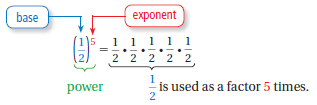
**10.1 Exponents**

|  |  |
| --- | --- |
| **Standards**  8.EE.1 | **Learning Objectives (I can…)**   * Write expressions using integer exponents * Evaluate expressions involving integer exponents |

A **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** is a product of repeated factors. The **\_\_\_\_\_\_\_\_\_\_\_\_\_**of a power is the common factor. The **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** of a power indicates the number of times the base is used as a factor.



**Example 1:** Writing Expressions Using Exponents

**Write each product using exponents**

**On Your Own:**

1. **2.**

**Example 2:** Evaluating Expressions

**Evaluate each expression.**

**Example 3:** Using Order of Operations

**Evaluate each expression.**

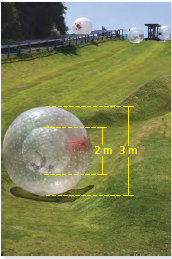
**On Your Own:**

1. **4. 5. 6.**

**Example 4:** Real Life Application

**In sphering, a person is secured inside a small, hollow sphere that is surrounded by a larger sphere. The space between the spheres is inflated with air. What is the volume of the inflated space?**

You can find the radius of each sphere by dividing each diameter given in the diagram by 2.



**On Your Own:**

**7. WHAT IF?** The diameter of the inner sphere is 1.8 meters. What is the volume of the inflated space?

**10.2 Product of Powers Property**

|  |  |
| --- | --- |
| **Standards**  8.EE.1 | **Learning Objectives (I can…)**   * Multiply powers with the same base * Find a power of a power * Find a power of a product |

**Key Idea**

**Product of Powers Property**

**Words:** To multiply powers with the same base, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ their exponents.

**Numbers: Algebra:**

**Power of Power Property**

**Words:** To find a power of a power, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the exponents.

**Numbers: Algebra:**

**Power of a Product Property**

**Words:** To find a power of a product, find the power of each factor and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**Numbers: Algebra:**

**Example 1:** Multiplying Powers with the Same Base

**Example 2:** Finding a Power of a Power

**Example 3:** Finding a Power of a Product

**Example 4:** Simplifying an Expression

**A gigabyte (GB) of computer storage space is bytes. The details of a computer are shown. How many bytes of total storage space does the computer have?**





The computer has 64 gigabytes of total storage space. Notice that you can write 64 as a power, . Use a model to solve the problem.

**10.3 Quotient of Powers Property**

|  |  |
| --- | --- |
| **Standards**  8.EE.1 | **Learning Objectives (I can…)**   * Divide powers with the same base * Simplify expressions involving the quotient of powers |

**Key Idea**

**Quotient of Powers Property**

**Words:** To divide powers with the same base, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ their exponents.

**Numbers: Algebra:**

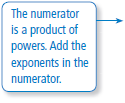
**Example 1:** Dividing Powers with the Same Base

**On Your Own:**

1. 3.
2. 4.

**Example 2:** Simplifying an Expression

**Simplify . Write your answer as a power.**



**Example 3:** Simplifying an Expression

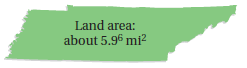
**Simplify . Write your answer as a power.**

**On Your Own:**

1. **6.**  **7.**

**Example 4:** Real-Life Application

**The projected population of Tennessee in 2030 is about . Predict the average number of people per square mile in 2030.**

Use a model to solve the problem.

**On Your Own:**

**The projected population of Alabama in 2030 is about . The land area of Alabama is about square kilometers. Predict the average number of people per square kilometer in 2030.**

**10.4 Zero and Negative Exponents**

|  |  |
| --- | --- |
| **Standards**  8.EE.1 | **Learning Objectives (I can…)**   * Evaluate expressions involving numbers with zero as an exponent * Evaluate expressions involving negative integer exponents |

**Key Idea**

**Zero Exponents**

**Words:** For any nonzero number *a*,\_\_\_\_\_\_\_\_\_\_\_\_\_. The power is undefined.

**Numbers: Algebra:**

**Negative Exponents**

**Words:** For any integer *n* and any nonzero number *a*, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is the reciprocal of .

**Numbers: Algebra:**

**Example 1:** Evaluating Expressions

**On Your Own:**

**Evaluate the expression.**

1. **2. 3.**
2. **5. 6.**

**Example 2:** Simplifying Expressions

**On Your Own:**

1. **8. 9.**

**Example 3:** Real-Life Application

**A drop of water leaks from a faucet every second. How many liters of water leak from the faucet in 1 hour?**

Convert 1 hour to seconds.

**On Your Own:**

**10. WHAT IF?** The faucet leaks water at a rate of 5−5 liter per second. How many liters of water leak from the faucet in 1 hour?

**10.5 Reading Scientific Notation**

|  |  |
| --- | --- |
| **Standards**  8.EE.3  8.EE.4 | **Learning Objectives (I can…)**   * Identify numbers written in scientific notation * Write numbers in scientific notation * Compare numbers in scientific notation |

**Key Idea**

**Scientific Notation**

A number is written in **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** when it is represented as the product of a factor and a power of 10. The factor must be greater than or equal to \_\_\_\_\_\_\_ and less than \_\_\_\_\_\_\_.



**Example 1:** Identifying Numbers Written in Scientific Notation

**Tell whether the number is written in scientific notation. Explain.**

**Key Idea**

**Writing Numbers in Standard Form**

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

* If the exponent is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, move the decimal point to the \_\_\_\_\_\_\_\_\_\_\_.
* If the exponent is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, move the decimal point to the \_\_\_\_\_\_\_\_\_\_\_.

**Example 2:** Writing Numbers in Standard Form

1. **Write** **in standard form.**
2. **Write** **in standard form.**

**On Your Own:**

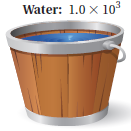
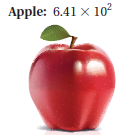
1. Is written in scientific notation? Explain.

**Write the number in standard form.**

1. **3.** **4.**

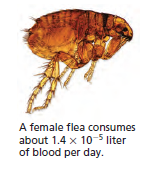
**Example 3:** Comparing Numbers in Scientific Notation

**An object with a lesser density than water will float. An object with a greater density than water will sink. Use each given density (in kilograms per cubic meter) to explain what happens when you place a brick and an apple in water.**



**Example 4:** Real-Life Application

**A dog has 100 female fleas. How much blood do the fleas consume per day?**



**On Your Own:**

1. **WHAT IF?** In Example 3, the density of lead is 1.14 × 104 kilograms per cubic meter. What happens when you place lead in water?
2. **WHAT IF?** In Example 4, a dog has 75 female fleas. How much blood do the fleas consume per day?

**10.6 Writing Scientific Notation**

|  |  |
| --- | --- |
| **Standards**  8.EE.3  8.EE.4 | **Learning Objectives (I can…)**   * Write large and small numbers in scientific notation * Perform operations with numbers written in scientific notation |

**Key Idea**

**Writing Numbers in Scientific Notation**

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

**Step 2:** Count the number of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_you moved the decimal point. This indicates the exponent of the power of \_\_\_\_\_\_\_\_\_\_\_\_\_\_, as shown below.

***Number Greater Than or Equal to 10 Number Between 0 and 1***

Use a \_\_\_\_\_\_\_\_\_\_\_\_\_ exponent when Use a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ exponent when

you move the decimal point you move the decimal point to

to the left. the right.



**Example 1:** Writing Large Numbers in Scientific Notation

**Google purchased YouTube for $1,650,000,000. Write this number in scientific notation.**



**Example 2:** Writing Small Numbers in Scientific Notation

**The 2004 Indonesian earthquake slowed the rotation of Earth, making the length of a day 0.00000268 second shorter. Write this number in scientific notation.**

**On Your Own:**

**Write the number in scientific notation.**

1. 500,000 **2.** 25,000,000 **3.** 683
2. 0.005 **5.** 0.00000033 **6.** 0.000506

**Example 3:** Using Scientific Notation

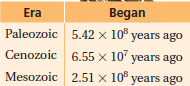
**An album has sold 8,780,000 copies. How many more copies does it need to sell to receive the award?**





**Example 3:** Real-Life Application

**The table shows when the last three geologic eras began. Order the eras from earliest to most recent.**



**10.7 Operations in Scientific Notation**

|  |  |
| --- | --- |
| **Standards**  8.EE.3  8.EE.4 | **Learning Objectives (I can…)**   * Add, subtract, multiply, and divide numbers written in scientific notation. |

To add or subtract numbers written in scientific notation with the same power of 10, add or subtract the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. When the numbers have different powers of 10, first \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the numbers so they have the same power of 10.

**Example 1:** Adding and Subtracting Numbers in Scientific Notation

**Find the sum or difference. Write your answer in scientific notation.**



**On Your Own:**

**Find the sum or difference. Write your answer in scientific notation.**

1. **2.**

To multiply or divide numbers written in scientific notation, multiply or divide the factors and powers of 10 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**Example 2:** Multiplying Numbers in Scientific Notation

**Find . Write your answer in scientific notation.**

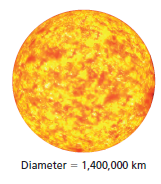
**Example 3:** Dividing Numbers in Scientific Notation

**Find . Write your answer in scientific notation.**

**On Your Own:**

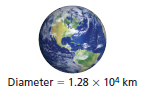
**Find the product or quotient. Write your answer in scientific notation.**

1. **4.**
2. **6.**



**Example 4:** Real-Life Application

**How many times greater is the diameter of the Sun than the diameter of Earth?**

Write the diameter of the Sun in scientific notation.