

Math 164 Course Syllabus

Foundations of Arithmetic (5 credits)

Spring 2010

Instructor: Dr. Mark Oursland

Office: Room 107D Bouillion Hall

Office Hours: 9:00 – 10:00 AM or by appointment

Email: oursland@cwu.edu

Office Phone: 963-2100

Course Description: Mathematical problem solving, reasoning, communication, and connections will be the foundation of every activity. Specific content will include concepts and procedures of: (a) numeration, computations, and number theory for the number systems of whole, integer, and rational numbers; (b) functions and relationships; and (c) probability and statistics.

Course Rationale: To meet the expectations for mathematics education for elementary teachers a shift in content, instructional and assessment practices are crucial. The Curriculum and Evaluation Standards of School Mathematics (NCTM, 2000) outlines the specific changes needed in pre-service mathematics education. “Prospective teachers must be taught in a manner similar to how they are to teach--by exploring, conjecturing, communicating, reasoning, and so forth.” In addition, “all teachers need an understanding of both the historical development and current application of mathematics. Furthermore, they should be familiar with the power of technology.” This course is designed to address these changes in mathematics education and prepare preservice elementary teachers with the necessary mathematical content to implement the different pedagogy modeled in this class. Traditionally elementary mathematics has had a preoccupation with computation and other traditional skills. The vision of this course is to initiate the following instructional reforms.

Content: Toward A rich variety of mathematical topics and problem situations

Away from just arithmetic

Learning: Toward investigating problems

Away from memorizing and repeating

Teaching: Toward questioning and listening

Away from telling

Evaluation: Toward evidence from several sources judged by the teacher

Away from a single test judged externally

Expectation: Toward using concepts and procedures to solve problems

Away from just mastering isolated concepts and procedures

Text: A Problem Solving Approach to Mathematics for Elementary School Teachers (10th) Authors: Billstein, Libeskind, and Lott

Course Standards: NCTM, Washington State, and NMSA teaching standards are addressed in this course.

1.0 Mathematical Problem Solving: <i>Teacher candidates know, understand, and apply the process of problem solving in each mathematical content area. As a result, candidates:</i>
1.1 Apply and adapt a variety of appropriate strategies to solve problems.
1.2 Solve problems that arise in mathematics and those involving mathematics in other contexts.
1.3 Build new mathematical knowledge through problem solving.
1.4 Monitor and reflect on the process of mathematical problem solving and evaluate reasonableness of solution.
2.0 Reasoning & Proof: <i>Teacher candidates reason, construct, and evaluate mathematical arguments; also interpret and compare information from a variety of sources in each mathematical content area. As a result, candidates:</i>
2.1 Recognize reasoning and proof as fundamental aspects of mathematics.
2.2 Make and investigate mathematical conjectures.
2.3 Develop and evaluate mathematical arguments and proofs.
2.4 Select and use various types of reasoning (e.g., inductive, deductive, proportional, spatial) and methods of proof.
3.0 Mathematical Communication: <i>Teacher candidates communicate their mathematical thinking orally and in writing, using appropriate mathematical language and notation to clearly and effectively express or present ideas and information in each mathematical content area. As a result, candidates:</i>
3.1 Systematically gather mathematical information for a given purpose and clearly communicate their findings to peers, faculty, and others.
3.2 Use the language of mathematics to express ideas precisely.
3.3 Use communication as a means of clarifying and organizing one’s own mathematical thinking.
3.4 Analyze and evaluate the mathematical thinking and strategies of others.

5.2 Create and use multiple representations to organize, record, and communicate mathematical ideas.
4.0 Mathematical Connections: <i>Teacher candidates recognize, use, and make connections between and among mathematical ideas and in contexts outside mathematics to build mathematical understanding. As a result, candidates:</i>
4.1 Recognize and use connections among mathematical ideas.
4.2 Recognize and apply mathematical ideas to other subject areas and to real-world situations.
4.3 Demonstrate how mathematical ideas interconnect and build on one another to produce a coherent whole.
6.0 Number and Operation: <i>Teacher candidates demonstrate computational proficiency, including a conceptual understanding of numbers, representations of numbers, and meanings of operations on numbers. As a result, candidates:</i>
6.1 Analyze and explain the mathematics that underlies the procedures involving operations with real and complex numbers.
6.2 Recognize the meaning and use of place value in representing whole numbers and finite decimals, comparing and ordering numbers, and understanding the relative magnitude of numbers
6.3 Demonstrate proficiency in real number computation using multiple algorithms, mental mathematics, and computational estimation.
6.4 Demonstrate understanding of, represent, and use fractions, decimals, and percents.
6.5 Demonstrate understanding of the meaning of operations on fractions, decimals, and percents.
6.6 Provide equivalent representations of fractions, decimals, and percents.
6.7 Create, solve, and use proportions.
6.8 Demonstrate understanding of the fundamental ideas of number theory (e.g. divisibility, factoring, multiples, prime factorization, prime and composite)
6.9 Understand and use exponential and scientific notations.
6.10 Compare properties of number systems.
6.11 Represent, use, and apply properties of complex numbers.
6.12 Recognize matrices and vectors as systems that have some of the properties of the real number system.
6.13 Demonstrate knowledge of the historical development of number and number systems, including contributions from many cultures.
7.0 Algebra: <i>Teacher candidates understand relationships among quantities, functions, ways of representing mathematical relationships, and analyzing change. As a result, candidates:</i>
7.1 Identify, explore, analyze, predict, and represent patterns, relations, and functions.
7.2 Apply techniques of algebra to linear, quadratic, and exponential functions.
7.3 Demonstrate knowledge of the relationships of equations and inequalities; including proportional reasoning.
7.4 Use mathematical models including technological tools to represent and understand quantitative relationships and functions.
7.5 Analyze the concept of change in various contexts.
7.6 Demonstrate knowledge of the historical development of algebra, including contributions from many cultures.
9.0 Data Analysis, Statistics, and Probability: <i>Teacher candidates demonstrate an understanding of concepts and practices related to data analysis, statistics, and probability. As a result, candidates:</i>
9.1 Design investigations, collect data, use a variety of ways to display data, interpret data representations and draw and represent conclusions that may include bivariate data and geometric probability.
9.2 Use appropriate methods such as random sampling or random assignment of treatments to estimate population characteristics, test conjectured relationships among variables, and analyze data.
9.3 Use appropriate statistical methods and technological tools to describe shape and analyze spread and center.
9.4 Use statistical inference to draw conclusions from data.
9.5 Identify misuses of statistics and invalid conclusions from probability.
9.6 Draw conclusions involving uncertainty by using hands-on and technology-based simulation for estimating probabilities and gathering data to make inferences and decisions.
9.7 Demonstrate knowledge of the historical development of statistics and probability, including contributions from many cultures.

Assessment and Evaluation Guidelines

The instructional and assessment activities are designed to inform student on their progress in achieving the course performances outcomes. The portfolio and written final exam give a multiple summative assessments of your achievement in meeting these performance outcomes. The instructor will give the students feedback on their progress in meeting the performance outcomes but they are responsible to monitor and initiate their own remediation of weak performances.

- Homework:** Homework will be given daily and check randomly from your math notebook. The math notebook will be revised into a portfolio in the later two weeks of the course.
- Quizzes:** You can expect 6 quizzes (20 points). These quizzes will give both the instructor and the students feedback on their performances of course outcomes.
- Examinations:** Two examinations (100 points each) will be given during the quarter after completing one or two chapters. The date of the test day will be announced at least four days prior to being given. The examinations will address the performance outcomes covered in the quizzes given since the last examination. After self-assessments of each exam the students may retake similar exams and earn back up to half of the miss points. The retake exams must be completed before the date of the next exam. A final comprehensive examination worth 200 points will be given at the end of the quarter covering all course performance outcomes.
- Project Papers:** Three class projects and four written papers (10 points) will be assigned and assessed. The three projects will be open-ended questions requiring discourse demonstrating your understanding and ability to apply the concepts of the three content areas outlined in the learner outcomes. The four written papers address each of the four process standards.
- Portfolio:** During the quarter keep your homework, class activities, projects, written papers, tests & quizzes, and self-evaluations in a three-ring notebook. Toward the end of the quarter you will organized all these artifacts into a course portfolio (100 points) through the following steps:
1. In the three-ring notebook organize the activities into one of the following four sections: (1) Assessment Activities, (2) Algebraic Sense, (3) Number Sense, and (4) Probability and Statistics.
 2. Complete the assessment section by putting the revised four written papers first to demonstrate your proficiency on the first four standards. Complete this section by including all the tests, quizzes, and self-assessments.
 3. Revise the three project papers and put them at the front of their corresponding portfolio sections: Project 1- Algebraic Sense, Project 2- Number Sense, and Project 3- Probability and Statistics.
 4. Include the course syllabus, portfolio evaluation, Individual Information, and a table of content at the beginning of the portfolio (before the assessment section).
- Grading:** Grades will be determined by the following percents:
- 93-100% = A, 90-93% = A-, 87-90% = B+, 83-87% = B, 80-83% = B- , 77-80% = C+, 73-77% = C, 70-73% = C-, 67-70% = D+, 63-67% = D, 60-63%, 0-60% = F.
- Schedule/Rules:** The instructor has a class schedule for the quarter but it is subject to change depending on the needs of the students. Toward the end of the course a record of all activities will be given to each student for the purpose of organizing their portfolio. Attendance is not taken but class participation is essential for learning the course objectives. If a student misses class, it is their responsibility to find out what was covered announced or assigned. In case of emergencies, it is their responsibility to contact the instructor as soon as possible. If a course deadline, quiz, or exam was missed assessment alternatives are left up to the discretion of the instructor.
- How to succeed:** Take the responsibility for your own achievement of these performance objectives. Use the activities, assignments, assessments and people such as the instructor to insure that you understand the mathematical concepts and can demonstrated this understanding in the form of the performance objectives.
- ADA:** Students with special needs or disabilities who desire academic accommodation are encouraged to submit a copy of the 'Confirmation of Eligibility for Academic Adjustments' from the Disability Support Services office as soon as possible so a plan can be developed that best serves the learning needs of the student. Students without this form should contact the Disability Support Services office in Bouillon 205 at 963-2171 or dssrecept@cwu.edu as soon as possible.