GRADE: 9

UNIT (S): Number Theory & Set Theory

TOPIC: Introduction to Sets and Set Notation

DATE: November 24 -- November 28, 2025 (1 week)

STANDARDS:

AT2A: Understand and use the concepts of set theory and logical reasoning.

AT2B: Represent and analyze mathematical situations and structures using algebraic symbols.

GENERAL OBJECTIVES:

- Students will develop a clear understanding of the concept of a set as a well-defined collection of objects.
- Students will appreciate the utility and precision of mathematical language and notation in describing collections.
- Students will strengthen logical reasoning and communication skills by defining, describing, and classifying sets.

SPECIFIC OBJECTIVES:

By the end of the week, students will:

1. Describe a set in words when given its members or otherwise.
2. List the members of a set described in words (e.g., "even numbers up to 20").
3. Use different ways of naming a set: a) describing in words, b) listing the members (roster method), c) using a letter as in A or set A.
4. Use symbols: a) ∈ (is an element of), b) { } (braces) when listing members of a given set.
5. Understand the difference between finite and infinite sets and how to indicate a finite set with continuation marks (i.e., '…').

6. Understand that an object or number may be a member of more than one set (group).

KEY VOCABULARY:

- Set
- Element / Member
- Roster Method
- Rule Method / Set-Builder Notation
- Finite Set
- Infinite Set
- Ellipsis (…)
- Universal Set
- Subset (Preview for extension)

RESOURCES:

- Whiteboards and markers
- Assorted physical objects (e.g., different colored shapes, buttons, number cards)
- "Set Sort" activity cards
- Digital tools (e.g., Quizlet for vocabulary, Desmos for set visualization activities)
- Chart paper and markers for group work

PRIOR LEARNING:

Check that students can:

- Classify objects based on common characteristics (e.g., color, shape, size).
- Understand basic number classifications (even, odd, prime).
- Follow precise written and verbal instructions.

LEARNING OUTCOME:

Students will be able to confidently and accurately describe, represent, and classify sets using correct mathematical terminology and notation. They will understand the concept of set membership and distinguish between finite and infinite collections.

CONTENT

A set is a well-defined collection of distinct objects. These objects, called elements or members, can be anything: numbers, letters, people, etc. Sets can be described in words (rule method), by listing all members inside braces { } (roster method), or represented by a capital letter. The symbol ∈ denotes membership. A set with a countable number of elements is finite, while a set that continues indefinitely is infinite, often indicated with an ellipsis (…). An element can belong to multiple sets simultaneously.

TEACHING/LEARNING ACTIVITY:

ENGAGE

The teacher will place a large, mixed collection of objects in the center of the room (e.g., red/blue squares/circles, even/odd number cards). Students will be asked to work in their table groups to "find a rule" and sort the objects into two or three distinct groups. After sorting, groups will write a one-sentence description of their rule (e.g., "Our set contains all red objects."). The teacher will then ask groups to share their sorting rules and the resulting groups. This will lead to introducing the term **"set"** as a well-defined collection.

EXPLORE

The teacher will organize students into small groups and provide each with a "Set Mission" envelope. Each envelope contains a different set of instructions, such as:

- *Mission 1:* Using the number cards 1-20, create a set defined by the rule "Multiples of 3."
- *Mission 2:* Using the geometric shapes, create the set "Shapes that are both blue and have straight sides."

  Students will use the physical materials to build their sets. They will then be challenged to represent their set in two different ways on their group's whiteboard. The teacher will

facilitate, prompting groups to consider the best way to *write down* their collection clearly.

EXPLAIN

The teacher will lead a session to formalize the language and notation of sets. As groups share their different representations from the "Explore" phase, the teacher will introduce and define the standard methods:

- **Roster Method:** Listing elements inside braces: {2, 4, 6, 8}
- **Rule Method:** Describing the set in words: "The set of even numbers between 1 and 9."
- **Set Notation:** Using a capital letter: Let E = {2, 4, 6, 8}.

  The teacher will explicitly introduce and model the use of the symbols { } and ∈ / ∉. The concepts of **finite** and **infinite** sets will be contrasted using examples like "days of the week" (finite) vs. "counting numbers" (infinite), demonstrating the correct use of the ellipsis ({1, 2, 3, ...}).

ELABORATE

The teacher will provide "Set Detective" scenario cards. Students will work in small groups to solve the scenarios, which require them to:

1. Create a set based on a complex description (e.g., "Numbers that are perfect squares less than 50").
2. Determine if given numbers are elements of multiple sets they've created.
3. Decide if a described set is finite or infinite and represent it correctly.

   Each group will create a poster showcasing their solutions for two scenarios, using all three methods of naming sets and correctly applying the ∈ symbol. The teacher will pose challenging questions such as, "Can the number 10 be in a set of even numbers and a set

of multiples of 5 at the same time? Explain." Groups will present their posters, explaining their reasoning.

EVALUATE

The teacher will observe students during group activities to assess their grasp of concepts and notation. Students will complete exit tickets at the end of sessions with quick tasks like "List the members of the set of prime numbers less than 10" or "Use the ∈ symbol to state that 4 is an element of set A." The teacher will provide a final **"Set Mastery Check"** worksheet for students to complete independently, containing problems that require describing, listing, and classifying sets, as well as written explanations.

DIFFERENTIATION:

- **Support:** The teacher will provide pre-made set templates with some elements filled in and vocabulary cards with symbols and definitions.
- **Extension:** Students will be challenged to create their own "Set Detective" scenarios for a partner to solve, including sets defined by two conditions (e.g., "even and greater than 15"). An introduction to the concept of a **subset** can be provided.

ASSESSMENT:

- Observation and checklists during "Set Mission" and "Set Detective" activities.
- Accuracy and notation use on exit tickets.
- Quality, accuracy, and justification of work on the "Set Detective" posters.
- Score and written explanations on the "Set Mastery Check" worksheet.

LINKS TO OTHER SUBJECTS:

- **Science:** Classifying organisms into kingdoms or elements into groups on the periodic table.

- **Language Arts:** The importance of precise language in definitions (comparing a "well-defined set" to a clear instruction).
- **Social Studies:** Grouping countries by geographic region or economic system.