to the due date or as soon as possible afterwards.