

Professor: Dr. Chris Black
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Required *Course packet to be distributed by the professor.*
Text: See the NO TEXTBOOK RULE below.

Required Straight-edge and compass.
Materials: GeoGebra software, available free from <http://www.geogebra.org/download>.

COURSE GOALS:

The goal of this course is to prepare future middle school mathematics teachers to teach geometry as outlined by the Common Core State Standards. In order to do this, we need an understanding of the development of geometry from its roots in Ancient Greece to the present. Euclid is seen as the father of geometry, so we will begin our geometric explorations by studying his work in the *Elements*, and we will end by looking at geometry from a transformational perspective which is in line with the Common Core State Standards in mathematics. WE DO NOT HAVE A TEXTBOOK IN THIS COURSE – rather, we will work *collaboratively* to create our own body of work based on both historical and modern methods of geometry.

MATH 456 students will...

- demonstrate an understanding of the axiomatic structure of geometry, including definitions, axioms and theorems, and reason using the language and structure of geometry, both orally and in writing.
 - make conjectures based on inductive reasoning and justify and prove those conjectures using deductive reasoning based on the axiomatic structure of Euclidean geometry.
 - establish congruence and similarity criteria and use them to prove congruence and similarity of polygonal figures. Students will recognize and use proportional relationships within similar figures to solve problems.
 - investigate the connections between the traditional approach to geometry and a modern approach using transformational geometry. Students will perform reflection, rotation, translation, and dilation in the plane using traditional construction tools as well as using analytic formulas requiring the use of coordinate geometry.
 - use appropriate dynamical geometry software to investigate and represent concepts, methods, and applications of geometry.
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COURSE TOPICS:

- ▷ Euclidean results concerning congruence, similarity, area, & polygons
- ▷ Compass and straightedge constructions
- ▷ Analytic and synthetic approaches to geometry
- ▷ Transformations of the plane

COURSE PHILOSOPHY & METHODOLOGY:

This is not a traditional lecture course. Just as you cannot learn to play violin by watching a recital, you cannot learn to do mathematics by watching me do mathematics. In this course, you will learn mathematics through discussion, presentation, and critical analysis, using pedagogical methods often labeled as ‘Inquiry-Based Learning’ (IBL).

For the first part of the course, each class session (after the first) will begin with student presentations. Roughly half of class time will be devoted to analysis of student work at the board. After student presentations have concluded, we will spend the remainder of the class period working through exercises that introduce the concepts in the upcoming section of material.

I will lecture only rarely, so we all need to be aware of the expectations placed upon us in this non-traditional model of learning.

What is Inquiry-based learning (IBL)? Inquiry-based learning is a set of pedagogical techniques that place student contributions at the center of the classroom interactions. There are many different ways to implement inquiry-based learning in the classroom. A successful IBL classroom is one in which the students are actively responsible for their own learning, under the guidance and mentorship of an expert.

What are the guiding principles of IBL?

1. Every student can and will do significant mathematics.
2. Students should be elevated from recipients of mathematical knowledge to creators of mathematical knowledge.
3. The mathematics classroom should be a shared learning community in which the students are actively engaged in discussion and development of course material.
4. The course material should include a significant body of mathematical knowledge, at varying levels of difficulty.

What is the role of the professor in this IBL course? The professor will:

1. ... facilitate and encourage classroom discussion;
2. ... clarify points or questions raised by students during presentations;
3. ... not speak significantly more than other members of the class;
4. ... be available for outside help during office hours or via email.

What is the role of the student in this IBL course? Students are expected to:

1. ... honestly attempt to solve every problem assigned;
2. ... revisit problems for which no solution was obtained on the first try;
3. ... persevere and seek help when stuck on a solution;
4. ... participate actively in classroom discussions;
5. ... develop a critical eye when examining solutions of others;
6. ... ask questions when they arise, both of the professor and the other students;
7. ... be respectful both when critiquing the work of others and when having their own work critiqued;
8. ... have at least one problem ready to present each day of class.

NO TEXTBOOK RULE:

You are not allowed to use outside resources for this course. You are only allowed to talk to students currently enrolled in the course and to the professor. **All other resources, including texts and the internet, are strictly forbidden.** In this course, you are doing research at your level, just as professional mathematicians do research. The only difference is that you are doing research where the answers are already known to experts. Looking for answers to these questions circumvents the learning process and counts as academic dishonesty. Ask for help when you need it.

GRADING:

Daily Homework:	37.5%
GeoGebra Tasks:	12.5%
Take-Home Quizzes:	25%
Final presentation:	5%
Portfolio:	20%

HOMEWORK:

Your standing assignment is to write up solutions to the daily problems given in the packets. There will be roughly 6-8 of these per day of class. You are expected to be ready to present at least one solution each day of class. Ideally, you will have solutions to every problem before arriving in class. You will present one solution and submit that problem for grading.

You will receive feedback on your solution during the presentation, and can revise as needed and submit by the end of the following day.

GEOGEBRA TASKS:

You will use GeoGebra to perform 5 mathematical tasks relevant to teaching geometry. These activities are designed to teach you the different capabilities of GeoGebra for both instruction and creation of professional-looking mathematical documents such as handouts, quizzes, and tests. The five GeoGebra tasks are worth 12.5% of the course grade.

TAKE-HOME QUIZZES:

There are three take-home quizzes in the course, in which you will prove some geometric results. The three take-home quizzes are worth 37.5% of the course grade.

The policy for take-home quizzes is that the only allowed sources are the professor and the course notes. Use of the internet, any other written source, or any person other than the professor is considered plagiarism and will result in a score of 0 on the exam. It's the law: WAC 106-125-020.

FINAL PRESENTATION:

The Pythagorean theorem is the only theorem explicitly called out by name in the grade 8 Common Core State Standards. Each student will study different proof of the Pythagorean theorem as part of the final tasks for this course, submitting their written work and presenting the proof to the class. This final proof and presentation is worth 5% of the course grade.

COURSE PORTFOLIO:

The course portfolio, due during finals week, is worth 20% of the course grade. The portfolio is a well-organized and neatly-written 3-ring binder containing the course packet, the collective work of the class on the problems, and some written analysis of the material. As there is no text, this portfolio will be your primary record of this class. There are 2 “portfolio checks” during the term to make sure you are keeping up with the task of assembling the portfolio. You will receive an additional handout describing the requirements and grading criteria for the course portfolio.

ADAPTATIONS FOR WINTER 2023:

As we are STILL in the COVID-19 pandemic, the following policies are in effect:

- To the extent that it is possible, please stay in touch with me if COVID-19 affects your ability to do the work in this course.
 - If you must miss a class, you do not need to provide a reason. Let me know ASAP so we can work out a way to get you the information you need to proceed.
 - Our goal in this class is to create a collaborative body of work – if you are unable to present a proof during class (for any reason), please work with your peers to make sure that someone has got it covered. Geometry is cumulative and needs to be worked through in order; it doesn’t matter who presents the work as long as someone does.
 - Any assignment can be rescheduled as needed – just ask! When possible, ask before the day of the scheduled event, but due to the extraordinary circumstances we’re living under right now, all requests will be honored. Let me know what adjustments you need so I can make the necessary arrangements.
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COURSE EXPECTATIONS:

With all that is going on in the world, we are all doing the best we can. If you encounter challenges in this course, please contact me ASAP so we can seek a resolution together.

MENTAL AND EMOTIONAL HEALTH AND SUPPORT:

Stress and other life circumstances that may be out of your control can make learning and focusing difficult. If you find stress or other mental health concerns make academics difficult, Central has resources to support you. I encourage you to reach out as soon as you notice you’re struggling.

- Student Counseling Services: Crisis appointments are available. Call 509-963-1391
www.cwu.edu/medical-counseling/counseling-clinic
 - Mental health crisis support outside of normal business hours: Call 1-800-273-8255 or Text HOME to 741741
 - Wellness Center: Confidential sexual assault and other victim advocacy. Call 509-963-3213 or visit www.cwu.edu/wecare, www.cwu.edu/path
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DISABILITY SERVICES:

Central Washington University is committed to creating a learning environment that meets the needs of its diverse student body. Students with disabilities should contact Disability Services to discuss a range of options to removing barriers, including accommodations: Hogue Hall 126, 509.963.2214, DS@cwu.edu, www.cwu.edu/disability-services.

ACCOMMODATION FOR RELIGIOUS OBSERVANCES:

In compliance with RCW 28B.137.010, Central Washington University makes every effort to deal reasonably and fairly with students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. Students must present written notice to their instructor within the first two weeks of class listing the specific dates on which accommodations are required. Contact the Dean of Student Success at (509) 963-1515 for further information.

STATEMENT ON DIVERSITY:

CWU expects every member of the university community to contribute to an inclusive and respectful culture for all in its classrooms, work environments, and at campus events. As a student in this course, you are expected to treat your professors, fellow students, and other people affiliated with your work at CWU with respect, regardless of their sex, race and color, religion and creed, national origin, sexual orientation, gender identity and gender expression, disability and use of assistive devices or a service animal, and veteran or military status.

EXPECTATIONS FOR STUDENT CONDUCT:

Students in this class are expected to interact with students and the professor professionally. Instances of disruptive conduct, obstructive conduct, or harassment (see definitions below from the Washington Administrative Code) will be referred to the Dean of Student Success.

Per WAC 106-125-020, the term “disruptive” or “obstructive” conduct means conduct, not protected by law, that interferes with, impedes, or otherwise unreasonably hinders the normal teaching, learning, research, administrative, or other functions, procedures, services, programs, or activities of the university. The term includes disorderly conduct, breach of the peace, violation of local or university noise policies, lewd or obscene conduct, obstruction of pedestrian or vehicular traffic, tampering with student election processes, or interfering with the orderly conduct of university investigations or disciplinary proceedings, including interfering with or retaliating against any witness, party, or other participant.

The term “harassment” means unwelcome and offensive conduct, including verbal, nonverbal, or physical conduct, that is directed at a person because of such person’s protected status and that is sufficiently serious as to deny or limit the ability of a student to participate in or benefit from the university’s educational program, or that creates an intimidating, hostile, or offensive environment for any campus community member(s). Protected status includes a person’s actual or perceived race, color, national origin, gender, disability, or other status protected by law.

ACADEMIC HONESTY AND RESPECT:

Each of us should consider our placement at this institution to be a privilege. We need to have respect for one another, and for ourselves. In light of these facts, cheating in any form will not be tolerated. You are encouraged to work together on homework problems, however anything you turn in with your name on it should have been written by you alone. In a course where much of your grade is determined by your proof writing, plagiarism is a concern. The word “plagiarize” is defined by the New Oxford American Dictionary as “the practice of taking someone else’s work or ideas and passing them off as one’s own.” Plagiarism includes but is not limited to:

- Copying another student’s work and submitting it as your own
- Submitting a proof copied from the another text or from the internet
- Consulting **any** source other than your class notes, texts previously assigned by Dr. Black for other courses, or the professor on a take-home exam

Any incidence of plagiarism will not be tolerated.