1 - The Axiomatic Method

Content Area: **Mathematics**
Course(s):
Time Period: **Marking Period 1**
Length: **4 weeks**
Status: **Published**

Summary of the Axiomatic Method

The first unit of study in this course introduces students to the structure of a logical system founded upon axioms, postulates, and clearly defined terms. Mathematical reasoning is a logical endeavor comprised of inductive, deductive, and abstract thought processes – comparable to the experience of learning chess. In this unit, students will learn how to identify and establish premises for an argument, and the importance of using basic principles within an academic field to further build one's knowledge of the subject. The axiomatic method consists of using rules predicated upon basic propositions, which in turn develop into more sophisticated levels of understanding. Students will experience how this process simultaneously manifests in both mathematics and chess.

Revision Date: July 2026

Essential Questions for the Axiomatic Method

- What is the definition of mathematics?
- What are logical structures?
- What are axioms and postulates?
- What is the axiomatic method?
- How are first principles used to develop theories and derive conclusions?
- What are the rules and basic principles of chess?

Enduring Understandings for the Axiomatic Method

- Mathematics is a logical system predicated on axioms, postulates, and clear definitions.
- The field of chess is a logical system consisting of clearly defined rules and basic principles.
- Known facts may be combined in logically valid ways to produce certain conclusions.
- Known facts combined in logically invalid ways may produce uncertain conclusions.

Objectives for the Axiomatic Method

Students Will Know

- The algebraic axioms of equality that are foundational for secondary mathematics.
- The axiomatic method, in which certain basic principles may be used to obtain conclusions that are logical consequences of the axioms.
- The rules of chess that define piece movements.

- The foundational principles of chess that guide decision-making in opening sequences.

Learning Plan for the Axiomatic Method

The instructor will utilize class time to introduce, explain, and exemplify the axiomatic method as it relates to concepts with linear algebra and the game of chess. Students will have ample opportunity to explore the role of first principles in both academic fields. Lessons include establishing and working with the algebraic axioms of equality, as well as foundational concepts within chess. Key vocabulary and essential concepts will be presented via whole group instruction, and students are expected to read through the teacher's guided note-taking handouts, and to explore online resources. Throughout this unit, the instructor will explain how first principles are foundational to one's understanding, and how more sophisticated ideas can be traced back to these basic concepts. Given that students have not previously received formal training in logic, they will be consistently encouraged to reflect on their experiences with the classroom activities through journaling in their individual notebooks. The instructor will facilitate both small group and whole group discussions allowing for students to make personal connections to the essential questions and objectives for enduring understandings with this unit. During class, students will alternate between applying the axiomatic method to linear equations and exploring the realm of possible chess moves in a variety of scenarios.

Objectives for the Axiomatic Method

Students Will Be Skilled At

- Identifying relevant algebraic principles associated with a variety of multi-step equations.
- Applying the algebraic axioms of equality to simplify and solve linear equations.
- Explaining the significance and implications of foundational chess principles.
- Using and interpreting algebraic notation for recording chess moves.

Evidence/Performance Tasks for the Axiomatic Method

Frequent formative assessments will be utilized at the individual level as opportunities for the instructor to provide critical feedback and ensure that students have grasped the importance of the axioms for both mathematics and chess. In addition, exploratory classroom activities in small groups will serve as formative assessments in which students can give and receive helpful peer feedback about their understanding of key concepts. Short written quizzes will be administered in the form of exit tickets towards the end of class to identify students' misconceptions and/or struggles with comprehension. Whole group discussion allows for students to verbally articulate their understanding of the axiomatic method and to elaborate on their conversations from their small group sessions. The unit will conclude with a summative written assessment that addresses the application of first principles with linear algebra, as well as the use of proper algebraic notation with sequences of moves that illustrate concepts which are foundational to chess.

Materials for the Axiomatic Method

Lecture notes and classroom activities designed by instructor
Internet resources, including YouTube instructional videos and teacher-recommended chess education websites.
Book: “Mathematical Reasoning Through Chess” by Dr. Gary Wenger (in progress)

Standards for the Axiomatic Method

Applying skills through chess provides an inclusive learning environment for all students. It promotes teamwork, mutual respect, and learning about each other's points of view. These activities incorporate the following elements:

New Jersey Diversity and Inclusion Law: In accordance with New Jersey’s Chapter 32 Diversity and Inclusion Law, this unit includes instructional materials that highlight and promote diversity, including: economic diversity, equity, inclusion, tolerance, and belonging in connection with gender and sexual orientation, race and ethnicity, disabilities, and religious tolerance.

1	Make sense of problems and persevere in solving them
	Brainstorming can create new, innovative ideas.
L.SS.11–12.1	Demonstrate command of the system and structure of the English language when writing or speaking.
2	Reason abstractly and quantitatively
9.4.2.CI.1	Demonstrate openness to new ideas and perspectives (e.g., 1.1.2.CR1a, 2.1.2.EH.1, 6.1.2.CivicsCM.2).
9.4.2.CI.2	Demonstrate originality and inventiveness in work (e.g., 1.3A.2CR1a).
3	Construct viable arguments and critique the reasoning of others
P.5	Utilize critical thinking to make sense of problems and persevere in solving them.
L.KL.11–12.2	Apply knowledge of language to understand how language functions in different contexts, to make effective choices for meaning or style, and to comprehend more fully when reading or listening.
	Critical thinkers must first identify a problem then develop a plan to address it to effectively solve the problem.
4	Model with mathematics
P.8	Use technology to enhance productivity increase collaboration and communicate effectively.
9.4.2.CT.3	Use a variety of types of thinking to solve problems (e.g., inductive, deductive).
3.a	Identify complex, interdisciplinary, real-world problems that can be solved computationally.
3.b	Decompose complex real-world problems into manageable sub-problems that could integrate existing solutions or procedures.
7	Look for and make use of structure
A.CED.A	Create equations that describe numbers or relationships
A.REI	Reasoning with Equations and Inequalities

Suggested Accommodations and Modifications

Link to Google Doc with list of accommodations and modifications:

https://docs.google.com/spreadsheets/d/1jqF3mSHC48EXTGESYLOmnO3ZbM_R5_etPyYULfrQhwE/edit#gid=1426178898