

Scale It Up

Use powers of 10 to compare huge and tiny quantities.

GRADE 8 • NY-8.EE.3

NY-8.EE.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."

NAME _____

DATE _____

COMPARE WITH DIVISION

To find how many times as large one quantity is, divide the larger quantity by the smaller quantity. Divide the coefficients, subtract the exponents, then round the coefficient if you need an estimate with one digit.

WORKED EXAMPLE

Estimate how many times as large 1×10^{16} is as 5×10^9 . Write the answer as a single digit times a power of 10.

1. $(1 \times 10^{16}) \div (5 \times 10^9) = (1 \div 5) \times 10^{16-9}$.

2. $(1/5) \times 10^7 = 0.2 \times 10^7$.

3. Rewrite 0.2×10^7 as 2×10^6 .

Answer: 2×10^6 times

PRACTICE 6 problems

- 1** Write 300,000,000,000 as a single digit times a power of 10.

ANSWER _____

- 2** Write 0.00000000000006 as a single digit times a power of 10.

ANSWER _____

- 3** How many times as large is 8×10^{12} as 2×10^8 ?

ANSWER _____

- 4** Which quantity is larger, 7×10^{-3} or 2×10^{-6} ? Estimate how many times as large it is.

ANSWER _____

- 5** Estimate $(4 \times 10^7) \div (6 \times 10^6)$. Write the estimated factor as a single digit times a power of 10.

ANSWER _____

- 6** Estimate $(3 \times 10^{14}) \div (8 \times 10^{10})$. Write the estimated factor as a single digit times a power of 10.

ANSWER _____

APPLY IT Show your work

- 1** An online game has 6×10^{14} bytes of data stored on its servers. One game update is 2×10^{11} bytes. How many times as large is the stored game data as the update?

WORK SPACE

ANSWER _____

- 2** A phone sensor records one signal that lasts 5×10^{-9} seconds and another that lasts 2×10^{-12} seconds. Estimate how many times as long the first signal lasts.

WORK SPACE

ANSWER _____

CHALLENGE One step up

A digital movie file is 9×10^{15} bytes, and a school photo is 4×10^{12} bytes. In 2 sentences, estimate how many times as large the movie file is, then explain why you must divide the coefficients as well as subtract the exponents.

WORK SPACE AND ANSWER

PART 1 • PRACTICE

#	PROBLEM	ANSWER
1	Write 300,000,000,000 as a single digit times a power of 10.	3×10^{11}
2	Write 0.0000000000006 as a single digit times a power of 10.	6×10^{-13}
3	How many times as large is 8×10^{12} as 2×10^8 ?	4×10^4 times
4	Which quantity is larger, 7×10^{-3} or 2×10^{-6} ? Estimate how many times as large it is.	7×10^{-3} is larger; about 4×10^3 times as large.
5	Estimate $(4 \times 10^7) \div (6 \times 10^6)$. Write the estimated factor as a single digit times a power of 10.	About 7×10^0 times
6	Estimate $(3 \times 10^{14}) \div (8 \times 10^{10})$. Write the estimated factor as a single digit times a power of 10.	About 4×10^3 times

PART 2 • APPLY IT

- 3×10^3 times** Divide the quantities: $(6 \div 2) \times 10^{14} = 11$. This equals 3×10^3 times.
- About 3×10^3 times** The ratio is $(5 \div 2) \times 10^{-9} - (-12) = 2.5 \times 10^3$. Round 2.5 to 3 for a one-digit estimate.

CHALLENGE

The movie file is about 2×10^3 times as large. Subtracting exponents gives 10^3 , and dividing the coefficients gives $9/4$, so the ratio is 2.25×10^3 , which rounds to 2×10^3 .

Accept equivalent correctly normalized forms when the value is exact. For Problem 5, accept about 7×10^0 times because $20/3$ is about 7, not 2×10^1 .