

MATH-211 Geometry and Measurement for Teaching (2 credits) Spring 2020

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Class Time/Place: **Section 102:** M, Tu, W, F: 12:40-1:40 in Swart Hall 5
Section 103: M, Tu, W, F: 1:50-2:50 in Swart Hall 5

Office Hours: My official office hours are: **M, Tu, W, F:** 9:30-10:30 in Swart 111
Thurs: 12:00-1:00 and 1:20-2:20 in Swart 111

At these times I will be sure to be in my office for you to stop in to talk, ask questions, and get help. However, when I am not teaching a class, I am usually in my office and available. Stop in, I'm happy to meet with you.

Catalog Description: Exploring, conjecturing, communicating and reasoning within the content domain of geometry. Foundational ideas of geometry including role of definitions, the idea of axioms, and the nature of mathematical objects. Measurement of length, area, volume and angle size. Prerequisite: Mathematics 110 with a grade of C or better.

Textbook: Beam et.al. *Big Ideas in Mathematics for Future Elementary Teachers: Big Ideas in Geometry and Data* (2019). This text is available through the University Bookstore.

Equipment/Supplies: In addition to the textbook, you will need a ruler, a compass, a protractor, scissors, and colored pencils or pens. Calculators will not typically be used in class. If we need a calculator for an in-class activity or on an exam, I will provide you with a simple calculator.

Upon successful completion of this course, students should be able to:

- Create and use a variety of problem-solving strategies. These include reasoning from diagrams and using geometric models to find generalities and constraints.
- Communicate the problem-solving process and the resulting mathematics both orally and in writing using the language of mathematicians.
- Describe the limitation of geometric representations and distinguish between these representations and the ideal objects they represent.
- Distinguish between an explanation of *how* to solve a problem and an argument that explains *why* it works.
- Use logic and structure (rather than authority) to determine when a solution is correct and complete.
- Craft arguments using fundamentals of logical reasoning.
- Distinguish among a statement, its converse, and its contrapositive and identify which are logically equivalent.
- Discuss mathematical activity using the language of doing mathematics (e.g. conjecture, counter example, theorem, proof).
- Refute claims by creating and using counter examples.
- Distinguish between and use both inductive and deductive reasoning.
- Listen, evaluate and respond effectively to the mathematical ideas of peers.
- Build connections among, and work with, a variety of representations.
- Analyze children's understanding of polygons and other mathematical objects.
- Explain axioms and key theorems from Euclidean geometry (including parallel line theorems, sum of polygons' interior angle measures, and the Pythagorean Theorem), and use them in making mathematical arguments.
- Identify and justify properties of, and relationships among, triangles, quadrilaterals, and other polygons.
- Explain the ideas, processes, and limitations associated with the process of measuring angle, length, area, surface area, and volume, including why units matter.
- Describe processes for unit conversion and scaling of one- and two- dimensional measures using models, the idea of units, and the multiplicative relationship.
- Explain why our standard formulas for perimeters, areas, and volumes make sense.
- Gain an appreciation for the beauty and importance of geometry.

Course Outline:

- **Unit 1: Fundamentals of Geometry** Definitions, Axioms, and Deductive Reasoning
- **Unit 2: 2-D Measurement:** Concept of Unit, Perimeter, Area, Pythagorean Theorem
- **Unit 3: 3-D Figures:** Polyhedra, Surface Area, and Volume

Course Philosophy and Approach: This course is designed to give you experience in thinking and communicating mathematically. This means that you will analyze problems, make conjectures, make arguments, learn to listen and evaluate the claims of others, and communicate your findings and ideas. In this course you will develop written and oral communication skills and explain mathematical ideas using appropriate language, notation, arguments and models.

In this course, I will expect you to not only know **how**, but also **why**. In class, in your homework, and on the exams, the focus will not be on just getting a correct answer, but on being able to justify that your answer is correct, being able to explain why your solution makes sense, and being able to understand and use a variety of techniques, models and ways to think about problems and their solutions. Another goal of this course is to learn how to make and understand **mathematical arguments** (proofs) for why something is true. Help your fellow classmates to improve the rigor of their reasoning by making them convince you!

It is my firm belief that **mistakes** are valuable learning experiences. It is expected that you will make mistakes in this class. I encourage you to share not only your successes with our class during discussion time, but also share your mistakes you made along the way. Often, we learn more from seeing an incorrect solution and analyzing it, than we learn from seeing correct solutions.

Format and Expectations: Class time will be spent in working on interesting and challenging problems in small groups and discussing problem solving ideas and solutions as a class. We will also spend time in class discussing assigned reading and homework problems. You will be expected to present solutions to problems, make conjectures and arguments, and participate in class discussions. This format will give you the opportunity to practice skills that you will need to be a teacher: listening and making sense of other people's mathematical ideas, explaining your ideas to others, and helping others understand mathematics.

You are expected to attend every class session. If you must miss a class session, I expect you to notify me in advance. If you are absent from class, you are responsible for the material covered. Arrange to copy another student's notes and be informed of any announcements made during class. It is very important that you are in class to participate in the problems and contribute to the class discussion. We need to hear your voice, since an important part of doing mathematics is evaluating and making sense of other people's mathematical ideas. Whether in small groups or in class discussions, I encourage you speak up and share your thoughts, reasoning, and questions with the class. You should fight hard to understand and to question everything that I, or a fellow student, offers. If you can't make sense of someone's argument, that probably means that they didn't explain it well enough, or their argument is incomplete or invalid. In any of these cases, we need you to speak up and ask your question so we have the opportunity as a class to refine the argument or see its flaw.

Homework: You are expected to read the text and work on problems outside of class on a regular basis. Expect to spend **8 to 12 hours** per week outside of class engaged in this course. Non-graded homework will be assigned at each class, usually a reading assignment and a set of problems from the text. Actually "doing" mathematics is the only way to understand mathematics. I urge you to work with others outside of class and discuss the homework problems with your classmates. If your group is having difficulty with the homework, I encourage you to come to me for help.

Grading: Your grade in this course will be based on:

- **Class Participation:** Class participation includes being prepared for class by doing the assigned reading and homework, actively contributing to small group discussions, asking and answering questions during small and large group discussions, and presenting solutions to the class. In order for you to earn full participation points, I expect you to actively participate in all of these areas. **Participation activities will account for 6% of your grade.**
- **Written Assignments:** We will have **five** written assignments that you turn in for a grade, typically a short paper describing a problem, how you solved it, and arguing that your solution is correct, or a set of several problems asking you to make mathematical arguments justifying conjectures or illustrating the mathematics concepts involved in their solution. You are encouraged to work together on these problems. Learn from each other, discuss the problems and concepts, and investigate proposed solutions with your classmates. However, you then must be able to write up the solutions on your own and in your own words. **Each graded assignment will be worth 6% of your grade.**
- **Exams:** There will be 2 exams given in class, scheduled for Friday 2/28 and Friday 3/20. Exam coverage will be announced in class prior to the exam. **Each exam will be worth 32% of your grade.**

The scale below shows the grade you will earn if you earn **at least** the given percentage of course points. Grades are based on performance, not need. No “extra” credit will be offered.

A	92%	B	82%	C	72%	D	62%
A–	89%	B–	79%	C–	69%	D–	59%
B+	86%	C+	76%	D+	66%	F	0%

Dropping the course: According to the Student Bulletin, the primary responsibility of dropping a class resides with the student. February 9th is the last day to drop with a full refund. Feb 28th is the last day to withdraw from the course. A student wanting to drop a course after that deadline may appeal with a REQUEST FOR LATE DROP FORM describing relevant extenuating circumstances beyond the student’s control.

Incompletes: According to the Student Bulletin, an Incomplete grade can be assigned only when a student is unable to complete the course work because of illness, injury, or other extenuating circumstances beyond the student’s control.

Academic Misconduct: Any form of academic misconduct including cheating on a quiz or exam, or in any way seeking to claim credit for the work or efforts of another person will be dealt with in accordance with system policy UWS 14, as referred to in the UW Oshkosh Student Discipline code. You are expected to behave with integrity and honor. The official UWO policy regarding academic misconduct can be found at <https://www.uwosh.edu/deanofstudents/university-policies-procedures/academic-misconduct>

Resources: There are many resources available to help you succeed in this course as well as thrive at UWO. If you are struggling with this course, please talk with me during office hours or make an appointment to meet outside of the scheduled times. Additionally, the following places are here to help you:

- **Center for Academic Resources:** The Center for Academic Resources (CAR) provides free tutoring for students in most undergraduate classes on campus. CAR is located in the Student Success Center, Suite 102. Check the Tutor List page on CAR’s website (www.uwosh.edu/car) for a list of tutors.
- **Writing Center:** The Writing Center provides helpful feedback on your writing assignments. You may schedule an appointment by visiting their website: <https://writingcenter.uwosh.edu/> drop-ins are also sometimes available.
- **Other Resources:** Please check out <http://www.uwosh.edu/resources/> for additional resources available to you.