GRADE 7 ACCELERATED · UNIT 3 · LESSON 9

Writing Small Numbers in Scientific Notation

MA.8.NSO.1.4

I can write very small numbers in scientific notation, read them back, and find how many times larger or smaller one number is than another.

Warm-Up

1. Write $4{,}300{,}000$ in scientific notation.
2. Write 10^{-3} as a fraction.
3. $\sqrt{95}$ is between which two whole numbers?
4. Write 0.007 as a fraction.

Warm-Up

1. Write 4,300,000 in scientific notation. **4.3×10^6**
2. Write 10^{-3} as a fraction. $\frac{1}{1{,}000}$
3. $\sqrt{95}$ is between which two whole numbers? **9 and 10**
4. Write 0.007 as a fraction. $\frac{7}{1{,}000}$

Vocabulary

negative power of 10

$10^{-n} = \frac{1}{10^n}$: a 1 in the nth decimal place. $10^{-3} = \frac{1}{1{,}000} = 0.001$

scientific notation

$a \times 10^n$ with $1 \le a < 10$ and n an integer — for a number less than 1, n is negative: $0.00025 = 2.5 \times 10^{-4}$

Notes

I. Negative powers of ten name the decimal places

10^0	10^{-1}	10^{-2}	10^{-3}	10^{-4}	10^{-5}
1	0.1	0.01	0.001	0.0001	0.00001

$$10^{-n} = \frac{1}{10^n} \qquad 10^{-3} = \frac{1}{1{,}000} = 0.001$$

A negative exponent puts the 1 in that decimal place: 10^{-4} is a 1 in the fourth place.

Notes

II. Small numbers in scientific notation

$$0.000007 = 7 \times 10^{-6} \qquad 0.0000672 = 6.72 \times 10^{-5}$$

$$3.4 \times 10^{-9} = 0.0000000034$$

The coefficient is still at least 1 and less than 10. The exponent is negative for a number less than 1.

The exponent is how many places the point moves: from 0.0000672 to 6.72 is five places right, so 10^{-5}.

Notes

III. How many times larger — or smaller?

$$\frac{7.2 \times 10^{-4}}{1.8 \times 10^{-7}} = 4 \times 10^{3} = 4{,}000 \qquad \frac{3 \times 10^{8}}{3 \times 10^{-4}} = 10^{12}$$

Divide the coefficients. Divide the powers of 10 — subtract the exponents. Multiply the results.

Which is bigger, 10^{-5} or 10^{-8}? The one with the larger exponent: $-5 > -8$, so 10^{-5}.

Example 1

The density of oxygen is 1,332 millionths of a gram per cubic centimeter.

Write this value as a decimal, then in scientific notation.

Example 1

$$\frac{1{,}332}{1{,}000{,}000} = 0.001332$$

$$0.001332 = 1.332 \times 10^{-3}$$

Answer: $0.001332 = 1.332 \times 10^{-3}$

Your Turn

A human hair is about 67 hundred-thousandths of an inch thick.

Write this value in scientific notation.

Your Turn

A human hair is about 67 hundred-thousandths of an inch thick.

Write this value in scientific notation.

67 hundred-thousandths = 0.00067

Move the point 4 places right: 6.7

$6.7 \times 10^{-4} = 0.00067$

Answer: 6.7×10^{-4}

Example 2

How many times larger is 7.2×10^{-4} than 1.8×10^{-7} ?

Example 2

$$\frac{7.2}{1.8} = 4$$

$$\frac{10^{-4}}{10^{-7}} = 10^{-4-(-7)} = 10^{3}$$

$$4 \times 10^{3} = 4{,}000$$

Answer: 4,000 times larger

Your Turn

How many times larger is 5.2×10^{-3} than 2.6×10^{-8} ?

Your Turn

How many times larger is 5.2×10^{-3} than 2.6×10^{-8} ?

Divide the numbers: $5.2 \div 2.6 = 2$

Divide the powers: $10^{-3} \div 10^{-8} = 10^{-3-(-8)} = 10^{5}$

$2 \times 10^{5} = 200{,}000$

Answer: 200,000 times larger

Whiteboards · Question 1 of 9

$$10^{-7}$$

Answer it.

Whiteboards · Question 1 of 9

$$10^{-7}$$

$$10^{-7} = \frac{1}{10^{7}} = \frac{1}{10{,}000{,}000} = 0.0000001$$

Answer: 0.0000001

Whiteboards · Question 2 of 9

Write 0.003 in scientific notation.

Answer it.

Whiteboards · Question 2 of 9

Write 0.003 in scientific notation.

The 3 is in the thousandths place: $0.001 = 10^{-3}$

$3 \times 10^{-3} = 0.003$

Answer: 3×10^{-3}

Whiteboards · Question 3 of 9

Write 2.5×10^{-4} in standard form.

Answer it.

Whiteboards · Question 3 of 9

Write 2.5×10^{-4} in standard form.

$10^{-4} = 0.0001$

$2.5 \times 0.0001 = 0.00025$

Answer: 0.00025

Whiteboards · Question 4 of 9

A machine's cutting tolerance is 0.0000988 inch.

The part it cuts is 4 inches long.

Write the tolerance in scientific notation.

Answer it.

Whiteboards · Question 4 of 9

A machine's cutting tolerance is 0.0000988 inch.

The part it cuts is 4 inches long.

Write the tolerance in scientific notation.

Move the point 5 places right: 9.88

$9.88 \times 10^{-5} = 0.0000988$

Answer: 9.88×10^{-5}

Whiteboards · Question 5 of 9

Which is 0.00081 written in scientific notation?

A. 8.1×10^{-3}

B. 8.1×10^{4}

C. 81×10^{-5}

D. 8.1×10^{-4}

Answer it.

Whiteboards · Question 5 of 9

Which is 0.00081 written in scientific notation?

Move the point 4 places right: 8.1

$8.1 \times 10^{-4} = 0.00081$

Answer: D — 8.1×10^{-4}

Whiteboards · Question 6 of 9

How many times larger is 6×10^{-3} than 2×10^{-5} ?

A. 300

B. 30

C. 3

D. 0.03

Answer it.

Whiteboards · Question 6 of 9

How many times larger is 6×10^{-3} than 2×10^{-5} ?

Divide the numbers: $6 \div 2 = 3$

Divide the powers: $10^{-3} \div 10^{-5} = 10^{-3-(-5)} = 10^{2}$

$3 \times 10^{2} = 300$

Answer: A — 300

Whiteboards · Question 7 of 9

Which is greater, 5.3×10^{-4} or 8.9×10^{-6} ?

Answer it.

Whiteboards · Question 7 of 9

Which is greater, 5.3×10^{-4} or 8.9×10^{-6} ?

$$5.3 \times 10^{-4} = 0.00053$$

$$8.9 \times 10^{-6} = 0.0000089$$

Answer: 5.3×10^{-4}

Whiteboards · Question 8 of 9

A computer displays a number as 4.2E−6.

Write the number in standard form.

Answer it.

Whiteboards · Question 8 of 9

A computer displays a number as 4.2E−6.

Write the number in standard form.

4.2E−6 means 4.2×10^{-6}

$4.2 \times 10^{-6} = 0.0000042$

Answer: 0.0000042

Whiteboards · Question 9 of 9

Fishing line A is 2×10^{-2} inch thick.

Fishing line B is 6×10^{-2} inch thick.

Which is thicker, and how many times? Name a thickness between them.

Write your answer in sentences.

Whiteboards · Question 9 of 9

Fishing line A is 2×10^{-2} inch thick.

Fishing line B is 6×10^{-2} inch thick.

Which is thicker, and how many times? Name a thickness between them.

Same power of 10, so compare 2 and 6.

$6 \div 2 = 3$

Between them: 4×10^{-2}

Answer: B; 3 times; e.g. 4×10^{-2} in.

Independent Set

1. Write 0.00047 in scientific notation.
2. Write 9.4×10^{-3} in standard form.
3. Write 0.0000061 in scientific notation.
4. Which is greater, 2.4×10^{-6} or 8.1×10^{-9} ?
5. How many times larger is 8×10^{-2} than 4×10^{-5} ?
6. A computer displays a number as $3.7\text{E}{-5}$. Write it in standard form.

IXL

1. Open IXL and start today's skills.
2. Work on paper where the question needs work. The answer box does not show it.
3. Every skill listed is required, to a SmartScore of 67. Due by the Unit 3 test.

Today's skills — all required

Convert between standard and scientific notation: small numbers — 85M

Compare small numbers — KDR

Powers of ten with negative exponents — SKD