



GOSHEN COLLEGE
MATHEMATICS DEPARTMENT
MATH 170 FUNCTIONS, DATA, AND MODELS – SPRING 2023-24

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 depends 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.
Catalog Description	Symbolic, graphical, numerical, and verbal representations of functions to model real-world phenomena and the use of data to fit and verify models. Recommended background: three years of high school algebra and geometry or Math 115. Meets the Quantitative Literacy requirement in the Goshen Core. 4 credit hours.
Learning Objectives	By the end of this course, students will: <ul style="list-style-type: none">• Recognize, use, and interrelate symbolic, numeric, graphic, and verbal representations of linear, quadratic, exponential, logarithmic, periodic, power, polynomial, inverse, and combined functions.• Solve problems presented in the context of real-world situations by creating, manipulating, and interpreting function models.• Obtain, display, summarize, and interpret univariate and bivariate quantitative data.• Fit appropriate function models to data and use the resulting models for prediction and analysis.• Use computer software to explore concepts, solve problems, and communicate results.
Instructor	David Housman, SC 117, dhousman@goshen.edu, 574-535-7405 (office). 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: <i>Functions Modeling Change: A Preparation for Calculus</i> , 6th Edition by Eric Connally, Deborah Hughes-Hallett, Andrew M. Gleason, <i>et. al.</i> , ©2019. 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. Instructions for how to register are in the <i>WileyPLUS Registration Instructions</i> link in Moodle. 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 contains the text, mini-lecture videos, assignments, and other resources. Moodle contains the schedule, class slides, documents, surveys, and grades.
Technology	SageMath and its collaborative notebook interface CoCalc will be used for computation. Free basic private server access will be provided. WolframAlpha , GeoGebra , 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 two years of high school algebra and one year of high school geometry, or a B grade in Math 115 Applied Algebra) can obtain an average grade (C+ or 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 written solution or pause the video, (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 (25%), three midterm exams (15% each for a total of 45%), and a comprehensive final exam (15%). The assignments grade and any midterm exam grade that is lower than the final exam grade will be replaced with the final exam grade. 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	<p>Achieve and exhibit understanding by completing exercises daily. Assignments will be completed through WileyPLUS. Solve each exercise on paper before submitting your answer online. If marked incorrect, determine the error in your thinking and submit a revised answer without penalty. It can be beneficial to collaborate but make sure you can solve similar problems on your own.</p> <p>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 and without assistance; however, it is always beneficial to work on assignments even if the deadline is not met.</p>
Extra Credit	<p>Receive one percentage point extra credit toward your assignments grade for each one of the following (completing all extra credit opportunities will add about 4% to your course grade):</p> <ul style="list-style-type: none"> • fill out a course survey or evaluation; • attend a quantitative activity (e.g., Science Speakers) and describe in no more than one page some interesting mathematical aspect of the activity, or participate in a Career Networks event and describe your most important discovery (limit 10); • attend a study session (limit 10); or • converse with David in his office prompted by one or more questions you have about the course (limit 3).
Labs	<p>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 and be due Mondays at 2:00 PM and graded by the start of Tuesday's lab. Rewrites and late submissions will be due one week after the original due date, and the posted grade will be $0.30 * (\text{original grade}) + 0.70 * (\text{revised grade})$.</p>
Exams	<p>Exhibit your mastery of the learning objectives without assistance or collaboration. Exams will be completed in-class using only writing instruments, a ruler, and a simple scientific calculator. For midterm exams, students will have an opportunity over the next twelve hours or so to resubmit any answers making use of any class resources. For resubmitted parts, the original and resubmitted grades will be averaged.</p>
STA and Tutoring	<p>Elise Jantz will be the Student Teaching Assistant (STA) 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 tutorcal.goshen.edu.</p>

Accessibility Accommodations Goshen College is committed to providing all students equitable access to programs and facilities. Students who need accommodations based on disability should contact the Academic Success Center (ASC). Students must register with the ASC before faculty are required to provide reasonable accommodations. For more information or to register, please contact the Director of Academic Success, Michelle Blank, Good Library 112, mblank@goshen.edu or 574-535-7526. To ensure that learning needs are met, contact the ASC the first week of classes. More information at: <https://www.goshen.edu/campuslife/asc/disability-services/>.

Collaboration and Academic Integrity 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.

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.

For exams, you may *not* use any resources unless a specific exception is stated by the instructor.

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.

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.

Placement Advice All students need to meet the quantitative literacy requirement. 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.