UNH Online Syllabus

## Course Name: Analysis and Applications of Functions (Math 418)

Academic Requirements Fulfilled: (Major requirement)

Class Start and End Dates: August 31- December 11

Instructor names: David Benson, Lauren Sager

Email: [David.Benson@unh.edu](mailto:David.Benson@unh.edu); [lauren.Sager@unh.edu](mailto:lauren.Sager@unh.edu)

Virtual Office Hours link:

* Prof. Sager:
* Prof. Benson: <https://unh.zoom.us/j/618373259?pwd=VGNVbVpXd2lPYkVwOS8xdWVzelk2UT09>
  + The password is Fluxion

# **Teaching Assistants**

# Sections 1-3: Cathy Dennis — Parsons NB24

# Sections 4-6: Becca Butler — Kingsbury N133

# Sections 7-9: Bit Na Choi — Kingsbury N310

# Section 10-12: Alice Hempel — Remote Recitations

# **Functions**

# Our modern mathematical definition of a function was introduced in the first half of the eighteenth century. It was summed up by the Swiss mathematician, Leonhardt Euler in his text, *Introductio in Analysin Infinitorum* (1748).

“A function of a variable quantity is an analytical expression composed in any manner from that variable quantity and numbers or constant quantities” [Ruthing, 1984, p. 72, as cited in Kleiner, 1989].

By an “analytical expression,” Euler meant what we call a formula. We will see in MATH 418 that the modern concept of function has progressed to include a much wider collection of constructs.

# **Milk the cow!**

A mathematics professor, Kamal Narang, used to say, “Learning mathematics is like being a dairy farmer. Dairy farmers need to milk the cows every day or else they will stop giving milk. So you need to work on mathematics every day or else you will stop being able to do it.”

## Textbook (required)

Precalculus by Abramson (available at: <https://openstax.org/books/precalculus/pages/1-introduction-to-functions>)

## Course Description

Analysis and applications of algebraic and transcendental functions with special emphasis on exponential, logarithmic, and trigonometric functions. Graphical analysis. Written projects will be required on some or all of the following topics: rates of change, optimization, logarithmic or exponential modeling, and trigonometric functions. Intended for students planning to take MATH 425. Prereq: MATH 302 or the equivalent.

## Course Learning Objectives

Upon completion of this course students will be able to

* Solve inequalities and absolute value inequalities.
* Determine the domain and range of a function.
* Find equations of lines and use linear functions to model and solve real world problems.
* Analyze the graphs of polynomials, sketch the graphs of polynomials and apply polynomial functions to solve real world problems.
* Determine the holes, roots and vertical asymptotes of a rational function.
* Determine if functions have an inverse and if so solve for the inverse.
* Manipulate exponential expressions and solve real world problems using exponential functions.
* Manipulate logarithmic expressions, solve exponential equations and real world problems using logarithmic functions.
* Evaluate trig functions at “nice” angles and some not so “nice” angles.
* Solve trigonometric problems, equations and triangles using trigonometric problems.
* Identify and manipulate polynomial, power, rational, exponential, logarithmic, trigonometric, and piecewise-defined functions. Identify functions’ domains.
* Represent a given polynomial, power, absolute value, rational, exponential, logarithmic, or trigonometric function numerically, symbolically, graphically, and verbally. Select the appropriate function in applied problems.
* Sketch graphs and appropriate transformations for the following: polynomial functions (linear, absolute value, quadratic, followed by those with degree three and higher), rational functions, exponential and logarithmic functions, and trigonometric functions.
* Understand and perform addition, subtraction, multiplication, division, and composition of functions. Perform these operations algebraically, numerically, graphically, and in applied settings.
* Understand the abstract concepts of function inverses and one-to-one functions. Find inverse functions using algebraic, numerical, graphical, and verbal techniques.
* Solve problems involving the inverses of (restricted) polynomial, power, rational, exponential, and trigonometric functions. Use appropriate inverse functions in applications.
* Understand the average rate of change of a function over an interval. Compare average rates of change of a function over different intervals, and compare the average rate of change of different functions over the same interval. Calculate the average rate of change numerically, algebraically, and graphically.
* Solve equations containing polynomial, absolute value, power, rational, exponential, logarithmic, or trigonometric functions in routine and applied problems.

# **What will be happening in each class?**

* When we are en masse on Mondays and Wednesdays, we will be learning new ideas and sharing our understandings of the mathematics that we have read about in the text. You will be asked to participate by working on problems in groups and by sharing your ideas about the problems and the reading with the rest of the class.
* In your Lab sections (~25 students each) on Tuesdays and Thursdays, you will be working in groups to make sense of mathematics ideas and to apply them to challenging problems to deepen your understanding. You will also be expected to share your sense making with other groups of students. We will have our weekly quiz to assess your individual understanding of the underlying mathematics.
* Fridays: We will work on new material after wrapping up the material from the week.

## Course Structure

myCourses is the learning management tool we use for this course. The course is online and synchronous and organized by modules. The overall course navigation

|  |  |
| --- | --- |
| *Course Navigation* | *Description* |
| *Home Page* | Landing Page for the course. Links to individual modules. |
| *Syllabus* | The syllabus, course schedule and other key class documents are located here. |
| *Modules* | Lecture zoom meeting link as well as office hour zoom meeting link. |

|  |  |
| --- | --- |
| **Module Structure** | |
| *Lecture* | The primary lecture(s) or media and key concepts. |
| *Resources (or Review)* | Assigned readings from the text or media for review. Recitation sections for questions and weekly quizzes. |
| *Assignments* | Activities and assignments related to Module, to include weekly homework. Homework will be assigned daily. A small selection of the homework problems will be submitted each week, except during exam weeks. |

## Course Schedule

| **Week #** | **Content** |
| --- | --- |
| **1** | Inequalities and absolute value |
| **2** | Functions, domain, range, graphs and transformations |
| **3** | Linear Functions |
| **4** | Quadratic Functions |
| **5** | Power functions, properties of exponents and polynomials |
| **6** | Rational Functions |
| **7** | Composition of functions |
| **8** | Inverse functions |
| **9** | Exponential functions |
| **10** | Introduction to Logarithms: basic computations, graphs and properties |
| **11** | Logarithms part two: equations and applications |
| **12** | Circles, angles, radians, coordinates sectors, arcs and two important right triangles |
| **13** | Introduction to six circle functions and basic identities |
| **14** | Review for Exam III (Thanksgiving week) |
| **15** | Trigonometric identity verification and computation of non “nice” angles |
| **16** | Sinusoidal Modeling and Review for the Final |

## Grades

|  |  |  |
| --- | --- | --- |
| **Item** | **% of final grade** | **Requirements** |
| Quizzes | 12% | There are 9 quizzes for course. Each quiz counts for 20 points and we will drop the lowest two quizzes. See details below regarding quizzes |
| Class Participation | 5% | This grade will be based on your participation in recitation. |
| Weekly Homework | 14% | There will be 9 weekly homework assignments, each worth 10 points. The lowest two homeworks will be dropped. See details below. |
| In-Term Exams | 42% | There will be three in-term exams. |
| Final Exam | 15% | The course has a cumulative final. Date/Time TBA. |

## Policy on Late Submissions and Quizzes

* Late homework will not be accepted.
* Make-up quizzes will be allowed only in very unusual circumstances. For example, if you must miss a quiz for a UNH-sanctioned event, the instructors will consider allowing a make-up. Court dates are not an acceptable reason for a make-up quiz.
* Make-up exams will be possible only if you inform the instructor before the exam with a verifiable medical reason or family emergency. Make-up dates will be announced. These will occur shortly after the actual exam date.

## Homework

We will have nine weekly homework assignments due on the first Monday after the assignment is assigned, except for the week of Labor day, where homework will be due on Tuesday. Homework will be available via webassign ([www.webassign.net](http://www.webassign.net)). During the first week of class a webassign expert will come to recitations in order to help students set up their webassign accounts. Typically access to webassign (including access to an e-text of our textbook) will be free for the first two weeks and then you will be required to pay online. A few problems each week will be selected for in-depth grading.

## Quizzes

We will have nine quizzes this semester. Quizzes will be electronic (on canvas) and will be taken during recitation. You are expected to bring your laptop or tablet to recitation to take your quiz in the classroom. You will have 25 minutes in order to complete the quizzes and upload any necessary work. As will all of our assessments, the quizzes are closed notes; you are not allowed the use of any resources such as your textbook or websites while you take the quizzes. See the section on Academic Honesty.

There will be a practice quiz on Thursday 9/3 in recitation. This quiz will not count for credit at all and will only serve to familiarize students with taking assessments on canvas as well as the formats of our assessments.

Please note that to ensure social distancing and fairness to our students we will not be answering questions about the quiz during the quiz.

## Midterm Exams

We will have three 90 minute exams on 9/22, 10/20 and 11/24 starting at 7:10PM. The exams will be posted on canvas. The format of the exams will be a mixture of multiple choice questions, fill in the blank, short response and essay questions. There will be problems where you need to do your work out on paper and take a picture of your work and upload it. These exams are closed notes and no calculator or any external tools are to be used on the exam. See the section on Academic Honesty. **You will not be allowed to make up a missed exam without *prior* approval from the instructor (not the TA) except under emergency circumstances.**

**Grade Calculation**

**Semester Grades:** At the end of the semester we calculate letter grades as follows

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **A** | 93 – 100% | **B–** | 80 – 82.9% | **D+** | 67 – 69.9% |
| **A–** | 90 – 92.9% | **C+** | 77 – 79.9% | **D** | 63 – 66.9% |
| **B+** | 87 – 89.9% | **C** | 73 – 76.9% | **D–** | 60 – 62.9% |
| **B** | 83 – 86.9% | **C–** | 70 – 72.9% | **F** | below 60% |

## Technical Requirements and Technical Support

See website listings for current recommendations and requirements related to this course - <https://online.unh.edu/technical-requirements>.

For technical assistance please call (603) 862-4242 or fill out an online support form at <https://itsupport.unh.edu/onlinelearning/>

## University Disability Accommodations

The University is committed to providing students with documented disabilities equal access to all university programs and facilities. If you think you have a disability requiring accommodations, you must register with Student Accessibility Services (SAS) <http://www.unh.edu/studentaccessibility>. Contact SAS at (603) 862-2607 or SAS, please provide me with that information privately so that we can review those accommodations.

## Academic Honesty

Students are required to abide by the UNH Academic Honesty policy located in the [Student Rights, Rules, and Responsibilities Handbook](http://www.unh.edu/vpsas/handbook/academic-honesty).

Plagiarism of any type may be grounds for receiving an “F” in an assignment or an “F” in the overall course. Plagiarism is defined as “the unattributed use of the ideas, evidence, or words of another person, or the conveying the false impression that the arguments and writing in a paper are your own.” (UNH Academic Honesty Policy, 09.3) Incidents are reported to the school dean and may be grounds for further action. If you have questions about proper citation refer to your department’s writing guidelines. You can contact me at any time on this issue. Additional resources are located below:

<http://libraryguides.unh.edu/unhmcitingsources>

<http://www.library.unh.edu/reference/citation.shtml>

## Covid-19 Statement and Policies

As faculty, TAs, and course instructors, we need your help to promote our [#unhtogether](https://www.unh.edu/coronavirus/unh-together) COVID response culture. We all have a responsibility during this COVID-19 pandemic to protect our own health and the health of friends and fellow community members. Violations of the COVID protocols by even a single individual can cause significant disruptions or discontinuation of in-person academic activities. Any student creating such disruptions undermines the opportunity for others to learn and engage with the UNH community, and as such, is in serious violation of the UNH [Student Rights, Rules & Responsibilities](https://www.unh.edu/sites/default/files/departments/student_life/2019-20_srrr_-_final_from_printing_-_formatted_for_website.pdf).

In alignment with our [#unhtogether](https://www.unh.edu/coronavirus/unh-together) commitment to the ongoing health and safety of our community during the COVID-19 pandemic, there are several changes in classroom expectations.

All students are required to wear masks in class and campus buildings unless a medical exception is made through an accommodation process. It is your responsibility to obtain a mask before coming to class. For information on proper use of masks, acceptable mask types, and other PPE and social distancing guidelines visit <https://www.unh.edu/coronavirus>. Students wishing to request a medical accommodation should contact the [Student Accessibility Services](https://www.unh.edu/studentaccessibility). Failure to comply with PPE and social distancing classroom protocols is a violation of the [Student Rights, Rules & Responsibilities](https://www.unh.edu/student-life/student-rights-rules-responsibilities). If you refuse to comply, you will be asked to leave class immediately and you may also be reported to the Office of the Dean of Students and your associate dean.

1) Your instructor or TA may be wearing a face shield without a mask during instruction and only while maintaining at least a 6-foot distance from any student.

2) Prior to class, please wait outside the building, weather permitting, or in the hall or common area, observing social distancing and leaving plenty of room for the prior class to exit the room and building. Wipes are available near the room entrance. Obey entrance and egress signage and any additional faculty directions on entering or leaving the classroom.

3) Each classroom entrance is equipped with hand sanitizer and surface wipes.

* + - * Use hand sanitizer as you deem appropriate.
      * Wipe down your personal space prior to class and throw the used wipes away on the way out of class or take them with you.

4) Sit only in marked seats. Classes and laboratories were restructured to minimize or eliminate contact between individuals of less than 6 feet.

5) Contract tracing is mandated by the State of New Hampshire. The following practices will facilitate effective contact tracing implementation should the need arise:

* + - * Students should sit in the same seat for each class period to minimize potential contacts.
      * We ask students to know the names of each of the people sitting closest to them — their nearest neighbors.

**OR**

* + - * We will be filling out a seating chart as part of each class.

**OR**

* + - * A picture will be taken of where you are sitting for each class.

6) UNH has developed "Wildcat Pass," a web and mobile app to help each of us keep track of the requirements for being in compliance with necessary testing, isolation and quarantine rules that will help to keep our community healthy.

* Log into your Wildcat Pass each day.
* Be prepared to show your mobile device or a computer printout of your daily Wildcat Pass if asked by a university representative.

**Changes to campus mode of operation and instructional modality**

1) This class is beginning the semester operating in a Yellow mode of operation ([see https://www.unh.edu/coronavirus/operation](https://www.unh.edu/coronavirus/operation)). This means lectures will be online via zoom and recitations will meet face to face. Students who elect to take the course online will attend recitations via zoom. If your health and safety requires shifting to an Orange or Red mode of university operation, the modality and schedule of this course may change.

2) All in-person class meetings will end on Friday, Nov. 20, during the Fall 2020 semester and will move to a remote modality starting Monday, Nov. 23. The type of remote learning we will use in this course is Zoom synchronous at regular time.

3) Your classroom is equipped with technology that will provide remote access to class instruction. Because of the need to accommodate potential isolation and quarantine due to the COVID pandemic, lectures or other class meetings for this course may be recorded by the university using UNH media platforms. Such recordings may be available for educational use by students enrolled in the class (including both for instruction and as a review tool), the course instructor(s), and other university officials who support course instruction. Your voice or image may be captured on the recordings, and by enrolling in this course you are consenting to such recording for these purposes. The university and Zoom have FERPA-compliant agreements in place to protect the security and privacy of UNH Zoom accounts. You may not share recordings outside of this course. Doing so may results in disciplinary action.

4) Students must learn how to access this course in all possible formats.

* + - * + Ensure that you have all necessary technology to participate in this course remotely.
        + Consult with the instructor and/or with [UNH IT for Students](https://td.unh.edu/TDClient/60/Portal/KB/ArticleDet?ID=2177) with questions.

**Attendance (including rotational) for in-person modalities**

Students are expected to adhere to the attendance policies specific to this course as outlined in the syllabus, as usual. Do not attend class if you have any symptoms of illness or if your daily Wildcat Pass does not show that you are cleared to participate in classes and other campus activities. Inform the instructor or TA, in advance if possible, that you will be absent from a scheduled in-person class. It is ultimately your responsibility to keep up with all course expectations. When appropriate, accommodations will be made.

[State clearly the course policy on rotational attendance if your course will be delivered in this modality. Include the following language if helpful:] If this class either begins with, or is forced by conditions to adopt, a rotational attendance component, you must only attend in-person on your assigned day(s) and may not switch days with other students or make other modifications to faculty instructions for in-person attendance.

**Exam Scheduling and Remote Proctoring**

This class will use canvas to administer and proctor exams. Within the first weeks of the semester, we will run a sample test using the required software. You will be asked to agree to the use of applicable technologies such as lockdown browser, webcam, recording of video, audio, etc. during the sample test. This software will be used for the remainder of the semester for quizzes/tests. If you have any problems with the use of the relevant technology, contact your professor to discuss reasonable alternatives. It is our goal to create a learning experience that is as accessible as possible. If you anticipate any issues related to the testing requirements of this course or need accommodations, please either discuss them directly with me or in conjunction with the [Student Accessibility Services Office](https://www.unh.edu/studentaccessibility) within the first week of classes to explore alternative options.

All final exams for the Fall 2020 semester will be administered remotely. Scheduling of those exams will follow normal practice.

## Math Help Center (MaC)

Regular hours (which differ slightly from our usual regular hours) at MaC will begin on Tuesday, September 8.  Online help will continue regular hours through the last day of classes, and we will have a special schedule during the final exam period.  In-person help will end on Friday, November 20. MaC will be closed on Tuesday, November 11.  MaC will also be closed Wednesday, November 25th through Sunday, November 29th.  On Tuesday, November 10th, MaC will follow a Wednesday schedule.

**Online help hours**: MW 1 to 5 pm and 7 to 10 pm; TR from 10 am to 5 pm; and Fridays and Sundays from 1 to 5 pm.  These hours will be for drop-in help, and I will post the zoom links sometime during the first week of classes.

**In-person help**:

     We will not be using our space in Christensen at all this semester, since the air flow there is not good enough.  Instead, all of our in-person help will be offered in Kingsbury W387 (the math ed resource room).  In-person help will be offered only MTWRF from 1 to 5 pm and, in order to use that help, students will have to reserve times.  (We can help at most 8 students in person at any given time.)

     Students who attend in-person help must wear masks.  We will not be supplying any materials for those students to use either.  We won't be able to supply scrap paper, and there won't be any books, calculators, writing utensils, etc. for students to borrow.  Everyone has to bring their own supplies.  Also, no food or drink will be allowed.

Note: This syllabus is subject to change. Students will be promptly notified of any changes.