Course of Study Title: Mathematics Content (5-12) Part IV: Induction & Recursion

Description: This course outline presents the required sequence of learning steps and activities to help you develop competence in the subject area of Induction & Recursion. In this case, your competence will be assessed as you complete a series of performance tasks. The tasks are listed in the sequence below at the point in which you should have covered the learning necessary to build the necessary competence to successfully complete the task. Once all tasks are completed at the appropriate level of competence you will receive a PASS on your AAP for the MIA Assessment. As with any learning activity, steps may be completed more quickly than noted below, or they could take the full amount of time indicated. We provide the pacing (Week One, Week Two, etc.) as a guide to the amount of time you should take to develop the competencies necessary and prepare to complete the required assessment on time. Completing your assessments within the required timeline keeps you on pace for Satisfactory Academic Progress and Graduation.

Introductory Text: This course outline presents the required sequence of learning activities to help you develop competence in the subject area of Induction & Recursion. Induction & Recursion are broad topics, with several items covered on the objective exam. This component of your work at WGU is designed to help you to gain a broad overview of the field of Induction & Recursion with a fundamental understanding of some key concepts and principles.

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                                    Tuesday, 9:00am – 5:00pm, Eastern Time
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                                    Friday, 9:00am – 5:00pm, Eastern Time

Disposition Statement: Western Governors University supports the development and demonstration of professional teaching dispositions throughout the course of its Teachers College (TC) licensure programs. All TC students and faculty will demonstrate the following dispositions described in the Teachers College’s conceptual framework and code of ethics:

Competent and caring
Respectful and embracing of diversity
Reflective practitioners
Equitable and fair
Professional practice consistent with the belief that all students can learn
Collaborative professionals
Professional leaders and change agents

Please review the <Teachers College Code of Ethics> found in the WGU Student Handbook.

Learning Resources:
(See listing on the Available Learning Resources tab of your AAP to enroll or order)

**Required:**

**Optional:**
- Blitzer, R. (2007). *Algebra & Trigonometry, 3rd ed.* Boston: Pearson Addison-Wesley. ISBN: 9780132191401. For additional materials at no cost to you, sign up for Blitzer using Available Learning Resources, which will give you free Web access to MyMathLab, which includes some videos, lots of quizzes, and other interactive capabilities as well as the full text of the book. This textbook is used for other assessments in the Math 5-12 program.

**Appropriate Calculator:** The TI-84+ graphing calculator, its predecessors TI-82, TI-83, or TI-83+, or equivalent calculators of other brands are recommended. Graphing calculators possessing built-in **Computer Algebra Systems (CAS) are not allowed** to be used on competency exams, so we recommend you do not use such a calculator while working on the mathematics tasks and topics. To download TI screenshots to your computer for inclusion in tasks, you will need a **TI Connectivity Kit**, available at [http://education.ti.com/educationportal/sites/US/productDetail/us_ti_connectivity_kit.html](http://education.ti.com/educationportal/sites/US/productDetail/us_ti_connectivity_kit.html)

**PLEASE NOTE:** The learning resources you are using to master the competencies for this assessment will also be valuable as you as you prepare for other assessments, namely, the MIC objective exam, the Praxis II exam, and any state-mandated mathematics content exams. Therefore, we recommend that you fully utilize these resources.

**WEEK 1**

**Subject Title:** Induction

**Subject Description:** Mathematical induction is a critical method of proof in mathematics.

**Background Information:** Induction is both conceptually tricky and computationally intense, so be prepared to read and learn carefully and slowly.

**Competency Title:** Induction & Recursion
Numerical Code: 203.5.2

Competency Description: The graduate understands the role of mathematical induction as a critical method of proof in mathematics and understands how recursion is used to define important relations and functions in mathematics.

Topic Title: Proof by induction

Instruction Text: Write a task to demonstrate you knowledge of proof by induction.

Activity Title: Read Section 4.1 in Rosen

Activity Type: Text

Description: The section is titled “Mathematical Induction.” Example 2 on page 268 is particularly important.

Activity Title: Read “Induction Proof”

Activity Type: Text

Description: This is a PowerPoint presentation and can be found under the Additional Resources heading in the MIA Available Learning Resources window.

Activity Title: Self Assessment: Mathematical Induction

Activity Type: Interactive Quiz

URLs: Go to the 6th link on http://highered.mcgraw-hill.com/sites/0072880082/student_view0/self_assessments.html#

Description: This is an interactive quiz to check whether you understand induction.

Activity Title: Solve Induction Problems

Activity Type: Interactive Practice Problems


Description: This is a set of induction proof problems, with the answer key accessible with a single click.

Activity Title: Task 1 in MIA

Activity Type: Performance Task Assessment

Description: Summary: Do a proof by induction.

Activity Title: Optional, Read Website by David Sumner
Activity Type: Online Text
URLs: David Sumner:
http://bigcheese.math.sc.edu/%7Esumner/numbertheory/induction/Induction.html
Description:
David Sumner: Non-interaction text, but exceptionally clear explanations and useful examples.

Activity Title: Optional, Read Section 11.4 in Blitzer
Activity Type: Text
URLs: None (www.coursecompass.com)
Description: The section is titled “Mathematical Induction”

WEEK 2
Subject Title: Recursion
Subject Description: Classroom application of recursion
Background Information: Recursion is used to define important relations and functions in mathematics.
Competency Title: Induction & Recursion
Numerical Code: 203.5.2
Competency Description: The graduate understands the role of mathematical induction as a critical method of proof in mathematics and understands how recursion is used to define important relations and functions in mathematics.

Topic Title: Appropriate use of recursive functions in a secondary mathematics classroom
Instruction Text: Write a task to demonstrate your knowledge of a recursion application appropriate for a secondary mathematics classroom.

Activity Title: Recursive Definitions, Rosen
Activity Type: Text
Description: Read Section 4.3 of Rosen up to, but not including, Lame’s Theorem (page 298). The section is titled “Recursive Definitions and Structural Induction” and this reading focuses on the first part of the title.

Activity Title: Recursive Definitions, Wikipedia
Activity Type: Text
URLs: http://en.wikipedia.org/wiki/Recursion
Description: Read Wikipedia’s treatment of recursion.
**Activity Title:** Solve Recursion Problems  
**Activity Type:** Textbook exercises  
**Description:** Do exercises 1 through 6, 23, 24, and 25 of section 4.3 in Rosen.

**Activity Title:** Self Assessment: Recursive Definitions  
**Activity Type:** Interactive Website  
**URLs:** Go to the 2nd to last link at [http://highered.mcgraw-hill.com/sites/0072880082/student_view0/self_assessments.html](http://highered.mcgraw-hill.com/sites/0072880082/student_view0/self_assessments.html)  
**Description:** This is an interactive quiz to check whether you understand recursion.

**Activity Title:** Optional, Recursive Algorithms  
**Activity Type:** Text  
**Description:** Read Section 4.4 of Rosen, titled “Recursive Algorithms.” This presents recursion within the context of a simulated computer programming language. The important thing to focus on is how the recursive approach breaks down familiar functions into their underlying actions.

**Activity Title:** Investigative Lesson Planning  
**Activity Type:** Website reading  
**Description:** This portion of the “MAT Tours” Website shows how to launch a problem that will lead to student learning via investigation. The URL leads to the first step. Make sure to click the “Next” button on the bottom to explore the other 5 important steps used for investigative lesson planning.

**Activity Title:** Lesson Plan Examples  
**Activity Type:** Website reading  
**URLs:** NCTM Illuminations:  
Math Forum: [http://mathforum.org/mathtools/cell/dm,17.12,ALL,ALL/](http://mathforum.org/mathtools/cell/dm,17.12,ALL,ALL/)  

**Description:**
NCTM Illuminations has several lessons that work with recursion and iteration. They are well worth reading to see excellent examples of how these topics can be incorporated into the classroom.

Math Forum has links to many good Java Applets illustrating recursion – “Predator Prey” and “Fish Population Grapher” are particularly recommended.

**Activity Title:** MIA Task 2  
**Activity Type:** Performance Task Assessment  
**Description:** Summary: Create secondary mathematics lesson plans that include grade-appropriate applications of recursive functions. Note that ‘application’ means ‘real-world application.’ Also, the task should be interpreted to mean a recursion application that is expressed as an algebraic formula, not a graphical/fractal situation.

**Feedback**
If you wish to provide feedback on this course of study, please contact Rob Duncan, Mathematics Program Coordinator, at rduncan@wgu.edu.