

CURRIKI ALGEBRA UNIT 2
Linear and Exponential Relationships
Lesson 2.6: Understanding Scientific Notation

Unit 2 Linear and Exponential Relationships

The first nine lessons (2.1-2.9) provide the instruction and practice that supports the culminating activity in the final unit project.

Lesson 2.6: Understanding Scientific Notation

Students should experience a variety of types of situations modeled by functions. Detailed analysis of any particular class of functions at this stage is not advised. Students should apply these concepts throughout their future mathematics courses.

Common Core State Standards by Cluster

Grade Level	Cluster	CCS Standard
8		8.EE.4
9	Reason quantitatively and use units to solve problems	N.Q.1 (Note: This standard is addressed because students evaluate the value of numbers that are written in scientific notation.)

Lesson Preparation Resources for Teachers:

- [Introduction to Scientific Notation](#) (Sal Kahn video)
- [Scientific Notation](#) (Sal Kahn: This video explains scientific notation as a way of expressing very large or very small numbers.)
- [Learn without Limits: Scientific Notation](#)
- TE_Vocabulary Page
- TE Scientific Notation Check Answer Key
- [TE_Traveling Through Space with Scientific Notation](#)

Instructional Materials for Students (Print one copy for each student)

- [SE_Vocabulary Page](#)
- [SE_Scientific Notation Practice](#) (optional)
- [SE_Scientific Notation Worksheet](#) (optional)
- [SE_MLB Team Salaries](#) (1 per group)
- [SE_MLB Team Stats 2012](#) (1 per group)
- SE Scientific Notation Check

Time: 50-minutes session

Lesson Objectives:

Students will be able to:

- write very large and very small numbers in scientific notation.

- translate numbers from scientific notation to numerical form.
- add, subtract, multiply and divide numbers in scientific notation.

Lesson Content

1. Background Building Activity for Students (5 minutes)

a. Vocabulary Building:

Print out one copy of the Vocabulary Page (blank) for each student. Review the scientific notation vocabulary words with the whole class prior to the warm-up problem. Students will create their own definitions including a visual representation.

b. Warm-Up problem:

Write the following chart of expressions on the board. Students will work in groups of 2 or three to rewrite the exponential numbers in numerical form and then the multiples of 10 as powers of 10. One example of each has been done.

$1 \times 10,000$	1×10^4
	1×10^6
	1×10^3
	1×10^{-5}
	1×10^{-2}
	1×10^{-8}
3×1000	3×10^3
$1.45 \times 10,000$	
$0.756 \times 100,000$	
$279 \times 1,000,000$	
$4,315 / 10,000$	
$567 / 10,000$	

c. Student activity to lead into lesson focus question

Ask students to use Think-Share-Pair grouping to discuss the following:

What patterns did you see in the warm-up problem?

How is raising the number 10 to a positive power different than raising the number 10 to a negative power?

What happens to the decimal as the number is written in exponential form and numerical form?

2. Focus Question based on today's lesson

Today's focus question (write it on the board):

How can very large and very small numbers be represented, so calculations can be simplified?

Give students the following example: There are about 1200 major league baseball players. The total salaries of all major league baseball players are \$3.6 billion. (MLBplayers.com)

Write the total salaries in numerical form.

Find the average salary of major league baseball players.

Write both numbers in scientific notation.

a. Whole Group Activity:

Allow time for a think-share-pair before discussing as a whole group. Discuss the structure of scientific notation. Explain that the first part is a number (the coefficient) between 1.0 and 9.9 or in other words: $1.0 \leq n < 10.0$. This number is multiplied by a power of 10. Ask a few students to share their strategies for find the average salary of a MLB baseball player. Discuss using scientific notation to rewrite the total salaries. Demonstrate how to divide numbers written in scientific notation.

$$\frac{3.6 \times 10^9}{1.2 \times 10^3} = (3.6 \div 1.2) \times (10^9 \div 10^3) = 3 \times (10^{9-3}) = 3 \times 10^6$$

Discuss as a class the benefits to using scientific notation to represent very large and very small numbers. Ask students to think of other places where very large and very small numbers are used and where scientific notation would be helpful (examples may include: dealing with world populations, nanotechnology, space exploration, etc.)

b. Small Group Activity

(Teacher observes students while they work to check for understanding.) Ask students to form groups of 3 students (a group of two will work as well). Provide each group with the *2011 MLB Salaries by Team* and *MLB Team Stats 2011*. Ask student groups to write their numbers and answers in scientific notation.

c. Individual Activity:

(Teacher observes students while they work to check for understanding.)

Choose 5 MLB baseball teams. Find their total payroll for the past 5 years, round this number and write it in scientific notation. Next, find the number of homeruns for the team for the last 5 years. Find the cost per homerun.

The MLB team with the highest payroll is the New York Yankees with a payroll around \$ 203 million. The team with the lowest payroll is the Kansas City Royals with a payroll around \$ 3.6 million.

There can be 40 players on a MLB roster. If the average salary of a MLB player is \$3 million, what is the average salary for any MLB team. (Show the work using scientific notation). How does your favorite team's payroll or the team closest to your home's payroll compare to the average?

Finally, what question about MLB players and salaries can you write and solve using the data provided?

3. Whole class discussion (10 minutes)

- a. Students share solutions and findings with the rest of the class, by sharing their calculations and findings using scientific notation. Students can challenge the class to express the solutions in numerical form.

Discuss:

- What are the benefits to writing numbers in scientific notation?
- When is scientific notation most helpful?
- Who would use scientific notation?

- b. **Algorithm:**

To write numbers in scientific notation:

Begin by rewriting the number with the decimal to the right of the first non-zero digit (in other words as a number between 1.0 and 9.9). Include all other non-zero digits.

Second, count the number of places the decimal would need to move from this new position, to its original position. This becomes the power on the 10.

Finally, to determine the sign on the power by deciding the direction the decimal would need to move to get back to the original number. If the decimal needs to move to the left, the power of 10 is negative; and if the decimal needs to move to the right, the power of 10 is positive.

To add or subtract numbers in scientific notation:

- Make the exponents on the 10 the same by determining the number by which to increase the smaller exponent by so it is equal to the larger exponent.
- Increase the smaller exponent by this number and move the decimal point of the number with the smaller exponent to the left the same number of places. (divide by the appropriate power of 10 .)
- Add or subtract the new coefficients.
- If the answer is not in scientific notation convert it to scientific notation.

To multiply numbers in scientific notation:

- Multiply the coefficients--round to the number of significant figures in the coefficient with the smallest number of significant figures.

- Add the exponents.
- Convert the result to scientific notation.

To divide numbers in scientific notation:

- Divide the coefficients--round to the number of significant figures in the coefficient with the smallest number of significant figures.
- Subtract the exponents.
- Convert the result to scientific notation.

4. Assessment Activity (5 minutes)

Provide each student with a copy of the Scientific Notation Check-Up. Allow time to for students to complete the assessment. Assess understanding by checking student responses using the Scientific Notation Check-up Answer Key provided.

5. Extension Activities:

The following four activities could be used as extensions for this lesson

- [Traveling Through Space with Scientific Notation](#) Lesson Plan for Travel through Space with Scientific Notation in which students are required to write very large and very small numbers in scientific notation and vice-versa. Links are included for additional resources.
- [Winning Records and Salaries](#)
Find the team salaries for the top three finishers in the National League and the American League for the previous year. Write the numbers in Scientific Notation. Is there a correlation between salary and winning?
- [How much sand?](#) The approximate size of a grain of sand is 5 mm. (2.54 mm = 1 in). The distance from home to first base is 90 ft. Calculate how many grains of sand would fit, end to end from home plate to first base. Write this number in scientific notation. If the infield is 8, 100 ft², what is the total number of grains of sand in an infield? Write this number in scientific notation.
- [Scientific Notation: How big? How Far? How Many?](#) This lesson provides a practical application of using scientific notation in Astronomy.

6. Homework assignment for additional independent practice

Scientific Notation Practice Students practice writing numbers in scientific notation and writing numerical representations of numbers that were in scientific notation.

Scientific Notation Worksheet This worksheet allows students to practice writing numbers in scientific notation and compute with numbers in scientific notation.