

# Representing Numbers Using Scientific Notation

## Summary

Students will write numbers in exponential and scientific notation.

## Main Core Tie

Mathematics Grade 8

[Strand: EXPRESSIONS AND EQUATIONS \(8.EE\) Standard 8.EE.3](#)

## Materials

- Graphing calculators
- One die for each pair of students
- Journal page
- Powers of 10 Yahtzee
- Appropriate practice from text

## Background for Teachers

Enduring Understanding (Big Ideas):  
Representing numbers using scientific notation.

Essential Questions:

- 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.

Ways to Gain/Maintain Attention (Primacy):

Technology, game, cooperative groups, journaling, discussion.

## Instructional Procedures

Starter (review):

What is the GCF for 12 and 24?

What is the LCM for 12 and 24?

What is the value of  $3^2$ ?

What is the value of  $10^2$ ?

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  $6 \times 2$ . 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  $1 \times 10$  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  $1 \times 10$  to each power up to the 10<sup>th</sup> 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  $6.0 \times 10^1$ ,  $10^2$ ,  $10^3$ ,  $10^4$ . 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  $2.5 \times 10^1$ ,  $10^2$ ,  $10^3$ ,  $10^4$ . 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  $3.2 \times 10^3$  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.

#### Assessment Plan

Questioning, observation

#### Bibliography

This lesson plan was created by Linda Bolin.

#### Authors

[Utah LessonPlans](#)