

AGEC 516

Mathematical Tools for Agricultural and Applied Economics

MWF 10:30 am - 11:20 am, Rawls 1071

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Office Hours: TBD

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Course Description: This course covers introductory level mathematics for graduate students in Agricultural and Applied Economics. The goal is to provide students with a common set of mathematical tools to support graduate coursework in microeconomics, macroeconomics, linear programming and econometrics and to improve the ability to read, understand and communicate in the language of mathematics for economists. In line with the applied nature of graduate work in Agricultural and Applied Economics, this course will take a practical approach to learning the basic mathematic tools of economics rather than a rigorous treatment of abstract mathematics. Students will be provided with the necessary technical skills to progress through a Masters in Science degree in the field and be given opportunities to expand their mathematical intuition. We will cover the basics of **calculus, matrix algebra, optimization theory and statistics**. We will make use of practical problems seen in microeconomics and math questions from the textbooks below.

Credit Hours: 3

Text(s): No textbook is required for this course. That said, it is strongly advised to obtain access to one of the following texts for reference and additional practice:

- **Mathematics for economists**, Carl P. Simon and Lawrence Blume. W.W. Norton & Company, 1994. ISBN-13: 9780393957334.
- **Fundamental methods of mathematical economics (4th edition)**, Alpha C. Chiang and Kevin Wainwright. McGraw-Hill, 2005. ISBN-13: 9780070109100
- Additional material will be provided throughout the course. A number of great math camp notes for economists are available online, including Berkley ARE's math camp notes. Don't be afraid or embarrassed to use online resources such as Google, Wikipedia, Wolfram Alpha, MathIsFun or PurpleMathtake any resource you have available to you!

Course Objectives:

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

1. Understand and apply mathematical and statistical methods commonly used to build economic models;
2. Become familiar with mathematical notations and concepts in advanced economics courses or articles;

3. Be able to read, understand and write in the language of mathematics for economists at the graduate level.

Course Policies:

The goal of this class is to build a common mathematical toolkit for graduate-level applied economics coursework and research, not to punish you for gaps in your mathematical background or difficulty in grasping mathematical concepts. As such, approach this class as a practical skills workshop that will make your life easier as you progress through the graduate program. We will use classroom sessions to cover lecture materials, but also to work through practice problems, address issues in completed homeworks or exams, and work together to develop best practices. Ask questions, use office hours and work in groups to help lift each other up. We're all in this together! Some general rules for the course are given below:

- **General**

- Please do not use computers or phones in class unless it directly relates to work being done in class. It can be distracting to you and others.
- Quizzes and exams are closed book, closed notes.

- **Grades**

- Homework: 25%
- Two Midterms: 20% each
- Final: 30%
- Participation: 5%

- **Homework**

- Homeworks will be assigned weekly and must be turned in at the beginning of the class on the due date. Late submission without prior approval of the instructor will receive a 25% penalty. Papers turned in after corrected papers have been returned will be marked, but no credit will be given.
- Group-work is encouraged and expected. Having to explain problem solutions to your peers is one of the best ways to improve your own understanding. Since homework is a substantial portion of the grade, however, it is required that homeworks be completed and submitted individually.
- Throughout the semester, some homeworks may have group-components that will be graded as groups. These assignments will be clearly defined as such.

- **Midterms and Final**

- **Tentative** dates for the midterms are 9/18/2017 and 11/6/2017 during the regular class periods.
- The date, time and location of the final will be announced by the University.
- While exams are not strictly cumulative, often the skills learned in a previous section will be useful in later sections.
- A make-up exam will not be given unless there is a documented university approved absence.

- **Attendance and Absences**

- Attendance is expected. We will work through exercises and sample problems in class and discuss as a group ways for solving problems.
- Students are responsible for all missed work, regardless of the reason for absence.

Communication: My primary out of class method of communication will be email to your Purdue email address and through Blackboard. It is your responsibility to check your email and the Blackboard course page on a regular basis. I recommend using your Purdue email account at least every 24 hours.

Academic Honesty Policy Summary: Academic dishonesty of any sort is strictly prohibited. Purdue policies define dishonesty as cheating, plagiarism, knowingly furnishing false information to the university, lying, using substitutes for taking examinations, illegal cribs, copying during examinations, and/or knowingly aiding or abetting another party in committing a dishonest act (<https://www.purdue.edu/odos/osrr/academic-integrity-brochure/>). If you are unsure whether your actions would be considered cheating, please ask the instructor first. Anyone found to be cheating or helping someone else cheat will be referred directly to the Dean of Students for disciplinary action. Penalties are severe and may include dismissal from the University. The risks associated with cheating far outweigh the perceived benefits. The Purdue Honors Pledge is given, "As a boilemarker pursuing academic excellence, I pledge to be honest and true in all that I do. Accountable togetherwe are Purdue."

Special Needs: If you have a disability that requires academic adjustments, please make an appointment to meet with me during the first week of classes to discuss your needs. If you are uncomfortable meeting with me, please see Prof. Gerald Shively. Please note that the university policy requires all students with disabilities to be registered wit Adaptive Programs in the Office of the Dean of Students before classroom accommodations can be provided.

If you have any other concerns or needs, emotional or physical, not directly addressed by university policy concerning students with disabilities, don't hesitate to get in touch with me. On campus facilities are provided for mental and physical health (CAPS and PUSH, respectively).

Campus Emergencies: In the unusual event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances. To get information about changes in this course, contact me by email at wmccain@purdue.edu.

To report an emergency, call 911. To obtain updates regarding an ongoing emergency, since up for Purdue Alert text messages, view here are nearly 300 emergency telephones outdoors across campus and in parking garages that connect directly to the PUPD. If you feel threatened or need help, push the button and you will be connected immediately.

If we hear a fire alarm during class we will immediately suspend class, evacuate the building and proceed outdoors. Do not use the elevator. If we are notified during class of a "Shelter in Place" requirement for a tornado warning, we will suspend class and shelter in the basement. If we are notified during class of a "Shelter in Place" requirement for a hazardous materials release or a civil disturbance (including a shooting or other use of weapons), we will suspend class and shelter in the classroom, shutting the door and turning off the lights.

Please review the Emergency Preparedness website for additional information:

http://www.purdue.edu/ehps/emergency_preparedness/index.html.

Tentative Course Outline:

Section 1: Review

- Basic algebra
- Functions and graphs
- Economic applications of graphs and equations

Section 2: Calculus

- Limits and continuity
- Fundamentals of derivatives
- L'Hôpital's Rule
- Partial and total derivatives
- Implicit function theorem
- Integrals

Section 3: Matrix algebra

- Vectors and matrices
- Matrix operations
- Determinants and inverses
- System of equations and Cramer's rule
- Jacobians and Hessians
- Definiteness

Section 4: Optimization

- Lagrangian
- Extrema and inflection points
- Concavity and convexity
- Homogeneity and homotheticity
- Univariate and multivariate optimization
- Comparative statics and the Envelope theorem

Section 5: Probability and statistics

- Random variables and sample statistics
- Expectation/variance
- PMF, PDF and CDF