

# Parent Newsletter

## Chapter 10: Exponents and Scientific Notation

### Standards

#### Common Core:

**8.EE.1:** Know and apply the properties of integer exponents to generate equivalent numerical expressions.

**8.EE.3:** Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other.

**8.EE.4:** Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.

### Key Terms

A **power** is a product of repeated factors.

The **base** of a power is the common factor.

The **exponent** of a power indicates the number of times the base is used as a factor.

A number is written in **scientific notation** when it is represented as the product of a factor and a power of 10.

### Essential Questions

How can you use exponents to write numbers?

How can you use inductive reasoning to observe patterns and write general rules involving properties of exponents?

How can you divide two powers that have the same base?

How can you evaluate a nonzero number with an exponent of zero? How can you evaluate a nonzero number with a negative integer exponent?

How can you read numbers that are written in scientific notation?

How can you write a number in scientific notation?

How can you perform operations with numbers written in scientific notation?

### Students will...

Write expressions using integer exponents.

Evaluate expressions involving integer exponents.

Multiply powers with the same base.

Find a power of a power.

Find a power of a product.

Divide powers with the same base.

Simplify expressions involving the quotient of powers.

Evaluate expressions involving numbers with zero as an exponent.

Evaluate expressions involving negative integer exponents.

Identify numbers written in scientific notation.

Write numbers in standard form.

Compare numbers in scientific notation.

Write large and small numbers in scientific notation.

Perform operations with numbers written in scientific notation.

Add, subtract, multiply, and divide numbers written in scientific notation.

Good to know.



### Key Ideas

#### Product of Powers Property

- To multiply powers with the same base, add their exponents.
- $a^m \cdot a^n = a^{m+n}$

#### Power of a Power Property

- To find a power of a power, multiply the exponents.
- $(a^m)^n = a^{mn}$

#### Power of a Product Property

- To find a power of a product, find the power of each factor and multiply.
- $(ab)^m = a^m b^m$

#### Quotient of Powers Property

- To divide powers with the same base, subtract their exponents.
- $\frac{a^m}{a^n} = a^{m-n}$ , where  $a \neq 0$

#### Zero Exponents

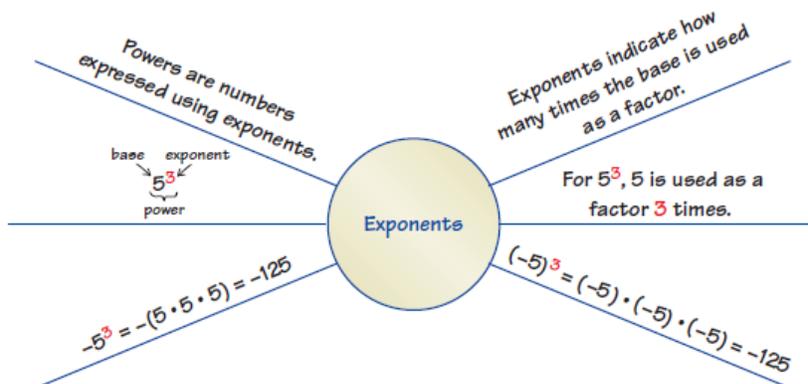
- For any nonzero number  $a$ ,  $a^0 = 1$ . The power  $0^0$  is *undefined*.
- $a^0 = 1$ , where  $a \neq 0$

#### Negative Exponents

- For any integer  $n$  and any nonzero number  $a$ ,  $a^{-n}$  is the reciprocal of  $a^n$ .
- $a^{-n} = \frac{1}{a^n}$ , where  $a \neq 0$

## Reference Tools

An **Information Wheel** can be used to organize information about a concept. Write the concept in the middle of the “wheel.” Then write information related to the concept on the “spokes” of the wheel. Related information can include, but is not limited to: vocabulary words or terms, definitions, formulas, procedures, examples, and visuals. This type of organizer serves as a good summary tool because any information related to a concept can be included.



## Key Ideas

### Writing Numbers in Standard Form

The absolute value of the exponent indicates how many places to move the decimal point.

- If the exponent is negative, move the decimal point to the left.
- If the exponent is positive, move the decimal point to the right.

### Scientific Notation

- A number is written in scientific notation when it is represented as the product of a factor and a power of 10.
- The factor must be greater than or equal to 1 and less than 10.

### Writing Numbers in Scientific Notation

**Step 1:** Move the decimal point so it is located to the right of the leading nonzero digit.

**Step 2:** Count the number of places you moved the decimal point. This indicates the exponent of the power of 10.

#### Number Greater Than or Equal to 10

- Use a positive exponent when you move the decimal point to the left.  $8600 = 8.6 \times 10^3$

#### Number Between 0 and 1

- Use a negative exponent when you move the decimal point to the right.  $0.0024 = 2.4 \times 10^{-3}$

## Quick Review

- - Use parentheses to write powers with negative bases.
  - When a number is written without an exponent, its exponent is 1.
  - When dividing powers, do not divide the bases.
  - Scientific notation is used to write very small and very large numbers.
  - When you write a number greater than or equal to 1 and less than 10 in scientific notation, use zero as the exponent.
  - To add or subtract numbers written in scientific notation with the same power of 10, add or subtract the factors. When the numbers have different powers of 10, first rewrite the numbers so they have the same power of 10.

## What's the Point?

The ability to use exponents and scientific notation is very useful in real life when working with very large and very small numbers. Have your student research the population of a few countries they would like to visit and write the numbers in scientific notation. Which country has the highest population per square mile? How about the lowest population per square mile? Why is this information useful?



The STEM Videos available online show ways to use mathematics in real-life situations. The Chapter 10: The Drake Equation STEM Video is available online at [www.bigideasmath.com](http://www.bigideasmath.com).