List some items/distances/weights that may be too large or too small to be represented by a normal number.

Too Large

ex: weight of every human
distance to the nearest
star other that our sun in
miles

Too Small

ex: diameter of ribosome
size of a virus

Scientific Notation

What You'll Learn

- Express numbers in standard form and in scientific notation.
- Compare and order numbers written in scientific notation.

Real-World Link

Space Earth is the third planet from the Sun in our solar system. Because Earth's rotation about the Sun is not circular, the maximum distance between Earth and the Sun is about 95 million miles and the minimum distance is about 91 million miles.

Standard form: numbers that do not contain exponents.

Scientific Notation: a form to represent very large and very small numbers that involve a factor and an exponent.

Key Concept ▶ Scientific Notation

Words	A number is expressed in scientific notation when it is written as the product of a factor and a power of 10. The factor must be greater than or equal to 1 and less than 10.
Symbols	$a \times 10^n$, where $1 \leq a < 10$ and n is an integer.
Examples	$3{,}500{,}000 = 3.5 \times 10^6$ $0.00004 = 4 \times 10^{-5}$

Example 1

Express each number in standard form.

a. 2×10^3

$2 \times 10^3 = 2000$ Move the decimal point 3 places to the right.

b. 6.8×10^5

$6.8 \times 10^5 = 680{,}000$ Move the decimal point 5 places to the right.

c. 3.25×10^{-4}

$3.25 \times 10^{-4} = 0.000325$ Move the decimal point 4 places to the left.

Got It? Do these problems to find out.

1a. 4×10^2 **1b.** 5.94×10^7 **1c.** 1.3×10^{-3}

400

$5.94\,00000$

59,400,000

.0013

Example 2

Express each number in scientific notation.

a. 4,000,000

$4{,}000{,}000 = 4 \times 10^6$

The decimal point moves 6 places.
The exponent is positive.

b. 0.072

$0.072 = 7.2 \times 10^{-2}$

The decimal point moves 2 places.
The exponent is negative.

Form
$a \times 10^n$

Got It? Do these problems to find out.

2a. 900

2b. 18,900

2c. 0.000064

9×10^2

1.89×10^4

6.4×10^{-5}

Example 4

STEM The space shuttle traveled at about 8 kilometers per second. At this rate, the shuttle would take about 4.5×10^4 seconds to fly to the moon. Is it more appropriate for a newspaper to report this time as about 4.5×10^4 seconds or about 12.5 hours? Explain your reasoning.

Got It? Do this problem to find out.

4. A dime is about 5.875×10^{-3} foot in diameter. Is it more appropriate to report that the diameter of a dime is 5.875×10^{-3} foot or 7.05×10^{-1} inch? Explain your reasoning.

005.875   7.05

.005875 ft   .705 in

It makes more sense to use the inch measurement. We can visualize 7/10th of an inch because it's a little more than half an inch.