

Tiny Powers, Big Numbers

Use powers of ten to write, compare, and order positive numbers.

GRADE 7 • 7.NS.1

7.NS.1 "The student will investigate and describe the concept of exponents for powers of ten and compare and order numbers greater than zero written in scientific notation..."

NAME _____

DATE _____

NEGATIVE POWERS OF TEN

When the exponent drops by 1, the value is divided by 10. A power such as 10^{-n} equals $1/10^n$, and multiplying by it moves a decimal point left n places.

WORKED EXAMPLE

Write 10^{-4} as a fraction and as a decimal.

1. Start with $10^0 = 1$.
2. Divide by 10 four times: $10^{-4} = 1/10^4$.
3. Write 10^4 as 10,000: $1/10,000 = 0.0001$.

Answer: $1/10,000 = 0.0001$

PRACTICE 6 problems

- 1** Write 10^{-3} as a fraction and as a decimal.

ANSWER _____

- 2** Write 10^{-5} as a fraction and as a decimal.

ANSWER _____

- 3** Write 7.3×10^2 in decimal form.

ANSWER _____

- 4** Write 0.0000068 in scientific notation.

ANSWER _____

- 5** Write $<$, $>$, or $=$. 2.9×10^7 ____ 8.1×10^6

ANSWER _____

- 6** Order from least to greatest: 5.2×10^{-2} , 7.8×10^{-3} , 1.6×10^{-1} , 9.0×10^{-2}

ANSWER _____

APPLY IT Show your work

- 1** A game update uses 3.5×10^8 bytes. A new character pack uses 6.2×10^6 bytes. Which uses more storage? How many more bytes does it use?

WORK SPACE

ANSWER _____

- 2** For a slow-motion video, one frame lasts 0.008 seconds. A second clip has frames that last 3.6×10^{-3} seconds. Which frame lasts longer? Write both times in scientific notation.

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

Without converting to ordinary decimals, order these numbers from least to greatest. Then explain how you decided: 6.7×10^{-8} , 2.3×10^{-6} , 9.5×10^{-7} , 1.8×10^{-8} .

PART 1 • PRACTICE

#	PROBLEM	ANSWER
1	Write 10^{-3} as a fraction and as a decimal.	$1/1,000 = 0.001$
2	Write 10^{-5} as a fraction and as a decimal.	$1/100,000 = 0.00001$
3	Write 7.3×10^2 in decimal form.	730
4	Write 0.0000068 in scientific notation.	6.8×10^{-6}
5	Write $<$, $>$, or $=$. 2.9×10^7 ____ 8.1×10^6	$>$
6	Order from least to greatest: 5.2×10^{-2} , 7.8×10^{-3} , 1.6×10^{-1} , 9.0×10^{-2}	7.8×10^{-3}, 5.2×10^{-2}, 9.0×10^{-2}, 1.6×10^{-1}

PART 2 • APPLY IT

- The game update uses more storage, by 343,800,000 bytes.** Convert the amounts to 350,000,000 and 6,200,000. Subtract to get 343,800,000 bytes.
- $0.008 = 8 \times 10^{-3}$, and $3.6 \times 10^{-3} = 3.6 \times 10^{-3}$. The first clip's frame lasts longer.** Rewrite 0.008 as 8×10^{-3} . The exponents match, so compare 8 and 3.6.

CHALLENGE

1.8×10^{-8} , 6.7×10^{-8} , 9.5×10^{-7} , 2.3×10^{-6} . A more negative exponent makes a smaller positive power of ten, and coefficients are compared when exponents match.

Accept equivalent decimal forms with trailing zeros. Accept scientific notation only when the coefficient is at least 1 and less than 10, and require the stated comparison or order.