Scientific Notation

Name: _____

Prerequisite: Multiply and Divide by Powers of Ten

Study the example problem showing how to multiply a decimal number by a power of ten. Then solve problems 1–7.

Example

Find $1{,}000 \times 0.006$.

Start by breaking 1,000 into the product of tens. Then, multiply.

$$1{,}000 \times 0.006 = 10 \times 10 \times 10 \times 0.006$$
$$= 10 \times 10 \times 0.06$$
$$= 10 \times 0.6$$
$$= 6$$

This means that $1{,}000 \times 0.006 = 6$.

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1 Write the missing powers of 10.

   a. _____ $\times 0.005 = 5$ _____ $\times 0.005 = 0.5$

   b. $0.09 \times$ _____ $= 0.9$ $0.009 \times$ _____ $= 9$

2 Jane says that multiplying a decimal by 100 is the same as multiplying the decimal by three factors of 10. Is Jane correct? Explain your answer.

   _____

   _____

   _____

3 Complete the equations.

   a. $0.002 \times 100 =$ _____

   b. $0.05 \times 1{,}000 =$ _____

Vocabulary

power of ten a number that can be written as a product of tens.

$10 = 10$

$100 = 10 \times 10$

$1{,}000 = 10 \times 10 \times 10$

Solve.

4 Remember that division is the inverse of multiplication. Complete the table below to show dividing 7 by powers of 10.

Ones	•	Tenths	Hundredths	Thousandths	
7	•	0	0	0	
	•				$7 \div 10$
	•				$7 \div 100$
	•				$7 \div 1{,}000$

5 Daryl explains why $8.2 \div 10{,}000$ is 0.00082. Complete his explanation.

There are _____ factors of 10 in 10,000. Each time I divide a number by a factor of 10, the result is 10 times _____ than the original number. For example, if I divide 8.2 by 10, the result is 0.82. This means that 0.82 is 10 times _____ than 8.2. So, $8.2 \div 10{,}000$ is 0.00082.

6 Complete the equations.

a. $0.004 \times 100 = 0.004 \times 10^2 = $ _____

b. $0.4 \times 1{,}000 = 0.4 \times$ _____ $ = $ _____

c. $600 \div 100 = 600 \div 10^2 = $ _____

d. $0.6 \div$ _____ $ = 0.6 \div 10^1 = $ _____

7 Yara multiplies and divides a certain number by the same power of 10. The product she gets is 40,000 and the quotient she gets is 0.000004. Find Yara's number and the power of 10 she used. Explain your reasoning.

_____

_____

_____

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Name: _____

Write Numbers in Scientific Notation

Study the example problem showing how to write a number in scientific notation. Then solve problems 1–10.

Example

In one year, more than 90,000,000 passengers used the Hartsfield-Jackson Atlanta International Airport in Atlanta, Georgia. Write 90,000,000 in scientific notation.

A number written in scientific notation is the product of a number that is greater than or equal to 1 and less than 10 and a power of 10.

You can think of 90,000,000 as $9 \times 10,000,000$. You can write 10,000,000 as a product of seven 10s, so 10,000,000 written with an exponent is 10^7.

This means that 90,000,000 written in scientific notation is 9×10^7.

1 Suppose that more than 96,000,000 passengers used the airport in the example. Write 96,000,000 in scientific notation.

_____

2 Write 64,500 in scientific notation.

_____

3 Describe how you would write 5.04×10^6 in standard form.

_____

_____

_____

4 Is 21.5×10^3 in scientific notation? Explain.

_____

Vocabulary

scientific notation a way to express a number as the product of a number greater than or equal to 1 but less than 10 and a power of ten.

5.4×10^6

1.08×10^{-5}

Solve.

5 The number 0.003 written in scientific notation is 3×10^{-3}. Why is the exponent negative?

_____

_____

6 Write 0.00052 in scientific notation.

_____

7 Is 4.23×10^{-5} greater than 1 or less than 1? Explain how you know.

_____

_____

_____

8 Sylvester says that 0.000002015 written in scientific notation is 2.015×10^6. Do you agree with him? Explain why or why not.

_____

_____

9 Explain how you could write the mixed number $45\frac{3}{8}$ in scientific notation.

_____

_____

_____

10 Jalil makes a generalization about writing numbers in scientific notation. Complete his statement. When you write a number greater than or equal to 1 in scientific notation, the exponent of the power of 10 will be _____.

When you write a number between 0 and 1 in scientific notation, the exponent of the power of 10 will be _____.

Name: _____

Compare Numbers in Scientific Notation

Study the example problem showing how to compare two numbers written in scientific notation. Then solve problems 1–7.

Example

The total area of Rhode Island is about 1.5×10^3 square miles. The total area of Georgia is about 6×10^4 square miles. The total area of Georgia is about how many times the total area of Rhode Island?

Use Standard Form

$1.5 \times 10^3 = 1,500$

$6 \times 10^4 = 60,000$

Compare by dividing: $\frac{60,000}{1,500} = 40$

60,000 is 40 times 1,500.

Use Scientific Notation

Compare the parts of 1.5×10^3 and 6×10^4.

$\frac{6}{1.5} = 4 \qquad \frac{10^4}{10^3} = 10^{4-3} = 10^1$

Combine the results: $4 \times 10^1 = 40$.

6×10^4 is 40 times 1.5×10^3.

The total area of Georgia is about 40 times the total area of Rhode Island.

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1 Which of the two methods shown in the example problem do you prefer? Explain why.

_____

_____

2 The total area of Ohio is about 4.5×10^4 square miles. The total area of Ohio is about how many times the total area of Rhode Island?

_____

3 Which is greater, 9×10^{-2} or 3×10^{-4}? How many times greater is the number you chose than the other number? Explain your reasoning.

_____

_____

Solve.

4 The total area of Kansas that is covered by water is about 5×10^2 square miles. The total area of Alaska that is covered by water is about 9.5×10^4 square miles. The total water area of Alaska is about how many times the total water area of Kansas?

Show your work.

Solution: _____

_____

5 The average masses of several insects or animals are shown in the table. The average mass of a hummingbird is about how many times the average mass of a housefly?

Insect or Animal	Average Mass (g)
Ant	4×10^{-3}
Bee	1×10^{-1}
Housefly	1.2×10^{-2}
Ruby-throated hummingbird	3.6

_____

6 Look at the table in problem 5.

a. Write the masses of the ant, bee, and housefly in order from greatest mass to least mass.

_____

b. The mass of the insect with the greatest mass is about how many times the mass of the insect with the least mass?

_____

7 The population of the United States is about 3.2×10^8. The population of the United States is about 80 times the population of Oregon. Write the population of Oregon in scientific notation.

_____

Name: _____

Scientific Notation

Solve the problems.

1 Which of the following expressions is equivalent to 4,325,000,000?

- **A** 4.325×10^{-9}
- **C** 4.325×10^{6}
- **B** 4.325×10^{-6}
- **D** 4.325×10^{9}

Carson chose **A** as the correct answer. How did he get that answer?

Will the exponent be positive or negative?

_____

_____

2 The mass of Earth's moon is about 7×10^{22} kilograms. The mass of Jupiter is about 1.89×10^{27} kilograms. The mass of Jupiter is about how many times the mass of Earth's moon?

Show your work.

How can the parts of each number help you to compare?

Solution: _____

3 Last year a restaurant chain spent 3.3×10^{6} dollars opening new restaurants. This year the restaurant will spend 9.9×10^{5} dollars. Which statement is true?

- **A** The restaurant spent $330,000 dollars last year.
- **B** This year the restaurant will spend $9,900,000.
- **C** The restaurant spent 6.6×10^{6} dollars more this year than last year.
- **D** This year the restaurant will spend about 0.3 times the amount it did last year.

How can you write numbers in standard form?

Solve.

4 Which of the following numbers is NOT in scientific notation?

> What does it mean for a number to be in scientific notation?

A 4.5×10^{-12}

B 3.025×10^{-9}

C 0.21×10^{7}

D 1.1×10^{10}

5 Write 0.0000003105 in scientific notation. Explain how you found your answer.

Show your work.

> Is the number between 0 and 1 or is it greater than 1? What does that tell you about the number in scientific notation?

Solution: _____

6 The area of the Pacific Ocean is about 1.56×10^{8} square kilometers. The area of the East China Sea is about 1.2×10^{6} square kilometers. Tell whether each statement is *True* or *False*.

> How do you compare numbers in scientific notation?

a. The area of the Pacific Ocean is about 15,600,000 square kilometers. ☐ True ☐ False

b. The area of the Pacific Ocean is about 130 times the area of the East China Sea. ☐ True ☐ False

c. The area of the East China Sea is about 130 times the area of the Pacific Ocean. ☐ True ☐ False

d. The area of the East China Sea is about 1,200,000 square kilometers. ☐ True ☐ False