2 - Number Systems

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

Summary of Number Systems

Discrete mathematics explores logical structures designed and developed by humans, for purposes of solving problems and better understanding the world in which we live. Discrete math is the branch of mathematics dealing with objects that can assume only distinct, separated values, and includes a wide variety of topics. This first unit presents an opportunity to challenge common misconceptions about mathematics by introducing students to multiple systems of numeration. Through studying number systems, students will learn the importance of notation and the underlying grammatical structure for the language of mathematics. A system of numeration is a set of numerals along with a rule that establishes how to combine them to represent numbers. In particular, students will learn about number systems in Base 2, Base 6, Base 10, Base 12, and Base 60, and will explore elementary concepts in number theory.

Revision Date: July 2026

Essential Questions for Number Systems

- What is a system of numeration?
- How are number systems defined by their bases?
- How can different number systems represent the same quantitative value in different ways?
- How have systems of numeration evolved over time?
- What are the advantages to having various systems of numeration?

Enduring Understandings for Number Systems

- A number is a quantity, and a “numeral” is a symbol used to represent a number.
- A system of numeration is a set of numerals along with a rule that establishes how to combine them to represent numbers.
- The language of mathematics is presented through systems of numeration, which are logical structures designed by humans.
- An infinite number of systems exist, yet some are more advantageous than others, depending on context.

Objectives for Number Systems

Students Will Know

- The language of mathematics is founded upon logical structures.
- How to represent numbers using different systems of numeration.
- Advantages of using different number systems.

Objectives for Number Systems

Students Will Be Skilled At

- Exponentiating a base number to construct a numerical representation for any value within a system.
- Converting numerical representations of quantitative values across different number bases.
- Writing and counting numbers in different systems of numeration.

Learning Plan for Number Systems

Due to the nature of this content being unfamiliar to students in the course, this particular unit will initially be presented through lectures with guided note-taking activities in the classroom. The instructor will introduce and clarify new concepts, and provide supplemental reading material to the students. Class discussions will follow on the deconstruction of number systems, making extensive use of examples and visual aids on both the white board and with the available SmartBoard technology. Students will have frequent opportunities to collaborate with their peers on completing exercises within various systems of numeration.

Evidence/Performance Tasks for Number Systems

This unit lends itself to many short, written quizzes. Formative assessments will include classroom activities and discussions, with immediate feedback from the instructor. Quizzes, in the form of entrance and exit tickets, will be frequently administered and reviewed during class time in order to identify students' misconceptions and/or struggles with comprehension regarding the arithmetic operations of mathematics with different number bases. For this unit, a summative assessment will be given as a written test during class time in which students will have to make conversions across mathematical systems with varying number bases. Alternatively, students may have the option to verbally articulate their understanding of key concepts or elaborate on their written responses.

Materials for Number Systems

Core instructional materials: Core Book List including district approved textbook: *Mathematical Ideas, 14th ed*. Miller, Heeran, Hornsby, and Heeran. Pearson (2020).

Supplemental instructional materials: Lecture notes and classroom activities designed by instructor. Internet resources, including instructional videos on YouTube, Khan Academy, and teacher-recommended math education websites.

Standards for Number Systems

Through collaborative learning about various discrete mathematics applications, students will embrace each other's differing points of view and logical reasoning. Through group and class discussions, students will reinforce their comfort with critiquing each other's thought process which incorporates elements of the following:

NJ 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 learning, including: economic diversity, equity, inclusion, tolerance, and belonging in connection with gender and sexual orientation, race and ethnicity, disabilities, and religious tolerance.

MA.N-RN	The Real Number System
P.4	Demonstrate creativity and innovation.
P.5	Utilize critical thinking to make sense of problems and persevere in solving them.
MA.A-SSE.B	Write expressions in equivalent forms to solve problems
P.8	Use technology to enhance productivity increase collaboration and communicate effectively.
P.9	Work productively in teams while using cultural/global competence.
MA.N-Q.A	Reason quantitatively and use units to solve problems.
MA.N-Q.A.1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

Suggested Accommodations and Modifications

Link to Google Doc with list of accommodations and modifications:

https://docs.google.com/spreadsheets/d/1pRh--nhM8IFIomBxghCfN1PrwPPFT7n_y6BvOpAt6nQ/edit#gid=1426178898