Math 319 Mathematical Modeling: 2023 Fall Syllabus

Prof. Andrew Ross (he/him), Eastern Michigan University

## **Basic Information**

Note: this syllabus is temporary, and may change up to the first day of class.

This version posted on: 2023-08-25

### **Something You Would Hope Wouldn't Need To Be Said, But It Does**

I stand against white supremacy and racism in all forms in my career, as part of my profession, and in my everyday life. I can supply you a lot of reading about white supremacy and racism in math--please ask! In the meantime, here are a few links or thoughts:

* [A Pathway to Equitable Math Instruction Dismantling Racism in Mathematics Instruction](https://equitablemath.org/wp-content/uploads/sites/2/2020/11/1_STRIDE1.pdf) (not that I am perfect at it. Please tell me ways that I can improve, if you have time and energy)
* the [Online Undergraduate Resource Fair for the Advancement in Academia of Marginalized Mathematicians](https://sites.google.com/view/ourfa2m2). You're a part of OURFAÂ²MÂ² now!
* [Hidden Norms webinars : Navigating Obstructive Rules in the Mathematical Sciences](https://www.hiddennorms.com/)

### **A Sense of Belonging**

I hope that everyone knows that they belong in this class, and that our class atmosphere contributes to that sense of belonging. You belong in this class even if nobody else (or only a few people) look like you--that's the fault of racist/sexist/ableist systems, not your fault. You belong in this class even if you feel like your math skills aren't where you want them to be--we'll work together on that.

### **Parenting**

Parenting is hard work, and doubly so when combined with being a student. I recognize that there may occasionally be times when the way to make it possible is to have your child accompany you to class (or be on a video call), whether that is because it's how your new baby gets fed, or because your older child's school doesn't meet that day, or whatever. Know that they are welcome! I trust your judgment on what your child can be present for, and that you will provide supervision/quiet activities for them during class. I honor the hard work that you are doing. EMU has a group for students who are parents–try looking into that? There’s also [an on-campus preschool](https://www.emich.edu/human-resources/benefits-wellness/family/index.php). Also, here is a [list of lactation rooms on campus](https://www.emich.edu/human-resources/benefits-wellness/family/index.php) (sadly, none in Pray-Harrold, where our in-person class is).

I also appreciate the issues involved in taking care of friends and relatives (such as elders).

### **General Description**

Math Modeling is the art of taking a real-world problem and stating it in mathematical terms. It often involves making simplifying assumptions. In our class, we get in the habit of doing all the parts of the math modeling cycle: modeling, solving, checking, and guessing. Often, a large part of the problem is even deciding which problem to solve. For example, should you find the best schedule for your staff at one location, or consider opening new locations? Should you start with a theoretical model then match it to data, or just model the data directly? We will also consider a lot of common mathematical models, and explore their properties.

The course is aimed as an introduction to the use of mathematics at the level of calculus in solving real-world problems. The emphasis will be on problems that are significantly different from the typical textbook examples in beginning calculus courses. A major focus of the course is to learn to recognize the assumptions that are made in developing a model and how to modify the assumptions to refine the model. Writing reports of models is an important part of the course. Modeling problems such as those used in the competitions sponsored by COMAP are suggested as an example of the type of problem that the student should be able to tackle, at least in a group setting, by the end of the course.

### **Course Catalog Entry**

The modeling process; model building and evaluation, techniques of modeling; model fitting and models requiring optimization; empirical model construction, single and multivariable dynamic models. Issues of mathematical modeling in social contexts (both general and education-related).

This course also develops secondary (grades 6-12) preservice mathematics teachers' mathematical modeling knowledge for teaching.

### **Prerequisites**

Officially, Math 120 or placement (formerly also required Math 122), but really we don't use it very heavily at all.

Some experience using Excel, Python, R, VBA, Mathematica, Maple, or Matlab will also be VERY helpful, but it is not strictly a prerequisite.

Follow-up courses: Math 325 Differential Equations, Math 418 Modeling with Linear Algebra, Math 419W Introduction to Stochastic Mathematical Modeling, Math 425 Math for Scientists, Math 436 Numerical Analysis

The U of M has two related courses: Math 462, "Mathematical Modeling", and Math 463, "Mathematical Modeling in Biology". However, these focus on differential equation models, while this class focuses on regression, operations research, and dynamical systems.

### **Class Meetings**

Math 319 Section 0, CRN 10270 , Mon/Wed 12:30-1:45 in Pray-Harrold 402

3 credit hours.

[Bonus Excel stuff is in this Youtube playlist](https://www.youtube.com/playlist?list=PLaiuJs8RVmOZhFCyjQuK05JpTPuRbliz_)

Class meetings will be mostly groupwork and interactive mini-lectures, with some time to work on problems in class, and some time to discuss problems from the homework. You should bring a laptop to most class sessions, since I couldn't get a computer lab for us. If you don't have a laptop, buddy up with someone who does.

I expect that you will work on Math 319 for 6 to 9 hours per week outside of class during a regular (Fall or Winter) semester, and 2 times that during a Summer semester (7.5-week session)

### **Instructor information**

Professor Andrew Ross

Pray-Harrold 515L

andrew.ross@emich.edu

<http://emunix.emich.edu/~aross15>

(734) 487-1658, but I strongly prefer e-mail instead of phone contact.

Math department main office: Pray-Harrold 515, (734) 487-1444

## Office Hours/Student Hours/Drop-In Hours and other help

“Office Hours” means time that instructors have set aside specifically to meet with students. In some sense they should be called “student hours” or “visiting hours”. I say this because some people might have thought or heard that “office hours” mean “do not disturb me in my office” which is actually the opposite of what it means.

What can we do in office hours? Things like:

· Ask questions about homework or quiz prep or projects. Depending on the situation, an instructor will usually help you walk through some very similar problems.

· Talk about the big picture of the class

· Get feedback on your learning

· Talk about what other classes to take, or the discipline (any discipline!) as a whole.

· Talk about advising, like whether adding a math or stat minor or double major might help your career prospects

· Talk about career thoughts and/or graduate school

· Talk about research interests and potentially doing a research project together, or finding a research advisor suited to you. Research means more than looking up information—think of it more like doing a science experiment or engineering design/build project. Graduate schools and employers want to see that you’ve done these things since they are more realistic than classroom exercises.

A student once said “I think office hours is for students who are struggling with the material and need extra help. I wouldn’t want my professor to know I’m struggling, even if I was.” While it’s true that struggling and needing extra help is a good reason to go to office hours (and/or email for help), it’s also good to drop by office hours even if you aren’t struggling, just to get to know the instructor and let them get to know you. It can help them adapt the course to your interests, and sometimes they can make connections with other faculty. Also, most instructors want to know if you’re struggling! Sometimes it’s not obvious, and we want to be able to streamline your learning experience as much as we can. Keep in mind that struggling isn’t a sign that you don’t belong here—college classes are hard for various reasons, and struggle is natural.

Someone else once said “I was the first person I knew, besides K12 teachers, who went to college. I had no guidance about stuff like this. There were many times when I'm sure a short office hour visit could have cleared up things I didn't understand, but I never felt like I had the right to go there.” Everyone belongs at office hours! And don’t worry about taking time away from other students—office hours usually aren’t busy anyway, and even if they are, instructors are usually skilled in balancing between different students.

If you’re worried about how to start a conversation in office hours, try:

· A question about a recent assignment

· A phrase or a line from a lecture or video that caught your attention

· A story about yourself that is perhaps relevant to the class or major or minor.

To read more about office hours, see <https://teaching.berkeley.edu/news/dont-be-alone-during-office-hours-0>

For online classes, or if it works better for you even for in-person classes, please make appointments with me using my [Google Calendar Appointment Page](https://calendar.google.com/calendar/u/0/selfsched?sstoken=UUZldW1CMzZVZ05BfGRlZmF1bHR8NDk2ZDRhMzIwYjlmNjFhNmMxZDIwOGViOWE0NTcyN2Q). You can reserve as many 10-minute appointments in a row as you need. If you can’t find an appointment time that works for you, *please email me with your availability for the next few days and we will find a time that works.*

In Fall 2023, my in-person drop-in office hours are:

MW: 3:00-4:00pm

TR: 1:00-1:45pm and 3:00-4:00pm .

You are welcome to drop by whether you are in an in-person class or an online class. I can also make appointments for in-person chats on other days of the week or times.

The Mathematics Student Services Center (or "Math Lab") is also here to help you, in Pray-Harrold 411, though in Summer 2023 they are only operating online. Their hours are posted [here](https://www.emich.edu/math/tutoring/). Please give them a call at 734-487-0983 or just drop by in Fall or Winter.

If you’re on campus, a good place to study, if the Math Lab doesn't suit you, is the Math Den, Pray-Harrold room 501.

Many assignments in this course will be in the form of papers, which I want to be well written. Please consult with [The Writing Center](http://www.emich.edu/english/writing-center/) for help in tuning up your writing.

### **Teaching philosophy, interests**

I am a very applied mathematician. Applied, applied, applied. Not pure. Impure. I try to focus on real-world problems, rather than artificial drill problems (though I do recognize the need for some drill). My classes spend much more time on formulating problems (going from the real world to math notation and back) than on proving theorems. If you want the theoretical basis for anything we are discussing, please ask!

My general math interests are in Industrial Engineering and Operations Research (IEOR). In particular, I do research in applied probability and queueing theory, the mathematics of predicting how long it takes to wait in line for service. You can learn more about this in Math 319 and 419 when I teach them. I also enjoy teaching about cost-minimizing/profit-maximizing methods called Non-Linear Programming (NLP) in Math 560.

### **(not-absolutely-)Required materials**

Most students do well in this course without a textbook. For those who feel the need to have one just in case, I suggest finding "A First Course in Mathematical Modeling", any edition, by Giordano, Weir, and Fox, in a library or the Math Den (PH 501).

A lot of our work will be done on computers, specifically in Excel or other spreadsheet software (except Apple Numbers). If you had been waiting for a good reason to buy a laptop, this is it.

Spreadsheets other than Excel (such as OpenOffice/LibreOffice, Google Docs, etc.) work reasonably well for most things in the class, but some things really don't work well without name-brand Excel. Fortunately, it's available free to EMU students (as of Fall 2016). Email me to ask for details.

#### **Course Web Pages**

I will post data files, homework assignment files, etc. on [my home page.](http://emunix.emich.edu/~aross15/)

We will use an on-line gradebook (via [EMU Canvas](http://canvas.emich.edu/)) to keep track of grades. It is a good idea to keep an eye on your scores using the system, and get extra help if your scores indicate the need. Nearly everything will be submitted via the various dropboxes inside EMU Canvas. The rule is: if it's not in a dropbox, it doesn't exist (for grading purposes).

#### **Supplementary Materials**

Here is a list of books that I have found interesting and related to math modeling. Perhaps some of them will strike your fancy, too. I own the ones that are starred (\*) and can lend them to you. Others you will have to find at the library or on the usual Internet booksellers. Links are given to Amazon, but I do not specifically endorse them or any particular bookseller. Of course, if you like a book you can see what similar books the online bookseller recommends.

* [Mathematical Modeling: A Comprehensive Introduction](http://www.math.colostate.edu/~collins/Modeling/331book.pdf), Gerhard Dangelmayr and Michael Kirby, a free e-text!
* [Optimization Modeling with Spreadsheets, Second Edition](http://portal.emich.edu/vwebv/holdingsInfo?bibId=1099790) by Kenneth R. Baker, 2011 (EMU library has electronic access)
* [An Introduction to Linear Programming](http://web.williams.edu/Mathematics/sjmiller/public_html/416/currentnotes/LinearProgramming.pdf), Stephen J. Miller, 2007 (free on the web)
* [An Introduction to Statistical Learning, with Applications in R by James, Witten, Hastie and Tibshirani (Springer, 2013) (free on the web)](http://www-bcf.usc.edu/~gareth/ISL/)
* [Practical Optimization](http://www.sce.carleton.ca/faculty/chinneck/po/) by John Chinneck (free on the web)
* [Decision Modeling Version 3.4.0, compiled on August 14, 2023](https://linney.mun.ca/pages/view.php?ref=36808) by David M. Tulett
* [Invitation to Dynamical Systems](http://www.ams.jhu.edu/~ers/invite/book.pdf), Edward R. Scheinerman (free on the web)
* Elementary Mathematical Modeling: A Dynamic Approach/ Sandefur, James
* \*[Towing Icebergs, Falling Dominoes, and Other Adventures in Applied Mathematics](http://www.amazon.com/exec/obidos/ASIN/0691102856) by Robert B. Banks, and its sequel:
* \*[Slicing Pizzas, Racing Turtles, and Further Adventures in Applied Mathematics](http://www.amazon.com/exec/obidos/ASIN/0691102848) by Robert B. Banks
* [Race car vehicle dynamics](http://www.amazon.com/exec/obidos/ASIN/1560915269) by William F. Milliken, Douglas L. Milliken
* [Going Faster: Mastering the Art of Race Driving](http://www.amazon.com/exec/obidos/ASIN/0837602262) by Carl Lopez
* [Logistics Systems Analysis](http://www.amazon.com/exec/obidos/ASIN/3540655336) by Carlos Daganzo
* [The nature of mathematical modeling](http://www.amazon.com/exec/obidos/ASIN/0521570956) by Neil Gershenfeld
* [Mathematical and Experimental Modeling of Physical and Biological Processes](http://www.amazon.com/exec/obidos/ASIN/) by Banks and Tran
* \*[Small is Profitable](http://www.amazon.com/exec/obidos/ASIN/) by Amory B. Lovins, et al.
* [Statistical Orbit Determination](http://www.amazon.com/exec/obidos/ASIN/) by Tapley and Schultz
* [Street-Fighting Mathematics](http://mitpress.mit.edu/books/full_pdfs/Street-Fighting_Mathematics.pdf) (free online book!)
* [Applied Mathematical Programming by Bradley, Hax, and Magnanti (Addison-Wesley, 1977)](http://web.mit.edu/15.053/www/) (free online book! A bit old, though).
* [Beasley's O.R. Notes](http://people.brunel.ac.uk/~mastjjb/jeb/or/contents.html) (free!)
* Quantitative Methods in Health Care Management: Techniques and Applications, by Yasar A. Ozcan (EMU library)
* Patient Flow: Reducing Delay in Healthcare Delivery, edited by Randolph W. Hall (EMU Library, incl. electronic copy)
* \*[Queueing Methods: for Services and Manufacturing](http://www.amazon.com/Queueing-Methods-For-Services-Manufacturing/dp/0137447566) by Randolph W. Hall
* Mathematical Modeling for the Life Sciences, by Jacques Istas
* [Turning Numbers into Knowledge: Mastering the Art of Problem Solving](http://www.numbersintoknowledge.com/) by Jonathan G. Koomey (EMU library, incl. electronic copy)
* \*[The Active Modeler: Mathematical Modeling with Microsoft Excel](https://emunix.emich.edu/~aross15/math319/math319_syllabus202109.htm) by Erich Neuwirth
* \* [Mathematical Modeling With Excel](http://www.amazon.com/Mathematical-Modeling-Excel-International-Mathematics/dp/076376566X/ref=pd_sim_b_3) by Brian Albright
* Dynamic Modeling and Control of Engineering Systems, 3rd edition, Kulakowski, Gardner, and Shearer
* [Guerilla data analysis using Microsoft Excel](http://www.mrexcel.com/store/index.php?l=product_detail&p=3)
* \*[Modeling for Insight: A Master Class for Business Analysts](http://www.amazon.com/Modeling-Insight-Master-Business-Analysts/dp/0470175559) by Powell and Batt
* [Management Science: The Art of Modeling with Spreadsheets](http://www.amazon.com/Management-Science-The-Modeling-Spreadsheets/dp/0470530677/ref=pd_sim_b_1) by Powell and Baker
* http://www.cscs.umich.edu/complexadaptivesystems/
* Methods of Operations Research (1951) by Morse and Kimball--especially for military applications
* Military operations research (1997) By N. K. Jaiswal
* Applied operations research (1988) By Ronald William Shephard--especially for military applications
* [Mathematics and Sports](http://www.maa.org/pubs/mathematics_and_sports.html) edited by Joseph A. Gallian
* Excel for scientists and engineers : numerical methods / E. Joseph Billo.
* Guerilla data analysis using Microsoft Excel / Jelen, Bill  
   Nonlinear regression:
* Handbook of nonlinear regression models / David A. Ratkowsky
* Nonlinear regression modeling : a unified practical approach / David A. Ratkowsky.
* Nonlinear regression / G.A.F. Seber and C.J. Wild.
* Applied logistic regression By David W. Hosmer, Stanley Lemeshow

Here are some journals that you might be interested in:

* [Interfaces](http://interfaces.journal.informs.org/)
* Mathematical and Computer Modelling
* [Journal of Quantitative Analysis in Sports](http://www.bepress.com/jqas/)
* [Journal on Spreadsheets in Education](http://epublications.bond.edu.au/ejsie/)
* INFORMS Transactions on Education

Other Stuff:

* Microsoft Excel, or other spreadsheet software like Gnumeric or OpenOffice or Google Docs
* Python or R is used for only a few people's projects--most people don't use them.
* Mathematica, Maple, or Matlab/Octave/Scilab are even more rarely used in this class.

## **Course Content**

### **Course Goals**

Our primary goal is to teach you to be a good (or great!) math modeler. To be a good modeler, you need:

* Good habits and procedures, just like a scientist, and
* Knowledge of common math models.

We have a few secondary goals, which may be more or less applicable to your personal situation:

* Get enough people together to form a few teams for the [Math Contest in Modeling (MCM)](http://www.comap.com/undergraduate/contests/mcm/), usually in February. Also see [these resources](https://www.comap.com/undergraduate/contests/resources/index.html) for the MCM. I participated in this 3 times as an undergrad and had a lot of fun. Recent EMU teams have done well!
* Give future teachers some great ideas to show your kids how high-power math is used in the real world. You may enjoy reading [Meaningful Math](http://www.meaningfulmath.org/).
* Give computer-science students lots of interesting things to program. You may like reading this blog entry about [math for programmers](http://steve-yegge.blogspot.com/2006/03/math-for-programmers.html).
* Teach you how to communicate your math models by writing math papers and giving math presentations.

### **Student Outcomes**

At the end of this course, students will be able to:

1. Recognize the assumptions and decisions that are made in developing a model, how to modify them to refine the model, and how to evaluate models.
2. Construct and evaluate optimization models.
3. Construct and evaluate dynamical system models.
4. Construct and evaluate empirical models using multiple regression and nonlinear regression.
5. Learn about people’s (students, professionals, or other stakeholders) understanding of math modeling using their explanations, justifications, and representations.
6. Generating questions and discussion that promote people’s (students, professionals, or other stakeholders) exploring conjectures and reasoning
7. Analytically examine and assess situations and mathematical models to inform action or change, especially in social contexts, and promote critical mathematical and statistical literacy in their future students, colleagues, or other stakeholders.

Here is a more detailed list:

* (General modeling skills):
  + categorize problems into operational/tactical/strategic categories,
  + identify nearby problems in the oper./tact./strat. hierarchy,
  + evaluate models by constructing simple test cases,
  + conduct cross-validation when needed,
  + select the most important variables to start modeling with,
* (Empirical modeling skills):
  + use ordinary, semilog, and loglog plots to evaluate relationships in data sets,
  + perform linear regression in software,
  + interpret the correlation coefficient,
  + perform transformations before regression as appropriate,
  + perform multiple variable linear regression in software,
  + fit sine/cosine functions to data using multiple linear regression (simplified Fourier),
  + fit a function to data using nonlinear regression,
  + decide when to use logistic regression (logit), and interpret the results
* (Communication skills):
  + write a technical report,
  + differentiate between literature of varying quality, e.g. peer-reviewed vs. working paper vs. white paper vs. web site,
  + design appropriate figures to communicate models and results,
* (Optimization skills):
  + Formulate non-linear programs (NLP) as appropriate,
  + solve NLP using software,
  + describe the (im)possibility of multiple optimal solutions (convexity/concavity)
  + formulate linear programs (LP) as appropriate,
  + solve LP using software,
  + describe the nature of LP solutions,
  + identify common LP models: network flow, diet/blending, inventory, assignment, (minimax ?)
  + formulate Integer programs (IP) as appropriate,
  + identify common IP models: knapsack, scheduling, (fixed charge ?)
* (Dynamical Systems skills):
  + use Dynamical Systems to model:
    - single-variable, incl. financial models (credit cards, mortgages),
    - single-variable limited population growth/ carrying capacity
    - two-population: predator/prey, competition, cooperation
    - age-structured populations (Leslie models)
    - Markov-chain models
  + Fit model parameters to data,
  + Describe equilibrium behavior,
  + Implement and interpret x=time plots, phase-plane plots, and delta-a\_n versus a\_n plots
* (Other models):
  + (?) describe basic Queueing models,
  + describe the Traveling Salesperson problem (TSP)
  + (?) describe project-scheduling models (PERT)
  + (?) describe dynamic-programming models (DP)

(optional topics that we might not get to are marked with a ?) Also compare this list of outcomes to the [CUPM 2015 course guide for math modeling.](http://www2.kenyon.edu/Depts/Math/schumacherc/public_html/Professional/CUPM/2015Guide/Course%20Groups/MathematicalModeling.pdf)

This course was originally organized around the Giordano modeling textbook, though it is not required for the course. Here we show which chapters from that book we cover, in roughly the order we will cover them. A star (\*) denotes full coverage, a plus (+) denotes partial coverage, and no symbol denotes no coverage. For example, DTMCs (as cool as they are) will be covered in Math 419 rather than 319.

Ch 2:+ proportionality, similarity

Ch 3:\* model fitting, least-squares

Ch 4:+ experimental modeling, high-order polynom, low-order polynom, splines

Ch 5:+ simulation

Ch 6: Discrete Time Markov Chains (DTMCs)

Ch 8:+ modeling using graph theory

Ch 7:+ Linear Programming (LP), one-dim. line search

(and add Integer Programming?)

Ch 13:\* Non-Linear Programming (NLP), inventory

Ch 9:+ dimensional analysis and similitude

Ch 10: graphs of functions as models

Ch 1:\* difference equations, dynamical systems

Ch 11:+ one-dim ODEs

Ch 12:+ systems of ODEs

Some variations in this outline are to be expected.

### **Grading Policies**

#### **Attendance**

Regular attendance is strongly recommended. Since there is no formal textbook, missing class means you will miss a lot! If you must miss a class, arrange to get a copy of the notes from someone, and arrange for someone to ask your questions for you.

My lectures and discussions mostly use the document camera, along with demonstrations in Excel and other mathematical software. I do not usually have PowerPoint-like presentations, and thus cannot hand out copies of slides.

#### **Homework**

Homework will be assigned about once per class meeting, though some assignments are short. It will sometimes be a small problem set designed to help you understand the behavior of math models. Other times, it will involve writing up a little paper on an assigned topic. All homework should be typed unless noted.

Homework papers should be submitted on-line, where they might be checked by TurnItIn or a similar service. This is partly to help keep you honest, and partly to help you learn acceptable ways to cite the work of others. A side benefit is that sometimes TurnItIn finds papers relevant to your work that you would not have found otherwise!

#### **Exams**

There will be no exams, unless the class demonstrates an unwillingness to be motivated any other way.

#### **Projects**

Instead of a mid-term and a final exam, you will do a mid-term and a final project. Your results will be reported in a paper and a presentation to the class. You may work by yourself or in a team of 2 people, but no groups larger than 2 will be allowed. You may switch project partners at your will. Your project grades will each be split something like this:

* 10 pct: proposal
* 80 pct: work and written report
* 10 pct: presentation

The final presentations will be made during the time slot reserved for the final exam.

On average, students should spend a total of about 30 minutes in office hours discussing the project. Plan for this in advance!

#### **Overall Grades**

No scores will be dropped, unless a valid excuse with evidence (as needed) is given. In the unfortunate event of a medical need, the appropriate grade or grades might be dropped entirely, rather than giving a make-up, at the instructor's discretion. You are highly encouraged to still complete the relevant assignments and consult with me during office hours to ensure you know the material.

Your final score will be computed as follows:

* 50 percent for all the homework together,
* 20 percent for the mid-term project, and
* 30 percent for the final project.

Final percentage scores will be given letter grades as follows:

* 92.0 and above : A
* 88.0 to 92.0: A-
* 84.0 to 88.0: B+
* 80.0 to 84.0: B
* 76.0 to 80.0: B-
* 72.0 to 76.0: C+, etc.

### **Mini Schedule**

There will be homework after pretty much every class session. Target due dates will be announced as we go along.

Here is the schedule for items related to the two big projects:

Oct 30: Proposal 1 due

Nov 13: Project 1 Report due; Project 1 Presentation due

Nov 29: Proposal 2 due

Dec 11: Project 2 Report due; Project 2 Presentation due

### **General Caveat**

The instructor reserves the right to make changes to this syllabus throughout the semester. Notification will be given in class or by e-mail or both. If you miss class, it is your responsibility to find out about syllabus and schedule changes, especially the due dates and times of projects, assignments, or presentations.

### **Advice from Other Math Modeling Students**

In the last two semesters, I've asked my math modeling students to give advice to you, future math modeling students, based on their experiences in my course. Here are some of the highlights:

* \* work in groups \* start the first day assignment is given \* don't take too many credits w/ this class \* ask a lot of questions \* utilize Dr. Ross
* Do go to his office hours more than you normally would; if you have a question ask don't wait.
* See Prof. Ross in office hours and don't be afraid to email him. He is usually very helpful and approachable.
* Plan on visiting Prof. Ross during office hours in order to do well in the class. You will learn a lot in the end, but be ready to work.
* [prof ross:] add a note to the syllabus stating something to the effect of, "This class will not be like other math classes. Instead of straight-up problems or proofs, the biggest amount of work will be setting up the models, exercises, etc. and in analysing what your results mean. It will not be the mathematical work done to obtain the results that is the tricky part." But word the note better.
* attend the office hours Prof Ross is really good at explaining & helping out with the homework
* WORK TOGETHER!
* Take notes during the computer lab days and send yourself the excel sheets.
* Go to class. The computer lab days help even if you know excel well.
* Go to class. Go to office hours and pick project that you're energized about and interested in even if they're harder. It will make this math class the best one you've ever taken.
* Don't drop the class! It sounds impossible in the beginning, but stick with it.
* Don't procrastinate.
* Take differential equations close to this class, it will make more sense!
* Start projects ASAP.
* Ask questions!!! The professor will guide you along the way like Yoda.
* Talking to anyone about your projects or the homework, be it Prof. Ross or other students, is a really, really good idea.
* Never be afraid to ask for help.
* If project falls through, have backups.

### **Land Acknowledgement**

The campus of Eastern Michigan University is located on the traditional territory (ceded in the 1807 Treaty of Detroit) of the Anishinaabeg, which refers collectively to the Ojibwe, Odawa, and Potawatomi (also known as the People of the Three Fires), and was also home to the Wendat/Wyandot people. This acknowledgement is included here to honor the elders and stewards of these heritages. Let’s consider [this](https://theconversation.com/land-acknowledgments-meant-to-honor-indigenous-people-too-often-do-the-opposite-erasing-american-indians-and-sanitizing-history-instead-163787) which concludes with “Land acknowledgments are not harmful, we believe, if they are done in a way that is respectful of the Indigenous nations who claim the land, accurately tell the story of how the land passed from Indigenous to non-Indigenous control, and chart a path forward for redressing the harm inflicted through the process of land dispossession. What many Indigenous persons want from a land acknowledgment is, first, a clear statement that the land needs to be restored to the Indigenous nation or nations that previously had sovereignty over the land. This is not unrealistic: There are many creative ways to take restorative measures and even to give land back, such as by returning U.S. national parks to the appropriate tribes. Following from this, land acknowledgments must reveal a sincere commitment to respecting and enhancing Indigenous sovereignty. If an acknowledgment is discomforting and triggers uncomfortable conversations versus self-congratulation, it is likely on the right track.”

### **University Writing Center**

The University Writing Center (115 Halle Library; 487-0694) offers one-to-one writing consulting for both undergraduate and graduate students. The UWC also has several college and program satellite locations across campus. The locations and hours for the other satellites can be found on the UWC web site: http://www.emich.edu/ccw/writing-center/contact.php Students seeking writing support at any UWC location should bring a draft of their writing (along with any relevant instructions or rubrics) to work on during the consultation.

## **Standard University Policies**

In addition to the articulated course specific policies and expectation, students are responsible for understanding all applicable university guidelines, policies, and procedures. The EMU Student Handbook is the primary resource provided to students to ensure that they have access to all university policies, support resources, and student's rights and responsibilities. Changes may be made to the EMU Student Handbook whenever necessary, and shall be effective immediately, and/or as of the date on which a policy is formally adopted, and/or the date specified in the amendment. Electing not to access the link provided below does not absolve a student of responsibility. For questions about any university policy, procedure, practice, or resource, please contact the Office of the Ombuds: 248 Student Center, 734.487.0074, emu\_ombuds@emich.edu, or visit the website at www.emich.edu/ombuds . [CLICK HERE to access the University Course Policies](http://www.emich.edu/studenthandbook/policies/academic.php#univ)

### **Food Pantry**

[Swoop's Pantry](https://www.emich.edu/swoopspantry/) (104 Pierce Hall, emich.edu/swoopspantry, 734 487 4173) offers food assistance to all EMU students who could benefit. Students are able to visit twice per month to receive perishable and non-perishable food items, personal hygiene items, baby items, and more. Students can visit our website for hours of operation and more information. If you are in a position to donate to Swoop's, I encourage you to do so!

### **Resources**

https://www.emich.edu/studenthandbook/campus-resources/index.php

### **EMU COVID Policies, etc.**

[www.emich.edu/emusafe](https://emunix.emich.edu/~aross15/math319/www.emich.edu/emusafe)

In addition to the articulated course specific policies and expectation, students are responsible for understanding all applicable university guidelines, policies, and procedures. The EMU Student Handbook is the primary resource provided to students to ensure that they have access to all university policies, support resources, and student's rights and responsibilities. Changes may be made to the EMU Student Handbook whenever necessary, and shall be effective immediately, and/or as of the date on which a policy is formally adopted, and/or the date specified in the amendment. Electing not to access the link provided below does not absolve a student of responsibility. For questions about any university policy, procedure, practice, or resources, please contact the Office of the Ombuds: 248 Student Center, 734.487.0074, emu\_ombuds@emich.edu, or visit the website at www.emich.edu/ombuds. [CLICK HERE to access the University Course Policies](http://www.emich.edu/studenthandbook/policies/academic.php#univ)

Refusals to comply with COVID mitigation requirements are a disruption of the classroom learning environment. This includes examples such as refusing to wear a face mask, maintain appropriate distancing, or otherwise comply with the University' COVID-19 policies. Steps that instructors may take in the event of a classroom disruption include:

Make reasonable efforts to resolve the classroom disruption within the classroom. This includes reminding the student that they must wear a face mask, class will not begin and instructors are not permitted to conduct a class session until they do so. Failure to comply with University policy will subject the student to disciplinary action.

If the behavior persists and the student does not comply with the policy, the instructor has the right to (and with masking violations SHOULD) discontinue the class session and immediately report the behavior to their department head/school director who will contact the Office of Wellness and Community Responsibility.

If the situation escalates and an instructor feels an immediate threat to themselves or others, they may contact DPS (911 or 734-487-1222) for support.

### **University Writing Center**

The University Writing Center Virtual (UWCV) offers writing support to all undergraduate and graduate students. In doing so, we value the diversity of our campus and honor all students and the languages they bring with them to the University.

### **Holman Success Center**

Provides Academic Support through a variety of virtual and in-person services

### **Disabilities Resource Center**

The DRC works collaboratively with students, faculty and staff to create an accessible, sustainable, and inclusive educational environment.

### **University Library**

Research support is available to all students, 24/7. This includes getting started with research, identifying sources to search, developing search strategies, evaluating resources, and more. See https://www.emich.edu/library/help/ask.php for all of the ways in which you can get help with research. Some University Library services have changed, and may continue to change, in response to the pandemic. Please check for current information at https://www.emich.edu/library/news/covid.php

### **Title IX regarding discrimination on the basis of sex**

Title IX of the Education Amendments of 1972 prohibits discrimination on the basis of sex under any education program or activity receiving federal financial aid. Sexual assault and sexual harassment is a form of sex discrimination prohibited by Title IX. What you need to know about Title IX

### **Student and Exchange Visitor Statement (SEVIS):**

The Student Exchange Visitor Information System (SEVIS) requires F and J students to report numerous items to the Office of International Students & Scholars (OISS)