

LESSON PLAN (Linda Bolin)

Lesson Title: Representing Numbers Using Scientific Notation Course: Math 7 Date: September Lesson 5	
Utah State Core Content and Process Standards: 1.1b, 1.1c Simplify numerical expressions with whole number exponents Represent numbers greater than one using scientific notation	
Lesson Objective(s): Students will write numbers in exponential and scientific notation	
Enduring Understanding (Big Ideas): Representing numbers using scientific notation	Essential Questions: <ul style="list-style-type: none">• How does multiplying by a power of 10 affect the decimal?• How does scientific notation differ from standard notation?• How can a number be written in scientific notation?
Skill Focus: Write numbers in scientific notation	Vocabulary Focus: Base, exponent, power, exponential expression, power of ten, standard notation, scientific notation
Materials: <ul style="list-style-type: none">• graphing calculators• one die for each pair of students• Journal page (attached)	
Assessment (Traditional/Authentic): questioning, observation	
Ways to Gain/Maintain Attention (Primacy): technology, game, cooperative groups, journaling, discussion	
Written Assignment: Powers of 10 Yahtzee Scientific Notation journal page appropriate practice from text	

Content Chunks

Post vocabulary on the board

Starter (review):

1. What is the GCF for 12 and 24?
2. What is the LCM for 12 and 24?
3. What is the value 3^2 ?
4. What is the value of 10^0 ?
5. Jana and Kaylee are playing a dice game. The person who forms an expression having the greatest value wins the game. They roll two dice and get a 6 and a 2. Jana forms 6×2 . Kaylee forms 6^2 . Who won the game?

Lesson segment 1: How does multiplying by a power of 10 affect the decimal?

Have students play the following game to review finding the value of powers of 10.

Powers of 10 Yahtzee

Students play against an opponent. The pair needs one die. Players take turns rolling the die until each has rolled the die 5 times. Each time they roll the die, they are rolling a power of 10. The base number is always 10. The object of the game is to have the greatest sum after rolling five numbers. Player 1 rolls the die, writes the number as 10 to whatever power is indicated on the die and finds the value for that expression. Both players write the exponential expression on their assignment papers, and use their calculators to find the value of the expression. It is then player 2's turn to roll the dice, write the expression and find the value. The players continue taking turns until each has had 5 turns. Players record both the five turns for player one and the five turns for player two. At that point the player each find the sum of their answers. The player with the greatest sum wins.

After the game, ask students to write 1×10 to the power for each of the problems they did with their opponent. Have them place a decimal point after the 1. Then, ask the students to count the number of zeros that follow the one and the number of places the decimal was moved to get the value for their numbers. Have them look for a pattern in and write that pattern on their paper. Ask students to write 1×10 to each power up to the 10^{th} power: 10^0 , 10^1 , 10^2 , 10^3 , etc. Students should record their work on the game paper. Using Think-Team-Share, have students work individually, and then discuss with their team. Q. What is the pattern with the decimal point?

Now, have students to use their calculators to review the pattern for the decimal point when multiplying a number *other* than one by increasing powers of ten. For example, try 6.0×10^1 , 10^2 , 10^3 , 10^4 . Students should record their work on the assignment paper. Ask students to write down their prediction for 10^5 , 10^7 , and 10^8 , and check the predictions using their calculators.

Next, try 2.5×10^1 , 10^2 , 10^3 , 10^4 . etc. Ask students to write down their prediction for 10^5 , 10^7 , and 10^8 . Have them use their calculators to check their predictions. A richer discussion will evolve if you use Think-Team-Share where students work individually, then discuss with their team. After the team discussion, you select a student to describe the patterns or predictions and invite others to add to the response.

Have students complete the problems #3 and #4 on the journal page.

Lesson Segment 2: How does scientific notation differ from standard notation?

“Notation” means a system for using symbols to write something. The *standard notation* for my name is Linda Anne Bolin. An abbreviated notation might be LAB. Write the standard notation for your name. Then write an abbreviated notation.

We use abbreviated notations to make other standard notations quicker too, like PC for personal computer, or NASA for National Aeronautics and Space Administration. Write a standard notation for something else and the abbreviated notation for it too.

After giving them time to finish the task above, ask them which is quicker, writing the standard notation for their name or writing the abbreviated notation. Discuss that even though it is definitely quicker, the abbreviated notation might be confusing, since many others could have the same initials. Q. Does anyone in here have the same initials as someone else in here, or someone they know? Similarly, the abbreviated notations we use for organizations or objects can be confusing. *Rep* could be Representative like our elected officials, or it could mean repetitions like the number of reps you do when lifting weights.

Numbers can be written with abbreviated notations to. But, mathematics is such a powerful language, that there is a way to write the abbreviation for a number without it ever being confused with another numbers abbreviation. We call this way "scientific notation"

Lesson Segment 3: How can numbers be written in scientific notation?

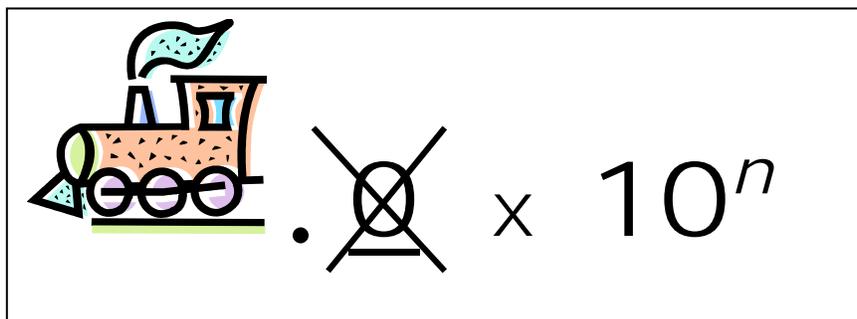
"I'm going to rewrite the number 3,200 using this scientific notation. Write 3.2×10^3 on the board and ask students to type this into their calculators to verify that it is indeed 3,200. Repeat this with a couple of numbers. Ask students to look at the pattern of what you have been doing, and to try writing 47,000 in scientific notation on their calculators without your doing it for them. Explain how to write a number in scientific notation. Do several examples with them and have them write the examples on the journal page for #1 and 2.

Show students how to select the scientific mode on their calculators and redo the models you gave them to do with pencil and paper. Q. How does the way the number looks on the calculator differ from the way the number looks on the paper? Focus on the *e* meaning "an exponent when the base is 10".

Sing the "Scientific Notation Train" song with them.

Do Mix-Freeze-Pair, where students move around the room until you say "Freeze!" Students stop and pair up and number themselves 1 and 2. You show a number in standard form on the overhead and ask for either #1 or #2 in each pair to tell their partner where the decimal will be placed. The other partner then tells what power of 10 will be used as a factor in order to move that decimal.

Have students complete the Scientific Notation Journal page. Assign appropriate practice for finding the value of powers of 10 and for writing numbers in scientific notation.



The Scientific Notation Train

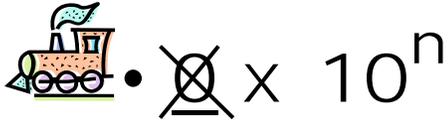
(Tune: Down At The Station. Lyrics by Linda Bolin.)

**First, move the decimal
Just behind the engine.
Next, drop the ending
Zeros off you see.**

**Then times by 10
And raise it to a power
Your number train runs
Scientifically**

Scientific Notation

Name _____



1. Here are some examples of numbers written in standard notation:
2. Here are some examples of numbers written in scientific notation:
3. Find the product for each of the following. Look for a pattern, so you can answer question #4.

$$6.1 \times 10^0 = \underline{\quad}, \quad 6.1 \times 10^1 = \underline{\quad}, \quad 6.1 \times 10^2 = \underline{\quad}, \quad 6.1 \times 10^3 = \underline{\quad}.$$

$$6.1 \times 10^4 = \underline{\quad}, \quad 6.1 \times 10^5 = \underline{\quad}, \quad 6.1 \times 10^6 = \underline{\quad}, \quad 6.1 \times 10^7 = \underline{\quad}.$$

4. Explain what happens to the decimal point when you multiply by a power of ten.

5. When changing a number in standard form to scientific notation, move the decimal to the right of the _____ digit. Then, count the number of places you moved the decimal. The number of places you moved the decimal is the _____ of 10 you have multiplied by in order to move that decimal.

$$52,000,000. \rightarrow 5.2 \underbrace{0000000}_{\text{seven places}} = 5.2 \times 10^7 \text{ or } 5.2e7$$

6. Here are five examples of numbers I have changed from standard notation to scientific notation: (write the standard number and the scientific notation)