LESSON MAKER PRO

Powers at Scale

Estimate huge and tiny quantities with powers of 10.

GRADE 8 · 8.EE.A.3

CCSS.Math.Content.8.EE.A.3 "Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. For example..."

NAME _____ DATE _____

COMPARE POWERS OF 10

Write an estimate as a single digit from 1 through 9 multiplied by a power of 10. To find how many times as much one quantity is, divide the coefficients and subtract the exponents.

WORKED EXAMPLE

Estimate A is 6×10^{12}. Estimate B is 4×10^{10}. How many times as much is A as B?

1. Divide: $(6 \times 10^{12}) / (4 \times 10^{10})$.
2. Divide coefficients and subtract exponents: $(6/4) \times 10^{(12 - 10)} = 1.5 \times 10^{2}$.
3. $1.5 \times 100 = 150$.

Answer: A is 150 times as much as B.

PRACTICE 6 problems

1 Write 0.00000009 as a single digit times a power of 10.

ANSWER _____

2 Write 80,000,000 as a single digit times a power of 10.

ANSWER _____

3 Write 7×10^{6} as an ordinary number.

ANSWER _____

4 Estimate A is 8×10^{8}. Estimate B is 2×10^{7}. How many times as much is A as B?

ANSWER _____

5 Estimate C is 5×10^{-3}. Estimate D is 2×10^{-5}. How many times as much is C as D?

ANSWER _____

6 Which estimate is larger, 1×10^{11} or 5×10^{9}? How many times larger is it?

ANSWER _____

APPLY IT Show your work

1 An online game estimates that players earned 7×10^8 points during one tournament. Players earned 2×10^7 points during a smaller tournament. About how many times as many points were earned during the first tournament?

WORK SPACE

ANSWER _____

2 A short video file uses about 9×10^9 bits of data. An audio clip uses about 3×10^7 bits of data. About how many times as many bits does the video file use?

WORK SPACE

ANSWER _____

CHALLENGE One step up

A lab estimates one sample has a mass of 2×10^{-7} grams and another has a mass of 5×10^{-10} grams. How many times as large is the first mass? Explain why you must use both the coefficients and the exponents.

WORK SPACE AND ANSWER

ANSWER KEY # Powers at Scale

GRADE 8 · 8.EE.A.3

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Write 0.00000009 as a single digit times a power of 10.	**9×10^{-8}**
2	Write 80,000,000 as a single digit times a power of 10.	**8×10^{7}**
3	Write 7×10^{6} as an ordinary number.	**7,000,000**
4	Estimate A is 8×10^{8}. Estimate B is 2×10^{7}. How many times as much is A as B?	**40 times**
5	Estimate C is 5×10^{-3}. Estimate D is 2×10^{-5}. How many times as much is C as D?	**250 times**
6	Which estimate is larger, 1×10^{11} or 5×10^{9}? How many times larger is it?	**1×10^{11} is larger, and it is 20 times larger.**

PART 2 · APPLY IT

1. **35 times as many points** Divide the estimates: $(7 \times 10^{8}) / (2 \times 10^{7}) = (7/2) \times 10^{1} = 35$.
2. **300 times as many bits** Divide the estimates: $(9 \times 10^{9}) / (3 \times 10^{7}) = 3 \times 10^{2} = 300$.

CHALLENGE

The first mass is 400 times as large. $(2/5) \times 10^{(-7 - (-10))} = (2/5) \times 10^{3} = 400$, so the coefficient ratio as well as the exponent difference matters.

Accept equivalent forms such as 90×10^{-9} for 9×10^{-8}, although the requested form uses one nonzero digit before the power of 10. For comparison answers, accept a correct ratio written as a number of times.