Xavier University
Number Theory
EDEL554
Spring 2014
(3 semester hours)

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Childhood Education and Literacy Department Mission Statement:
Xavier University’s Department of Childhood Education and Literacy is dedicated to the pursuit of knowledge and to the orderly discussion of critical issues confronting educators in a free, inquiry-based environment committed to current and relevant scholarship and research related to our profession. Xavier University seeks to create awareness of social justice in all disciplines through its emphasis on living the Jesuit tradition of intellectual, moral, and spiritual preparation. The candidates in the Early Childhood, Middle Childhood, Montessori and Literacy programs, through their academic and professional training, are prepared to value the lives of children regardless of racial, linguistic, socio-economic, religious, or ethnic background and to work with and value family and school structures in both urban, rural, and suburban settings. Special attention is given to developmentally effective practices and advocacy for all children, with ethical issues and values as expressed through the Jesuit tradition. Thus, the Childhood Education and Literacy preparation at Xavier University strives to send out into the education community candidates who are morally sensitive to the academic and social needs of our time, foster an appreciation for human diversity, reason critically, and think creatively. Candidates in the Childhood Education and Literacy Department are encouraged to develop and maintain a disposition toward lifelong learning in the profession of education and to the service of their students and their students’ families and communities.

Course Description:
This course introduces teachers to the branch of mathematics known as number theory, in which one studies properties of positive integers with respect to the operations of multiplication and division. Emphasis in this course is placed on the mathematical content of number theory and on how number theory is taught in grades K-8, with particular attention to student learning of number theory in these grades. Topics include the division algorithm, properties of prime and composite numbers, the sieve of Eratosthenes as a way of understanding distributions of primes and composites, the infinitude of primes, the fundamental theorem of arithmetic, properties of the greatest common factor and methods of computing the greatest common factor including the
Euclidean algorithm, properties of least common multiples, use of base ten and expanded notation, writing numbers and computing in different bases, and arithmetic progressions.

**Goals:** As a result of this course participants will:
- Explore patterns and relationships among counting numbers
- Develop deeper understanding of our base ten number system
- Appreciate importance of “number play” (e.g., exploring numbers and patterns) as adult learners and as elementary teachers.
- Investigate research on the challenges students encounter as they develop their understanding of our number system.
- Enrich K - 8 learning opportunities and problem solving based on a deeper understanding of number theory.
- Examine number theory concepts from the perspective of the K-8 classroom, become familiar with the Ohio Mathematics Common Core Standards and Model Curriculum, and demonstrate an understanding of how the concepts associated with this strand of mathematics develop across the grades.
- Discuss strategies for teaching number theory concepts to students K-8.

**Learning Outcomes:**

- **Properties of positive integers with respect to multiplication. & division.**
  Prime & composite numbers; factoring of integers; factor diagrams; the sieve of Eratosthenes; Fundamental Theorem of Arithmetic; relatively prime numbers; greatest common factor; least common multiple; least common denominator; division algorithm; Euclidean algorithm; divisibility rules; connections among prime numbers; GCF, LCM, and work with fractions; linear functions, slope, and factorization.

- **Objectives:** Teachers will:
  - determine whether a positive integer is prime or composite.
  - implement the Sieve of Eratosthenes.
  - determine the prime factorization of a number through multiple representations such as factor diagrams, ordered pairs of factors, factor trees, division algorithm.
  - generate and apply the Fundamental Theorem of Arithmetic; express positive integers as the unique product of primes.
  - determine whether two positive integers are relatively prime.
  - identify the factors and multiples of any positive integer.
  - use multiple representations to determine the GCF and LCM of a pair of positive integers.
  - understand and implement the division algorithm to obtain a unique quotient and remainder when dividing an integer by a positive integer.
  - generate and informally prove rules for divisibility and apply understanding of divisibility rules to real life situations.
  - use prime factorization to reduce fractions to lowest terms.
  - express the GCF and LCM in function notation and graph the functions.

- **Number Systems:** Use of base 10 & expanded notation, scientific notation, writing & computing in different bases to strengthen understanding of base ten system, positional and non-positional systems; history of number systems.
Objectives: Teachers will:
• determine properties of integers that depend on expanded notation.
• compute in different bases (+, − ×).
• translate numbers between bases.
• express numbers in other bases using pictorial models & exponential notation.
• differentiate between positional and non-positional number systems

Counting Problems and Arithmetic Progressions: Combinations & permutations, arithmetic progressions, Gauss’ formula

Objectives: Teachers will:
• recognize situations that are involve counting problems/arithmetic progressions.
• use a variety of representations and strategies to solve counting/arithmetic progression problems.

Text book and Resources

COURSE POLICIES:
Professionalism: Professional behavior is that which is expected of all teachers and is what you have come to expect of your students. Students are required to demonstrate behavior consistent with a professional career. In particular, students are expected to adhere to the following guidelines:

Academic Honesty: The Childhood Education and Literacy Department values academic honesty. It is expected that each student will submit original work. Where others’ works and ideas are used, citations must be included. Please refer to the Xavier University Catalog for the official statement and consequences.

Attendance: Arrive to class on time and stay for the entire day. The Xavier University catalogue states “In order to earn credit in any course for which he/she is registered, the student is required to attend classroom and laboratory exercises regularly and promptly. Lack of reasonable attendance as determined by the individual faculty member is reason for denial of credit for a course and possible course failure.” Full attendance is required for credit. Special consideration will only be given to unexpected extreme situations.

Class Participation: All participants are expected to be actively engaged in classroom activities. Participants must contribute to class discussions, share ideas and questions, help other participants when possible and share solutions to class and homework problems.
Teamwork: Help others and participate in discussions groups and morning homework groups.

Attitude: Maintain a positive attitude. If you are feeling frustrated with some aspect of the course, it is your responsibility to discuss this with Debbie, Sheila, Jason, Deb or Ken.

Course Homework/Assignments and Reflective Portfolio: You are expected to work diligently on homework, to complete all assignments to the best of your ability and stay after class for office hours or ask for help from an instructor if the work is challenging for you. Show all your work on your homework solutions, put effort into making sure it is legible. You will keep a working portfolio and will complete a reflective portfolio of your final versions of selected in-class assignments.

Growth/Effort: You are expected to show growth in mathematics, relative to where you were when you came into the program. Not everyone will be at the same place mathematically when they come into the course or at the end of the course, but everyone should make gains. If you feel that you are not making progress, it is your responsibility to make arrangements for additional learning experiences or one-on-one tutoring with an instructor.

Post Inventory Tests/Final Homework Packets: If the post inventory test indicates areas that have not been mastered you will be given an incomplete for the class and will need to sign a revision contract. You will be expected to view Khan Academy Videos to remediate areas of concern and complete the required assignment to demonstrate mastery of the content.

A similar contract will be signed if the final homework packet demonstrates areas that have not been mastered. You will be given an incomplete for the course and will be required to sign a revision contract. The contract will specify the work to be done, products to be submitted and the final deadline. Failure to do so will result in failure of the course.

The post inventory test score will factor into your final grade.

Accommodations: Office hours at Mayerson Center: Daily from 3:00 – 4:00. If extra help is needed please contact Debbie Kuchey or Sheila Doran.

Student Evaluation/Assessment
Grading will be based on the following expectations:
- Completing all problems and practice sets.
- Completing required readings, responses, and preparation for discussions prior to class meeting.
- Completing all assignments by the due date.
- Archiving all solutions to problems, in-class presentations of solutions, and class notes in their working course portfolio. Participants will choose five problems to include in their Reflective Portfolio.
- Attending all classes, participating fully in class discussions and presentations of solutions, and being helpful to colleagues in learning from one another.

Work Products and Grades:
Homework (50%)
Daily homework rubric and end of the course homework packet.
Presentations and Participation (10%)
Throughout the course activities will be presented to the class for discussion and response. Participants will be expected to respond appropriately and effectively, orally and in writing, based on content knowledge.

Final Course Reflective Portfolio (10%)
Each participant will be required to submit a reflective portfolio containing revised copies of five problems that had an impact on their learning during this course. The revised problems should show multiple ways of solving the problem along with a written reflection of the impact this particular problem had on the participant.

Teaching Learning Lab Assignment (10%)

Daily Quizzes (10%)

Post Inventory Test/Final (10%)

Grade Scale: Because this is a graduate course, students must receive a B- or better for credit.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Minimum Score</th>
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<tbody>
<tr>
<td>A</td>
<td>93-100</td>
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<tr>
<td>A-</td>
<td>90-92</td>
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<tr>
<td>B+</td>
<td>88-89</td>
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<tr>
<td>B</td>
<td>83-87</td>
</tr>
<tr>
<td>B-</td>
<td>80-82</td>
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## EDEL 554 Number Theory
### Course Calendar

<table>
<thead>
<tr>
<th>DATE</th>
<th>TOPIC</th>
<th>ASSIGNMENT</th>
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<tbody>
<tr>
<td>January 11</td>
<td>• Number Theory Pre-Inventory&lt;br&gt;• Divisors, primes and composites&lt;br&gt;• Sieve of Eratosthenes and prime number testing&lt;br&gt;• Factor trees and GCDs&lt;br&gt;• Venn Diagrams, GCDs, and LCMs</td>
<td>Complete assigned homework given in class</td>
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<tr>
<td>January 25</td>
<td>• Factor diagrams&lt;br&gt;• “Working Together” problem&lt;br&gt;• Trading Coins Activity&lt;br&gt;• Introduction to number bases</td>
<td>Complete assigned homework given in class&lt;br&gt;<strong>For Feb 8th Teaching and Learning Lab: Read Developing Essential Understanding of Number and Numeration</strong></td>
</tr>
<tr>
<td>February 8</td>
<td>• Developing Essential Understanding of Number and Numeration</td>
<td><strong>For Next Teaching and Learning Lab: Read The Progressions for the CCSS in Mathematics K-5 Number and Operations in Base 10.</strong></td>
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<tr>
<td>February 22</td>
<td>• Thouandsaire&lt;br&gt;• The Division Algorithm&lt;br&gt;• Modular or Clock Arithmetic&lt;br&gt;• Brokem Rock Problem</td>
<td>Complete assigned homework given in class</td>
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<tr>
<td>March 8</td>
<td>• GCF through functions&lt;br&gt;• Sam and Etta Earn Money&lt;br&gt;• Matrix: the Double Cross&lt;br&gt;• Divisibility rules</td>
<td>Complete assigned homework given in class</td>
</tr>
<tr>
<td>March 22</td>
<td>• The Progression for the CCSS in Mathematics K-5 Number and Operations in Base 10</td>
<td><strong>High Stakes Assessment Prompt Assignment</strong></td>
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<tr>
<td>April 5</td>
<td>• Caeser Cipher&lt;br&gt;• Finger Multiplication&lt;br&gt;• Russian Peasant Multiplication&lt;br&gt;• Letter Arrangements and Counting Problems</td>
<td>Complete assigned homework given in class</td>
</tr>
<tr>
<td>April 26</td>
<td>• Slope and Equivalent Fractions&lt;br&gt;• Orange Juice- rates and ratios&lt;br&gt;• Egyptian Fractions&lt;br&gt;• Ancient Number Systems</td>
<td>End of course homework assignment</td>
</tr>
<tr>
<td>May 3</td>
<td>• FINAL</td>
<td>Reflective Portfolio Due: End of Course Homework</td>
</tr>
</tbody>
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*The instructor reserves the right to make changes in the syllabus and/or calendar if circumstance so dictates.*