Math 108

Mathematical Problem Solving

Spring 2023 • Honors

MERCYHURST UNIVERSITY

Description

This course is intended to put the mathematical skills you already have to good use, and learn some new ones along the way. We'll see how mathematics can help us better understand the world around us. Most importantly, we'll understand how the strategies used to solve a specific problem can be expanded and used in a wide array of real life situations.

Objectives

On successful completion of the course, students will be able to:

- Interpret and formulate problems in the language of mathematics
- Display mastery of basic computational skills
- Solve problems using essential principles from geometry, algebra, probability, and statistics
- Demonstrate the use of mathematical reasoning by justifying and generalizing patterns and relationships
- Demonstrate the use of basic mathematical processes and algorithms.

Prerequisites

There are no prerequisites for this course. However, this section is only open to Mercyhurst Honors program students.

Office Hours

Drop in with any questions or just to chat during office hours - no appointment or notice required. If you need to meet with me outside those times, please email me to arrange a time. Zoom appointments on evenings and weekends are also possible with prior notice.

Section Information

MWF 1 - 1:50
Hirt 103
3 Credits

Instructor

Lauren Williams, PhD
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(814) 824-2226
Old Main 404

Office Hours

Monday 10 - 11
Monday 2 - 3
Tuesday 9 - 11
Wednesday 2 - 3
Friday 12 - 12:50
and by appointment

Homework

Assignments will be posted to Blackboard throughout the semester. You will have at least one week to complete each assignment. Assignment types and content will vary. Some will be traditional math problems, which will allow you to practice the methods we see in class. Others will be short responses to prompts on related material, which will give you the opportunity to express your opinions and thoughts on the application of mathematics principles in solving the world's problems. Detailed prompts will be provided for each assignment.

Extensions

If you will not be able to submit your work by the deadline, please let me know as soon as possible. You do not have to have an "official" reason for an extension, but you will need to let me know when you will be able to complete the work (up to one week from the original deadline). This is so I am able to extend the same extension to all students. Late work will otherwise be accepted up to two days after the deadline with a 10% penalty. Work will not be accepted after this period, so I am able to return graded work to other students.

Grading

Your course grade will be based entirely on homework - there are no in class exams in this course.

Mathematics Department Grading Scale

F	D	D+	C	C+	B	B+	A
0%	60%	67%	70%	77%	80%	87%	90%

Course Policies

- Attendance is not required, but highly encouraged. You do not need to notify me of an absence *unless* you be out for an extended time.
- Your work on homework assignments should be your own. You are encouraged to work together, but any writing assignments should reflect your own thoughts and ideas.
- Plagiarism, in any form, will not be tolerated and will result in a grade of 0 on the assignment. Be sure to include references for any quoted material.

University Policies and Information

ADA

Mercyhurst University values inclusion and is committed to the goal of providing equal opportunities for all. Mercyhurst abides by federal, state, and local laws in admissions, employment, academic programs, and all services provided. Mercyhurst University is committed to complying with its obligations under the Americans with Disabilities Act (ADA), Section 504 of the Rehabilitation Act and the Fair Housing Act to ensure that a person with a disability is granted reasonable accommodations, when such accommodations are necessary, to afford that person equal opportunity to obtain a Mercyhurst education and use university facilities. Please refer to the HUB

https://lakersmercyhurst.sharepoint.com/sites/StudentsHub

and select the Services tab, then ADA Accommodations from the dropdown for instructions to request an accommodation. You may also contact Susan Reddinger, ADA Coordinator, ADA@mercyhurst.edu, 814-824-2362, Egan Hall 200. For students with questions about Academic Support, please refer to the HUB

https://lakersmercyhurst.sharepoint.com/sites/StudentsHub

and select the Academic Resources tab, then Academic Support for more information.

Title IX Information

Mercyhurst is committed to providing an environment free from sex discrimination, including sexual harassment and sexual violence. Please refer to the HUB:

https://lakersmercyhurst.sharepoint.com/sites/StudentsHub

and select the Resources tab, then Title IX – Sexual Respect from the dropdown for more information. If you would like to file a sexual misconduct complaint, please contact Ann Miller, Title IX Coordinator and Compliance Officer, titleix@mercyhurst.edu, 814-824-2363. Please be aware that in compliance with Title IX, educators must report incidents of sexual assault/harassment, stalking, and domestic/dating violence. If you disclose any of these situations in class, in papers, or to me personally, I am required to report it to the Title IX Coordinator (or any of the Deputy Title IX Coordinators).

Course Evaluations

Near the end of the semester, you will be asked to complete an online course evaluation. The evaluation will be completed in class during the last two weeks of the semester using any laptop, tablet, or mobile device. The response tool allows you to note aspects of the course that helped you learn, as well as aspects that might be modified to help future students learn more effectively. You will receive an email letting you know when the evaluation window for our class is open. Please note that these course evaluations are anonymous and instructors do not see the results until after the grades for the course are submitted.

Course Outline

This course is designed to have a flexible schedule, rather than a list of lectures to be delivered on a particular day. This will give us the option to spend more time on a topic that seems interesting, and introduce new topics based on *your* input.

The course itself will be structured into six units, with 2-3 weeks of class time devoted to each.

Unit 1: Background Mathematics

Before we can solve the problems of the world, we'll need a few tools. This will be a review of some math skills you first met in high school or earlier, as well as an overview of some new topics we'll need throughout the course.

Unit 2: Infrastructure

So much of our daily life is depended on systems that we rarely think about. How should our roads and traffic lights be configured? How do we decide if we need to update utility services, like water and energy, and what do we base those changes on? Can we use mathematics to make delivery and transportation more efficient, saving both money and the environment?

Unit 3: Government

The United States, like many countries, allows its citizens to choose their representatives in government. But many people are dissatisfied with the way voting and elections are run. Is there a better alternative to the "first past the post" model we use for most elections? Can we use mathematics to detect issues like gerrymandering? Should we reconsider our methods of apportionment?

Unit 4: Economics

Money may not rule the world, but it's hard to deny the effect it has on all of us. We'll see how linear algebra can help us determine if an economy is balanced and healthy. We'll also look at an introduction to game theory, a field that combines mathematics and psychology to help companies decide how to stay competitive and profitable. Can mathematics really help us settle problems of "fairness" when it comes to limited resources?

Unit 5: Health and Ecology

All life - humans, fish, pandas, bacteria, trees, etc - must be balanced with its environment in order to be successful. We'll see how we can use mathematics to model a population, and decide if humans need to intervene. We'll also see how a centuries old math problem can help us predict and prevent the spread of disease.

Unit 6: Technology and Artificial Intelligence

What exactly is machine learning and artificial intelligence? Our lives today are very different than just a few decades ago thanks to rapid changes in technology, but are there any problems we should consider as we allow computers to make life changing decisions for us?