

Scale It Up

Compare huge and tiny quantities with scientific notation.

GRADE 8 • 8.NR.2.3

8.NR.2.3 "Use numbers expressed in scientific notation to estimate very large or very small quantities, and to express how many times as much one is than the other."

NAME _____

DATE _____

COMPARE POWERS OF TEN

To find how many times as much one quantity is as another, divide the larger quantity by the smaller quantity. Divide the coefficients, subtract the exponents, and rewrite the result in scientific notation if needed.

WORKED EXAMPLE

How many times as much is 7.2×10^{11} as 2.4×10^7 ?

1. Write a division expression: $(7.2 \times 10^{11}) / (2.4 \times 10^7)$.
2. Divide the coefficients: $7.2 / 2.4 = 3$.
3. Subtract the exponents: $10^{(11 - 7)} = 10^4$.
4. Combine the results: 3×10^4 .

Answer: 3×10^4 times as much

PRACTICE 6 problems

- 1** How many times as much is 4×10^8 as 5×10^6 ?

ANSWER _____

- 2** How many times as much is 9×10^{-4} as 3×10^{-7} ?

ANSWER _____

- 3** Estimate how many times as much is 6×10^{12} as 2×10^9 .

ANSWER _____

- 4** How many times as much is 1.5×10^{-8} as 5×10^{-10} ?

ANSWER _____

- 5** How many times as much is 8×10^{15} as 2×10^{11} ?

ANSWER _____

- 6** How many times as much is 7×10^{-3} as 1.4×10^{-5} ?

ANSWER _____

APPLY IT Show your work

- 1** A student posts a video that gets about 3×10^6 views. Another video gets about 6×10^4 views. About how many times as many views does the first video get?

WORK SPACE

ANSWER _____

- 2** A phone camera pixel is about 1.2×10^{-6} meter wide. A dust grain is about 3×10^{-5} meter wide. About how many times as wide is the dust grain?

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

A giant sequoia is about 9×10^1 meters tall. A bacterium is about 4×10^{-6} meters long. About how many times as tall is the sequoia as the bacterium is long? Explain how you handle the coefficient in your answer.

PART 1 • PRACTICE

#	PROBLEM	ANSWER
1	How many times as much is 4×10^8 as 5×10^6 ?	8×10^1 times as much
2	How many times as much is 9×10^{-4} as 3×10^{-7} ?	3×10^3 times as much
3	Estimate how many times as much is 6×10^{12} as 2×10^9 .	3×10^3 times as much
4	How many times as much is 1.5×10^{-8} as 5×10^{-10} ?	3×10^1 times as much
5	How many times as much is 8×10^{15} as 2×10^{11} ?	4×10^4 times as much
6	How many times as much is 7×10^{-3} as 1.4×10^{-5} ?	5×10^2 times as much

PART 2 • APPLY IT

- 5×10^1 times as many views** Divide 3×10^6 by 6×10^4 . The coefficients give $1/2$, and $10^{(6-4)}$ is 10^2 , so the result is 50, or 5×10^1 .
- 2.5×10^1 times as wide** Divide 3×10^{-5} by 1.2×10^{-6} . Since $3 / 1.2 = 2.5$ and $10^{(-5 - -6)} = 10^1$, the result is 2.5×10^1 .

CHALLENGE

2.25×10^7 times as tall. Dividing gives $(9 / 4) \times 10^{(1 - -6)} = 2.25 \times 10^7$, and 2.25 is already between 1 and 10.

Accept equivalent decimal or whole-number forms, such as 80 for 8×10^1 and 30,000 for 3×10^4 . Students may show exponent subtraction as adding the opposite when dividing quantities with negative exponents.