Place Value Detective: The Case of the Giant Number

Materials Needed:

- Large whiteboard or several large pieces of paper
- Dry-erase markers or regular markers in different colors
- A set of 10 index cards, each with a large digit written on it (0, 1, 2, 3, 4, 5, 6, 7, 8, 9)
- A "Place Value Chart" (can be drawn on the whiteboard) going up to the billions place
- 5-7 "Secret Mission" envelopes, each containing a different challenge card (see Main Activity section for examples)
- A notebook and pencil for Ayrik's "Detective Log"

Lesson Plan Details

Subject: Mathematics (Number Sense)

Grade Level: 5-6 (for 11-year-old student, Ayrik)

Time Allotment: 60 minutes

1. Learning Objectives

By the end of this lesson, Ayrik will be able to:

- Clearly articulate the difference between **place value** (the position of a digit, e.g., tens place) and **digit value** (how much the digit is worth, e.g., 40).
- Construct and deconstruct numbers up to one billion based on specific place value criteria.
- Apply knowledge of place value to solve creative, multi-step number puzzles.

2. Alignment with Standards

This lesson aligns with Common Core State Standards (CCSS) for Mathematics, specifically:

- **CCSS.MATH.CONTENT.5.NBT.A.1:** Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and 1/10 of what it represents in the place to its left.
- **CCSS.MATH.CONTENT.5.NBT.A.2:** Explain patterns in the number of zeros of the product when multiplying a number by powers of 10.

3. Instructional Strategies & Lesson Activities

Part 1: The Warm-Up - "Number Scramble" (5 minutes)

1. Lay out the 10 digit cards (0-9) face up on a table.
2. **Instruction:** "Detective Ayrik, your first task is a quick one. Using these digit cards, create the largest 6-digit number possible. Now, create the smallest 6-digit number possible. How did you know where to put the 9 and the 0 in each number?"
3. **Goal:** This quickly assesses prior knowledge and gets Ayrik thinking about the power of a digit's

position.

Part 2: The Briefing - "Place vs. Value" (10 minutes)

1. Draw a large place value chart on the whiteboard, up to the billions.
2. Write a large number, for example: **745,132,896**.
3. **Direct Instruction:** "Excellent work, Detective. Now for the main briefing. We need to be clear on two key terms: **Place Value** and **Digit Value**."
4. **Analogy:** "Think of it like an apartment building. **Place Value** is the apartment number (e.g., 'Apartment 100'). It just tells you the location. **Digit Value** is who lives inside and what they're worth. If the digit '3' lives in 'Apartment 100,' its value is 300."
5. **Guided Practice:** Point to the digit '4' in 745,132,896.
    - "What is the **place value** of this 4?" (Answer: ten millions place)
    - "Correct. And what is the **digit value** of this 4?" (Answer: forty million or 40,000,000)
6. Repeat with 2-3 other digits, ensuring Ayrik can distinguish between the name of the place and the value of the digit in that place.

Part 3: The Main Activity - "Mission: Build-a-Billion" (30 minutes)

1. **Setup:** Present the "Secret Mission" envelopes. Explain that each envelope contains a set of clues to build a specific "target number."
2. **Instruction:** "Detective, your mission is to use your digit cards and the place value chart to construct the target numbers described in these files. Open your first mission."
3. **Sample Missions (on cards inside envelopes):**
    - **Mission #1:** Build a 7-digit number where the digit in the thousands place is 8, the digit in the millions place is 2, and all other digits are 0. What is the number? (Answer: 2,008,000)
    - **Mission #2:** Build a 9-digit number. The value of one digit is 50,000,000. The value of another digit is 3. The digit in the hundreds place is twice the digit in the ones place. Fill the other places with any digits you want, but you can only use each digit once.
    - **Mission #3 (Creative Challenge):** Build the largest 9-digit number possible where the sum of the digits in the thousands period (hundred thousands, ten thousands, thousands) is exactly 15.
    - **Mission #4:** Build a number where the digit 7 is worth 100 times more than the digit 7 in the number 4,571. (Requires placing a 7 in the thousands place).
4. **Process:** Ayrik will work through the missions, using the cards and whiteboard to build his numbers. Encourage him to "think out loud" as he solves the puzzles.

Part 4: The Wrap-Up - "The Final Report" (15 minutes)

1. **Instruction:** "Excellent work solving those cases, Detective. For your final report, you get to be the creator. Design your own 10-digit 'mystery number.' It can be any number you want."
2. Ayrik writes his number on the whiteboard (e.g., 3,987,654,321).
3. **Task:** In his "Detective Log" (notebook), he must write a report on his number. The report must include:
    - The number written in word form (e.g., Three billion, nine hundred eighty-seven million...).
    - A list of three different digits from his number. For each digit, he must identify its **place value** and its **digit value**.
4. **Share:** Ayrik presents his final report, explaining his findings. This is a great chance for him to be the teacher.

4. Differentiation and Inclusivity

- **For Extra Support:** Keep numbers within the millions. Provide a pre-printed place value chart with the names of the places already written in. The mission cards can be simpler, focusing on only one or two conditions.
- **For an Advanced Challenge:** Introduce decimals into the missions (e.g., "Build a number where the digit in the tenths place is 3 and the digit in the ten thousands place is 5."). Ask comparative questions: "In your number, how many times greater is the value of the 8 than the value of the 2?"
- **Inclusivity:** The "detective" theme is gender-neutral and focuses on problem-solving, a universally engaging concept. The hands-on nature of the lesson caters to kinesthetic learners.

5. Assessment Methods

- **Formative (Ongoing):**
  - Observation of Ayrik's thinking process during the "Number Scramble."
  - Listening to his answers during the "Place vs. Value" briefing.
  - Watching how he manipulates the digit cards and solves the problems during the "Mission: Build-a-Billion" activity. I can ask questions like, "Why did you place that digit there?"
- **Summative (End of Lesson):**
  - The "Final Report" serves as the primary summative assessment. It demonstrates his ability to apply all the concepts learned in a creative way. I will check for accuracy in:
    1. Writing the number in word form.
    2. Correctly identifying the place value for three chosen digits.
    3. Correctly stating the digit value for those same three digits.