LESSON MAKER PRO

Powers in Action

Use exponent rules to work with very large and very small numbers.

HIGH SCHOOL · MT.CORE.NUM.REAL.1

MT.CORE.NUM.REAL.1 "Use reasoning to establish properties of integer exponents, including scientific notation."

NAME _____ DATE _____

THE BIG IDEA

When you multiply powers of 10, add their exponents because you are joining groups of factors of 10. When you divide powers of 10, subtract the exponents; a negative exponent means take the reciprocal. In scientific notation, the number before the multiplication sign must be at least 1 but less than 10.

WORKED EXAMPLE

Write $(9 \times 10^7)(8 \times 10^6)$ in scientific notation.

1. Multiply the numbers in front: 9 x 8 = 72.
2. Add the exponents: $10^7 \times 10^6 = 10^{13}$.
3. Rewrite 72×10^{13} as 7.2×10^{14}.

Answer: 7.2×10^{14}

PRACTICE 6 problems

1 Write $10^4 \times 10^2$ as one power of 10.

ANSWER _____

2 Write $10^4 / 10^6$ as one power of 10.

ANSWER _____

3 Write 10^{-3} as a fraction.

ANSWER _____

4 Write $(2 \times 10^3)(4 \times 10^2)$ in scientific notation.

ANSWER _____

5 Write $(6 \times 10^4) / (2 \times 10^2)$ in scientific notation.

ANSWER _____

6 Write 0.00042 in scientific notation.

ANSWER _____

APPLY IT Show your work

1 A short video file uses 4×10^7 bytes of storage. Your phone has 2×10^{10} bytes of free storage. How many of these files can fit if you use all the free storage for them?

WORK SPACE

ANSWER _____

2 An indie game has 2×10^5 downloads. Each download uses 3×10^7 bytes. How many bytes are downloaded altogether? Write your answer in scientific notation.

WORK SPACE

ANSWER _____

CHALLENGE One step up

A student writes $(4 \times 10^{-2})(6 \times 10^3) = 24 \times 10^{-6}$. Explain the error, then write the correct product in scientific notation.

WORK SPACE AND ANSWER

Powers in Action

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Write $10^4 \times 10^2$ as one power of 10.	**10^6**
2	Write $10^4 / 10^6$ as one power of 10.	**10^{-2}**
3	Write 10^{-3} as a fraction.	**1/1000**
4	Write $(2 \times 10^3)(4 \times 10^2)$ in scientific notation.	**8×10^5**
5	Write $(6 \times 10^4) / (2 \times 10^2)$ in scientific notation.	**3×10^2**
6	Write 0.00042 in scientific notation.	**4.2×10^{-4}**

PART 2 · APPLY IT

1. **500 files** Divide the storage by the file size: $(2 \times 10^{10}) / (4 \times 10^7) = 0.5 \times 10^3 = 500$.
2. **6×10^{12} bytes** Multiply the number of downloads by the bytes per download: $(2 \times 3) \times 10^{5+7} = 6 \times 10^{12}$ bytes.

CHALLENGE

The student multiplied the exponents instead of adding them. Since -2 + 3 = 1, the product is $24 \times 10^1 = 2.4 \times 10^2$.

For the storage problem, accept 5×10^2 files as well as 500 files. In the challenge, the explanation must identify that exponents are added when powers of 10 are multiplied.