

Instructor: Dr. Chris Black  
Office: Snoqualmie Hall #302B  
Office Hours: W 2:30 - 4:00, and by arrangement  
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Required Text: None

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Required Materials: TI-83+ graphing calculator.

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#### COURSE RATIONALE:

One of the essential principles for building understanding in mathematics is to make the subject problematic. Instruction should allow students to wonder why things are the way they are, to inquire, to search for solutions and to resolve incongruities. In a problem-based approach, students are expected to solve problems or make sense of mathematical situations for which no well-defined routines or procedures exist. In introductory activities, as well as in application settings, students are expected to explore problems, make conjectures, and draw generalizations about mathematical concepts and processes. Students can also make connections between mathematical ideas that are familiar to them by solving new problems in a variety of different settings. Although no one claims the existence of the one correct way to teach, using good problems to plan instruction with the focus on student thinking and reasoning is one strategy that holds promise.

The educational outcomes of a problematic approach to mathematics education are to:

- Build new mathematical knowledge through solving problems.
  - Solve problems that arise in mathematics and in other contexts.
  - Apply and adapt a variety of appropriate strategies to solve problems.
  - Monitor and reflect on the process of mathematical problem solving.
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#### GOALS FOR THIS COURSE:

- To assess the student's mathematical knowledge in mathematical content areas.
- To give student experiences with solving problems using many different strategies.
- To create learning activities where problems are posed to engage students in meaningful mathematics.
- To create assessment methods that give clear insight into students' understanding of mathematical concepts.

## OUTCOMES FOR THIS COURSE:

Math 499E students will be able to...

- ... solve problems in each of the content areas in the mathematics teaching program.
- ... solve problems that arise in mathematics and in other contexts.
- ... apply and adapt a variety of appropriate strategies to solve problems.
- ... monitor and reflect on the processes of mathematical problem solving, communication, reasoning, and making connections.
- ... reflect on the philosophical and pedagogical practices of teaching mathematics.

The goals and outcomes of this course align with both NCTM and CTL standards. Students will demonstrate their ability to meet the outcomes of this course through reading, reflecting, and writing about problems posed. Writing about mathematics helps the writer consolidate ideas because it requires the writer to reflect and clarify the thought process. Communication is part of NCTM's call for mathematical literacy, which asserts that communication plays an essential role in assessing and developing understanding. Communication can take the form of various oral and written endeavors, but the primary goal remains to enhance the writer's mathematical reasoning and ability to make connections between branches of mathematics and with other disciplines.

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## ASSESSMENT EXERCISES:

You will be asked to write sample exam problems that assess student knowledge in the areas of algebra and geometry, as described in the Washington State Grade Level Expectations (GLE's) for mathematics. For each of the two assignments, you need to create an exam question that addresses a specific mathematics standard, provide a solution appropriate for distribution to students, provide a grading rubric to describe the grading criteria for your exam question, and explain how your question relates to the standard. Each of the two assessment exercises is worth 25 points, and will become an artifact in your final portfolio.

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## TEACHING PAPERS:

You will be presented with two scenarios related to using a problematic approach to teaching mathematics. You will be asked to write a paper and accompanying lesson plan for each in which you reflect and react to curriculum issues involving mathematical problem solving, while demonstrating your ability to create and teach mathematical activities centered around problems. Papers deemed insufficient by either the author or the instructor may be rewritten two times if returned to the instructor each time within a week. Each of the two teaching papers is worth 25 points. Teaching papers must be typed and will become artifacts in your final portfolio.

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## FIELD EXPERIENCE:

You are expected to observe a 6-12 mathematics class on at least a biweekly basis. During your observations, you are to pay particular attention to the use of problem-solving in the classroom. Write a 2-4 page paper describing your experiences, giving specific examples, and emphasizing what you've learned about and observed in regards to problem solving. You may draw from prior experiences as well, from PreAutumn or prior classroom exposure as an observer or volunteer (but not as a student). Finish by describing at least three practical things you learned, and support them with examples from your field experience. This paper is worth 20 points, and your cumulative classroom attendance is worth 10 points.

## PROBLEM SOLVING PAPERS & EXERCISE SETS:

You will be presented with 9 problem solving assignments, in which we will focus on problem solving techniques while applying mathematical knowledge from previous courses. These problems will be done individually. Many of the problems will be representative questions from the targeted content area (listed below), however, part of the assignment is also to reflect on the main techniques of the content area and explain the methods of your solution. There may be times when you will need to find an external resource to review some mathematical content embedded in a problem. In addition to the problem solving papers, for each of the content areas you will be presented with exercise sets to be done individually.

Content areas for these assignments are:

- Number Sense
- Discrete Mathematics
- Calculus (2)
- Statistics & Probability
- Measurement
- Geometric Modeling
- Algebra & Abstract Processes (2)

Problem sets are worth 30 points each, and exercise sets are worth 10 points. Problem sets must be typed, and will become artifacts in your final portfolio.

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## ATTENDANCE/CITIZENSHIP:

Discussion, interaction, and group problem solving will all be important aspects of this course, which necessitate your attendance. Citizenship addresses your behavior and comportment with class members and the instructor. We each need to be respectful of other students, other cultures, and differing ideas within our learning community. Attendance & citizenship are worth 25 points.

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## PARTICIPATION:

Each student is expected to present solutions to exercises from the PRAXIS review materials to the class, in the role of a classroom teacher. I will allow you to volunteer for this activity, but if you do not volunteer, I will call on you to do so. Write-ups for these problems will go into your final portfolio. Participation is worth 25 points.

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## PORTFOLIO:

The final assessment for the course is a portfolio containing all assignments, worth 100 points. This portfolio will be done in LiveText. As the artifacts in the portfolio will have been separately assessed, the portfolio grade hinges on the quality of your reflection paragraphs. The portfolio is due on Friday, December 7th at **noon**. Completion of the portfolio is mandatory for passing the course.

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## FINAL PROBLEM:

During the last week of classes, each student will have 10 minutes to present a problem to the class. You will find a 'big problem' in any of the content areas, and prepare a handout for your classmates with the problem, a list of at least 5 questions to ask your students to lead them to the solution, and a clearly written solution. You will not have time to present the solution to the class, but you will need to introduce the problem and explain the mathematical tools necessary to solve it. The problem can be one you create yourself, or one that you find in a text or online. The problem, your solution, and your presentation are worth 30 points.

GRADING:

Assessment Exercises:	50 points
Teaching Papers:	50 points
Problem Solving Papers & Exercise Sets:	360 points
Field Experience:	30 points
Participation:	25 points
Attendance & Citizenship :	25 points
Portfolio:	100 points
Final Problem	30 points

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HONOR, RESPECT, AND ACADEMIC HONESTY:

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. Some of these problems are really challenging! You are encouraged to work together on them, however anything you turn in with your name on it should have been written by you alone. The word “plagiarize” is defined by Merriam-Webster as “to steal and pass off (the ideas or words of another) as one’s own: use (another’s production) without crediting the source.” This is a very serious offense.

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DISABILITY SERVICES:

Students with disabilities may arrange for academic adjustments by providing the instructor with a copy of the “Confirmation of Eligibility for Academic Adjustments” from the Disability Support Services Office as soon as possible. To obtain this form, contact the Disability Support Services Office at the main campus at [dssrecept@cwu.edu](mailto:dssrecept@cwu.edu) or (509) 963-2171.