# Math B201 – Multivariable Calculus – Section 2
# Bryn Mawr College – Fall 2019

**Instructor:** Dr. Katherine Raoux
**Office:** Park 359
**Email:** `kraoux@brynmawr.edu`
Email is generally the best way to reach me.

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**Course meets:** Mon, Wed, & Fri 12:10-1:00 pm in Park 338
+ Tuesday lab section

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**Exam dates:**
Exam 1 – October 2-4
Exam 2 – November 6-8
Final Exam – December 16-20
• Exams are self-scheduled •

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**Problem Session:** Bryn Mawr graduate student Savannah Williams will hold Problem Sessions Tues. & Thurs. evenings 6:30-8:00pm in Park 336.

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**What is a Problem Session?** In the Problem Sessions, our TA Savannah will facilitate student discussion of the course material. Possible topics include review of previous material, or extra example problems. All students are encouraged to attend!

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**Office hours:** I will hold office hours on Wednesdays 2:30-4:00pm and alternatively, you can email me to make an appointment.

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**What are office hours?** College courses move quickly through material and we have limited time in class. Office hours are your opportunity to ask me questions you have about the homework and material. This is my time for you, so use it! Everyone is welcome!

## Course overview

Calculus is the study of how things change. In previous courses, you built a foundational understanding of limits, derivatives and integrals for single variable functions. In Calculus I, you developed tools to answer questions like: How fast has the average daily temperature in Orlando increased over the past ten years? We take this as our jumping off point into a new world of higher dimensions. In Multivariable Calculus, we develop the tools required to answer broader questions like: How fast has the average daily temperature of a given point on Earth changed over the past ten years?

We begin the course by studying multivariable functions both algebraically and geometrically. Because we live in a 3-dimensional world, we will primarily focus on 2- and 3-variable functions so as to let our intuition guide our understanding. However, the true power of the framework we build lies in that it applies to functions of arbitrarily many variables. In this way, the calculus allows scientists and social scientists to study complex data sets by the same methods that you would use study a simple object in motion.

Topics we will address include functions of several variables, partial derivatives, integration, vector calculus, the divergence theorem and Stokes' theorem.

## Learning Goals

As a student in this course you will learn to:

- extend the techniques of single-variable calculus to functions of several variables;
- solve complex problems;
- think visually;
- carry out accurate mathematical calculations;
- use computer resources to symbolically and graphically understand concepts.

## Course Materials

- **Textbook:** *Calculus*, 6th edition by Hughes-Hallett (*Single and Multivariable* Chapters 12-20 or *Multivariable*)
- **Online homework:** `www.edfinity.com`
- **Online discussion platform:** `www.piazza.com`
- **Software:** *Mathematica*

You need to make accounts for both *Edfinity* and *Piazza* (see details below). *Mathematica* is free on campus computers. Students may also obtain a free license for their personal computers.

# Textbook

You will need to obtain a copy of either *Calculus: Multivariable*, 6th edition or Chapters 12-20 of *Calculus: Single and Multivariable*, 6th edition by Hughes-Hallett. We will follow the text closely, covering about a section per day. I expect that you prepare for class each day by reading/skimming the appropriate section. I will post Chapter 12 on Moodle to help you get started. There are also copies on reserve in the Collier Library.

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## Grade Breakdown

Your grade will be comprised of the following components:

- Exam 1 — 20%
- Exam 2 — 20%
- Final Exam — 30%
- Course Engagement — 5%
- Homework — 15%
- Computer labs — 10%

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# Exams

Exams are an opportunity for you to demonstrate your understanding of the material and for me to give you feedback on your progress. We will have two self-scheduled midterm exams and a self-scheduled final exam. Exams are closed book and closed note.

The first midterm is scheduled for between October 4-6 and the second midterm is scheduled for between November 6-8. The final exam will take place during finals week December 16-20 and is comprehensive. Exams may not be taken late without advanced permission. An extension may only be granted in the case of an emergency, hospital stay or similar major crisis.

# Course Engagement

Learning the material in this course requires your engagement. I expect you will come to lecture *on time* and participate. I will pass around an attendance sheet each day. If you will miss a class, please email me so that I know you are okay and I will excuse your absence.

Participation includes but does not necessarily mean speaking in class. Some ways to demonstrate course engagement are:

- attending lecture regularly;
- attending the Problem Sessions or office hours;
- asking or answering questions on *Piazza* (see details below);
- asking questions or making comments during class.

I anticipate all students will earn full marks for course engagement. If I notice a lack of engagement on your part, I will reach out to you to clarify the situation. A sustained lack of engagement may result in lower than full marks.

## Academic integrity

The Bryn Mawr Honor Code is in effect for all students enrolled in this course.

Exams are to be completed on your own without the help of other students or outside resources.

For other assignments, I encourage you to work together, collaborate and discuss the material. You should seek help from me, our teaching assistant Savannah Williams, or any of your peers. However, the work you turn in, whether online or in person, must be your own. It is not okay to copy work from another student or resource without carefully working through the material yourself. Submitting such work is a violation of the honor code.

## Class Ettiquette

The classroom should be a place where open discussion and collaboration flourish. Building an environment where students feel comfortable asking questions takes effort on the part of the professor and the other students.

I encourage you to ask and answer each other's questions in a respectful manner. I value your questions and will do my best to answer them! This platform for open discussion extends outside of the classroom to office hours, the Problem Session, and our online forum Piazza.

I also expect that email correspondence is thoughtful and respectful. This includes addressing your correspondence properly, e.g. "Dear —," and signing, e.g. "Best, —".

# Homework

Problem solving in mathematics requires learning a theoretical framework and also how to apply that framework. As with many technical skills, the more you practice, the more proficient you will become. The homework in this course is your opportunity to practice.

Homework will be assigned on Moodle for each section of the text and falls into two categories:

- **Suggested Practice** – These exercises are for your own practice and *will not be collected or graded.*
- **Required Exercises** – These exercises are to be completed through the online homework system *Edfinity*. Due dates are listed on Moodle and *Edfinity*. Since the homework is online and can be accessed from anywhere, *extensions will be granted only in extenuating circumstances with advanced permission*. If you think you need an extension please email me. Generally, even if you are not in class, you are still responsible for turning in your homework on time.

Details for getting started with *Edfinity* are provided below.

# Computer Labs

Most people who use calculus in their work (scientists, economists, etc.), do so through interactions with computer models. In the computer labs you will learn to use the program *Mathematica* to apply the techniques we learn in class to more sophisticated examples that occur in the real world. The lab meets weekly on Tuesday.

# Accessibility

Bryn Mawr College is committed to providing equal access to students with a documented disability. Students needing academic accommodations for a disability must first register with Access Services. Students can call 610-526-7516 to make an appointment with the Director of Access Services, Deb Alder, or email her at `dalder@brynmawr.edu` to begin this confidential process. Once registered, students should schedule an appointment with the professor as early in the semester as possible to share the verification form and make appropriate arrangements. Please note that accommodations are not retroactive and require advance notice to implement. More information can be obtained at the Access Services website. (http://www.brynmawr.edu/access-services/)

Any student who has a disability-related need to record this class first must speak with the Director of Access Services and to me, the instructor. Class members need to be aware that this class may be recorded.

# Getting Started with *Edfinity*

*Edfinity* is the online homework platform we will use in this course. The underlying software is known as WeBWorK. It was developed by the Mathematical Association of the Americas (MAA). *Edfinity* is a commercial service, partially funded by the National Science Foundation (NSF), that hosts WeBWorK for us and provides a simple, intuitive, user interface and easy-to-grasp analytics on class performance. The Mathematics Department is paying the cost of the license. *You do not need to pay*.

- Once you have registered for this course, I will send you an invitation to *Edfinity*. (Invitations will go out the afternoon of Wednesday September 4).
  Alternatively, use the link: `https://edfinity.com/join/EDAGLBMP`
- You will need to make an account with *Edfinity* as a student. Please make your account using your Bryn Mawr email and your name as it appears in Bionic.

**Best practices for doing homework online:**

- Keep good notes of your problems and solutions! Multivariable calculus problems are challenging! Do not expect to be able to answer the questions immediately. You will need to do work before finding the answers. It is important to keep a good notebook/binder of your work!
- Once you see the problems, either copy them down into a notebook OR take screen shots of the problems and print out to put in a binder.
- Work out the solutions to the problems in your notebook or on loose leaf paper that you can put into a binder.
- When you submit your solution on the Edfinity site, you will be told immediately if your answer is correct. You have an unlimited number of chances (before the deadline) to resubmit!
- You do not need to complete all the homework questions for a section at one time. Do what you can and return later to complete. *Your assignment will be automatically turned in at the due date/time.*

Finally, since this is our first semester using *Edfinity* at Bryn Mawr, it is possible that there are small technical glitches. It is possible that the you may enter an answer correctly but the system's programming fails to recognize it. (This shouldn't happen. These problems have been used year after year at other institutions.) If this does happen, remain calm. We are humans. We can control the computers. The steps you should take (roughly in order) are:

- *Double* check your work and, if possible, find a friend to discuss with in person.
- *Triple* check what you've typed. There is a big difference in how the computer will interpret $\sin 2t$ versus $\sin(2t)$.
- If appropriate, post to the *Piazza* forum.
- Please try not to use the *Email instructor* button at the bottom of the problem page. This is less useful than posting to *Piazza* because you will not be able to show me your work and your peers cannot benefit. I will receive emails from *Piazza* also! Please email me directly about an *Edfinity* problem only if you feel it would be inappropriate to post to *Piazza*.
- Use the *Report a technical issue* link for issues like: your login breaks, the submit button breaks, etc.

**Special Getting Started with Edfinity Help Sessions:**

- Wednesday September 4, 2:30 - 4:00pm (Lisa Traynor, Park 329)
- Thursday September 5, 6:30 - 8:00pm (Savannah Williams, Park 336)
- Friday September 7, 3:00 - 4:00pm (Katherine Raoux, Park 359)

# Getting Started with *Piazza*

Piazza is a social learning platform for higher education. To get an account, go to `https://piazza.com/brynmawr` or follow the link to *Piazza* from our Moodle page. You will need to register with your Bryn Mawr email address. There is also a free Piazza app for iPhones and Androids. I encourage you to get the app on your phone.

**Working with Piazza:** For each section of our textbook, you will see two folders on Piazza: a "class" folder and a "discussion + hw" folder.

- Class Folders
  I will often start class by asking you some warm-up questions. I am planning on using the "poll" feature in Piazza to ask these questions. You will be asked to "vote". We can then survey everyone's answer.
  In polls, your answer is anonymous to your fellow students. (However, I am able to see your participation.)

- Discussion and Homework folders
  When you are learning a subject, it is natural to have LOTS of questions. On Piazza, you will have the opportunity to ask questions at any time. Think of this as a class forum.
    - Student posts are always anonymous to other students.
    - Instructors can see the authors of posts. This is a great way to gain class engagement credit!
    - You are encouraged to ask questions.
    - You are encouraged to read the questions of your fellow students; you might have the same question!
    - Please answer the questions of your fellow students! (Instructors will not be constantly monitoring Piazza. Think of this as helping someone else in the class. Someone may repay the favor to you some day.)
    - Instructors have the ability to endorse answers written by students.
    - Instructors will periodically monitor the site for activity.

**How to ask questions effectively:** To get the most out of Piazza, it is important to learn how to ask questions in a way to get the information you need to move forward.

You are allowed to ask any question that is more specific than "How do you do this problem?", provided you ask thoughtfully. Here are two possible posts. One is what we want and one is what we do not want:

- Post 1:
  ```
  How do I do Problem 3?  Calculate f'(x) for f(x) = x⁻².  Thx lol.
  ```
- Post 2:
  ```
  Hey y'all,
  Problem 3 on my Edfinity homework for Section 4.2 asks me to
  calculate f'(x) where f(x) = x⁻².  I tried using the power rule,
  where I lower exponents by 1.  I keep getting f'(x) = -2x⁻¹ which
  is wrong.  Or Edfinity is wrong.  Can you help?  Thanks!
  Best,
  Questioner asking the right way.
  ```

**How to answer questions:** It can be fun to help your fellow students. This is a great way to reinforce the course material. Often students are better at understanding confusions!

Some Guidelines:

- Always respond with respect.
- Encourage your fellow students! (e.g. "You're on the right track!") Math is hard for all of us at times.
- Try to nudge fellow students in the right way; don't do the exercise for them.
- Don't worry about saying something incorrectly. Other students (and instructors) can chime in and/or endorse answers.