

MATH 1483: Mathematical Functions and Their Uses

What is this class about? Before we get into anything too heavy, I want to start out by bringing up two questions that so many of us have asked about mathematics at one point or another. What is math good for? When am I ever going to use this stuff? (Actually, I imagine that many of you have uttered more colorful and unrepeatable variations of these questions, but the sentiment is the same.) I have great news for you: this course is specifically designed to answer this very question. We are going to concern ourselves almost exclusively with how mathematics can model and help us to understand the real world. I'm sure you've heard this all before and been told about how incredibly useful mathematics is and then been presented with a problem that is utterly unconvincing. You know the kinds of problems I'm talking about: Sally is 5 years old, and her older brother is twice the age of her younger sister who is 3 years older than Sally's cousin was 4 years ago – as if someone would ever be in a situation in which they knew ridiculous information like this but not the children's actual ages¹. What makes examples like this so frustrating is that authentic, interesting applications of mathematics to everyday life are abundant. We'll explore many of these applications: some will be pertinent to your major (business, finance, education), others will be of personal significance (how much does it cost to buy a home?), and still others will be just for fun. As we go, we'll notice one thing over and over again: the importance of understanding the relationship between various quantities. This focus will give us a way to navigate the chaos that pervades the world around us and will uncover patterns that will help us to better understand it.

"You may not be aiming for a mathematically oriented career. That's fine - most people aren't. But you can still do math. You probably already are doing math, even if you don't call it that. Math is woven into the way we reason. And math makes you better at things. Knowing mathematics is like wearing a pair of X-ray specs that reveal hidden structures underneath the messy and chaotic surface of the world. Math is a science of not being wrong about things, its techniques and habits hammered out by centuries of hard work and argument. With the tools of mathematics in hand, you can understand the world in a deeper, sounder, and more meaningful way."

-- Jordan Ellenberg, How Not to be Wrong

Course Objectives: at the conclusion of the course, students will be able to

- analyze various representations of functions (table, graph, formula, words) from the viewpoint of (1) identifying the relevant quantities and their units of measure, and (2) coordinating the changes in these quantities.
- identify various classes of functions (such as linear and exponential functions) that exhibit certain characteristics (such as rate of change, concavity, and limiting values).
- use mathematical concepts (such as rate of change, concavity, and limiting values) to gain insight into a real world situation – that is, interpret what mathematical concepts mean within the given context. Special emphasis will be placed on contexts involving the natural sciences, business, and the social sciences.
- articulate verbally and in writing the meaning of mathematical concepts and how they might be interpreted – in other words, what information they provide – within real world scenarios.

This course will often involve active participation on your part. Many classes will consist of small group activities and whole class discussions. You are expected to attend every class period prepared to actively contribute to both your own learning and the learning of your classmates. This includes asking questions, answering questions, making conjectures, giving explanations, and presenting solutions.

Instructor: John Paul Cook, Ph.D., Assistant Professor of Mathematics. Please feel free to contact me using any of the following:

- *Office Hours:* My office is room 406 (fourth floor) of the Mathematical Sciences building, and my office hours are on Tuesdays and Thursdays (check online.okstate.edu for the specific times); also by appointment as needed.
- *Email:* cookjp@okstate.edu
- *Google Hangouts/GChat:* username cookjohnpaul@gmail.com (please only use this username for Hangouts; if you'd like to email me, please use my official @okstate email)

Course Communication and Website: Important course announcements, whenever possible, will be made in class. I will also make use of the following methods to disseminate course information:

- Your official @okstate.edu email
- The class's Brightspace page (online.okstate.edu)
- The class GroupMe

Course Materials: We will use the following textbooks as references:

- *Online Textbook. Functions & Change: A Modeling Approach to College Algebra, Custom OSU edition with WebAssign*, by Crauder, Evans, and Noell. Do *not* purchase an access code online or in the bookstore – everyone's access to the online textbook and assignments has been billed to their bursar account. (That is, unless you have actively opted out of the direct-billing option. If you don't know whether you've opted out or not, you probably haven't.) A hard copy of the textbook is not required, though you are welcome to purchase it if you'd like.
 - Be sure to register for this course using course code (which is available on our class's page on <http://online.okstate.edu>) as soon as you can! Once you have the course code, go to www.webassign.net.
- *Graphing Calculator.* You are *required* to have a graphing calculator for this course. I will use a TI-83 Plus graphing calculator in all course videos (a TI-84 is very similar and therefore acceptable). Graphing calculators other than the TI-83 Plus or TI 84 are not compatible. You may check out a TI-83/TI-84 graphing calculator *for free* from the Mathematics Department (Math Sciences 401) for use during the semester (while supplies last).

Grades, or, how your progress towards the course objectives will be evaluated: Your experience with grades might unfortunately share some resemblance to following sentiment:

'We tend to teach mathematics as a long list of rules. You learn them in order and you have to obey them, because if you don't obey them you get a C–. *This is not mathematics.*'

– Jordan Ellenberg, *How Not to Be Wrong*, p. 12

The evaluation methods and criteria in this course are designed to avoid an 'obey the rules or get a C–' classroom environment. In this class, we adopt something closer to the following stance:

'First, learning is a developmental process rather than only a question of acquisition. Learning entails primarily intellectual and personal changes that people undergo as they develop new understandings and reasoning abilities ... grading becomes not a means to rank but a way to communicate with students.'

– Ken Bain, *College Teachers*, p. 153

You will have many opportunities to demonstrate evidence of your learning and progress in this course and receive feedback:

- *Written Homework and In-Class Quizzes (100 points):* The best way to learn mathematics is to do mathematics. Practicing and thinking about concepts and skills in this course outside of class on a regular basis is critical to learning. As such, there will either be a quiz or a homework assignment due nearly every class period. Because of the importance of keeping pace with the course content, late assignments are not accepted and makeup quizzes will not be given (another reason for this is that solutions to the homework and quizzes will often be discussed in the same class period, which would give anyone submitting an assignment late or taking a makeup quiz an unfair advantage). Fortunately, though, to account for legitimate reasons that might prevent you from attending class or completing assignments, I will drop at least two of your lowest scores from this category at the end of the course. Homework and quiz scores will be averaged and scaled to 100 points.
- *WebAssign Homework (50 points):* One of the greatest advantages of having an online homework component to the course is the ability to get immediate feedback. Though I try to return all written assignments in a timely fashion, nothing can compare to online homework modules, which allow you to instantly see whether or not a proposed answer is correct. Similar to written assignments, no late work will be accepted on WebAssign, but there is an added bonus (literally) for those who take advantage of the online resources available to you: though this grade category will be scaled to 50 possible points, by completing all of the online assignments you can earn up to a total of 70. That means there's a chance to earn an extra 20 points, which would raise one of your midterm scores or your written homework/in-class quiz average by 2 letter grades!
- *Exams (2 midterms @ 100 pts each + 1 final @ 150 pts = 350 pts):* Whereas the point of homework and quizzes is to help you learn something, the motivation behind an exam is for you to show what you have learned. There will be 2 midterm exams (100 points each) and a comprehensive final exam (150 points). I will always provide details in class about specific content to be covered on the exam with an appropriate amount of time for preparation (usually 1 week in advance). The midterm exams will occur during regularly scheduled class periods in our regular classroom. Regarding the final exam:
 - If you are in the T/Th 12:30 section, the final exam will take place on **Tuesday, December 11th from 10:00am to 11:50am** in our usual classroom.
 - If you are in the T/Th 2:00 section, the final exam will take place on **Thursday, December 13th from 2:00pm to 3:50pm** in our usual classroom.

Makeup exams are not permitted unless an unforeseeable emergency arises. Please come speak with me directly if you encounter circumstances that you believe merit an exception.

- *Attendance* and participation are exceptionally important in this course. Regardless of your career plans, your ability to articulate your thoughts in writing is key, but your ability to verbally articulate and discuss ideas – sometimes off the top of your head and on-the-fly – is just as important. This is a difficult yet necessary skill, and the only way to develop that skill – at least within the context of this class – is to attend class and actively participate. Along these lines, you are expected to attend each class period. The bottom line: simply turning in assignments is not enough to make sufficient progress towards the course goals. Please come speak with me directly and in person if you have questions about this matter.

At the end of the term, the total amount of points you have earned will be divided by the total amount of points possible (100 points for written HW/in-class quizzes, 50 for WebAssign homework, 200 for midterms exams, and 150 for the final exam = 500 total points), and that percentage will automatically translate into your final course letter grade (on the standard 10 point scale): 450 points guarantees an A, 400 points guarantees a B, 350 points guarantees a C, and 300 points guarantees a D.

What you can expect from me: I've spent this entire syllabus talking about what I expect from *you*. Let's change focus. Here is what you can expect from me: my overall goal, in addition to teaching you mathematics, is to teach you to be an independent learner and a critical thinker. I want you to learn and, more importantly, learn how to

Additional University Information:

MLSC (Mathematics Learning Success Center): The MLSC is located on the 5th floor of the library here on the OSU-Stillwater campus. This is a great resource -- tutors are available on a walk-in basis more than 50 hours per week during regular business hours (and even during select hours in the evenings and on weekends!). For more information (such as specific hours of operation), visit <http://math.okstate.edu/mlsc>.

Syllabus Attachment: OSU has compiled useful information that applies to all classes. This website includes add/drop/withdrawal dates, university holidays, accommodations for students with disabilities, academic resources, and much more. You are responsible for reading this information. Download by visiting <https://goo.gl/0aQUnk>.

Incomplete Grade: The grade of "I" is given to students who satisfactorily completed the majority of the course work and whose work averages "D" or better, but who have been unavoidably prevented from completing the remaining work of the course. A condition that the students must repeat the course in order to remove the "I" is not permitted. The maximum time allowed for a student to remove an "I" is one calendar year.

Academic Integrity: The University has explicit rules governing academic integrity. Please consult the OSU Syllabus Attachment mentioned above. Working with another person or in study groups on problems can be helpful. However, *all work submitted must be your own*. Academic dishonesty (cheating) undermines the effort set forth by every other student at this university who works hard to submit their own assignments. All suspected cases will be dealt with according to university policy. Don't do it!

Special Accommodations for Students: If you think you have a qualified disability and need special accommodations, you should notify the instructor and request verification of eligibility for accommodations from the Office of Student Disability Services.

As instructor, I reserve the right to make changes to this syllabus in order to accommodate the needs of the class. Any such changes will be announced in class.