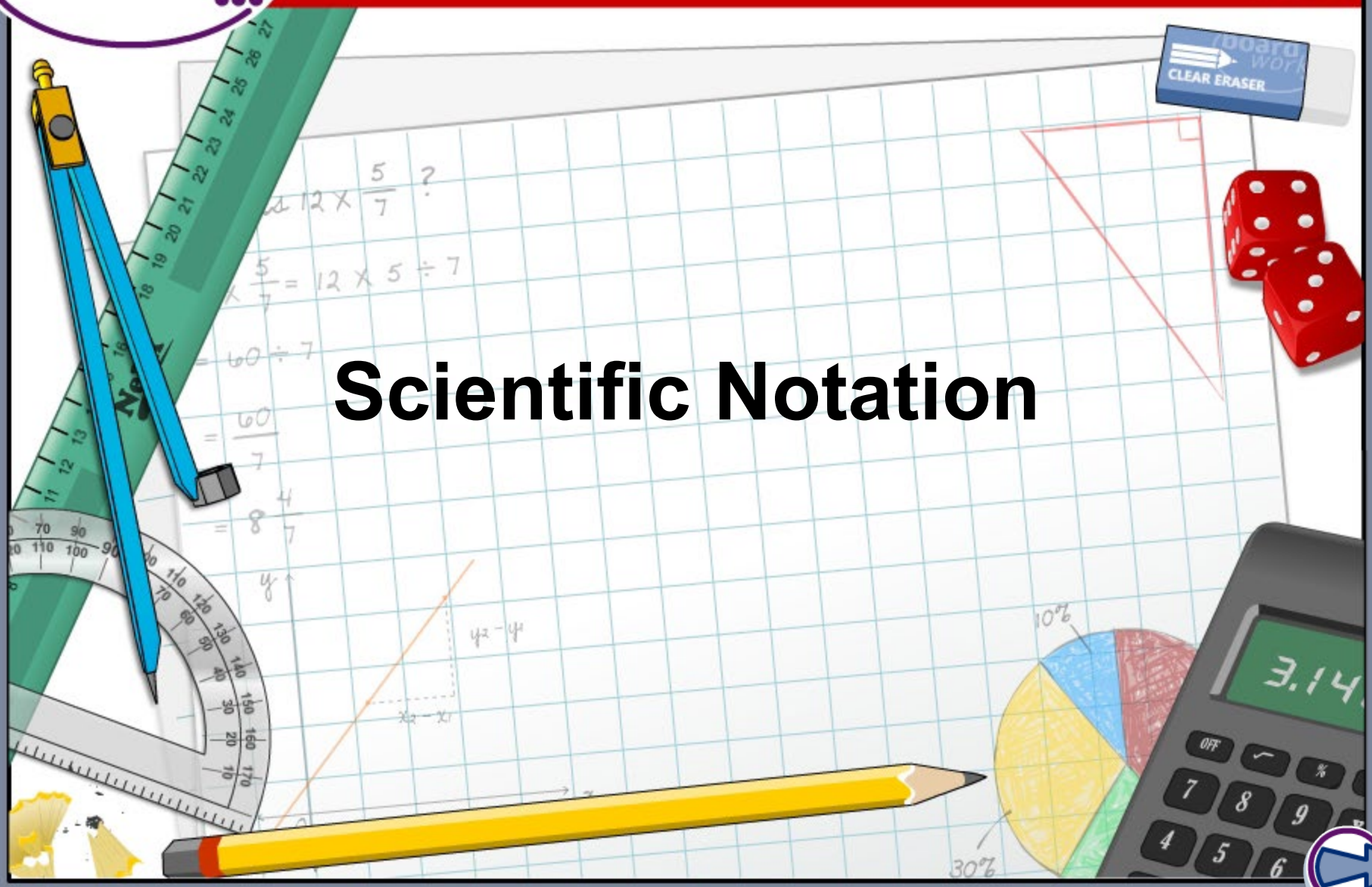


Scientific Notation

Information

Common core icons

This icon indicates a slide where the Standards for Mathematical Practice are being developed. Details of these are given in the Notes field.

Slides containing examples of mathematical modeling are marked with this stamp.

This icon indicates an opportunity for discussion or group work.

The **Standards for Mathematical Practice** outlined in the Common Core State Standards for Mathematics describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.

These are:

1) Make sense of problems and persevere in solving them.

2) Reason abstractly and quantitatively.

3) Construct viable arguments and critique the reasoning of others.

4) Model with mathematics.

5) Use appropriate tools strategically.

6) Attend to precision.

7) Look for and make use of structure.

8) Look for and express regularity in repeated reasoning.

This icon indicates that the slide contains activities created in Flash. These activities are not editable.

This icon indicates teacher's notes in the Notes field.

Powers of ten

Our decimal number system is based on **powers of ten**.

We can write powers of ten using **exponential form**.

$10 = 10^1$

$100 = 10 \times 10 = 10^2$

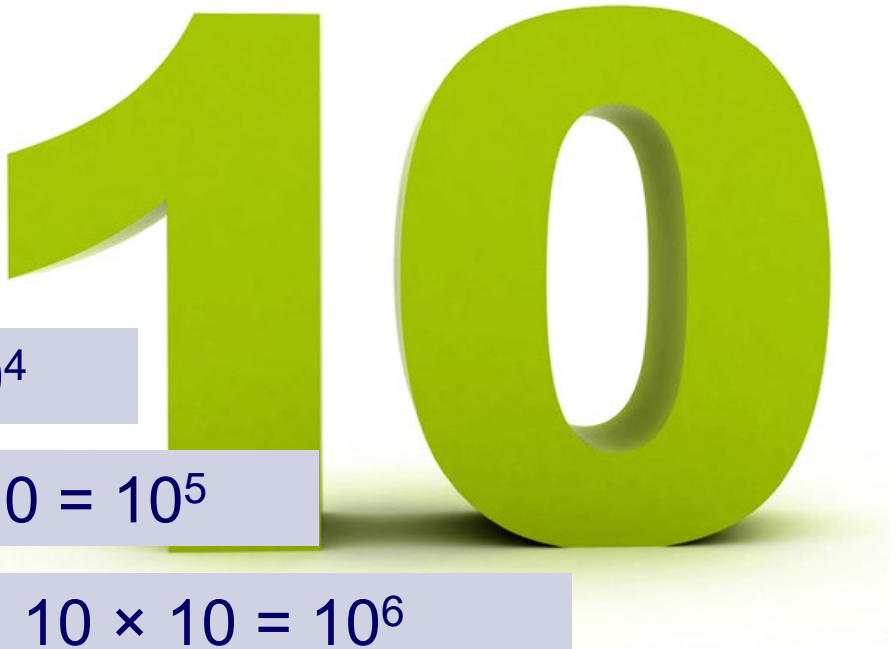
$1000 = 10 \times 10 \times 10 = 10^3$

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

$100{,}000 = 10 \times 10 \times 10 \times 10 \times 10 = 10^5$

$1{,}000{,}000 = 10 \times 10 \times 10 \times 10 \times 10 \times 10 = 10^6$

$10{,}000{,}000 = 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 = 10^7$ …



Introducing scientific notation

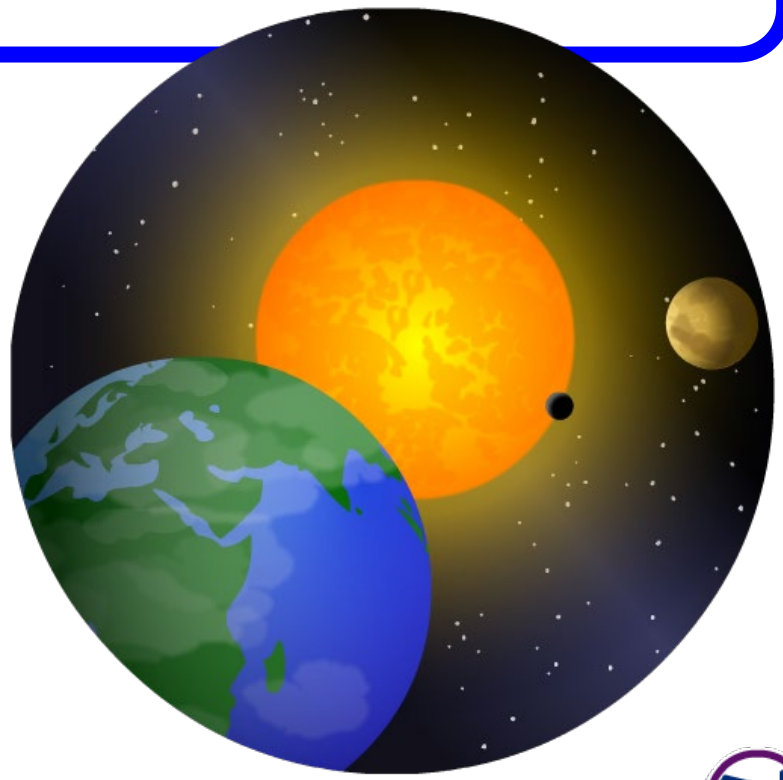
We can write very large numbers using **scientific notation**.

To write a number in scientific notation, we use a number between 1 and 10, multiplied by a power of 10.

For example, the average distance from the Earth to the Sun is about 150,000,000 km.

We can write this number as $\mathbf{1.5 \times 10^8}$ **km**.

A number between 1 and 10 — **A power of ten**



Writing large numbers

Question 1 of 2:

Write the number **80,000,000,000** in scientific notation.

Click the "=" button to show
the calculations step by step.

Large number practice (1)

How can we write these numbers in scientific notation?

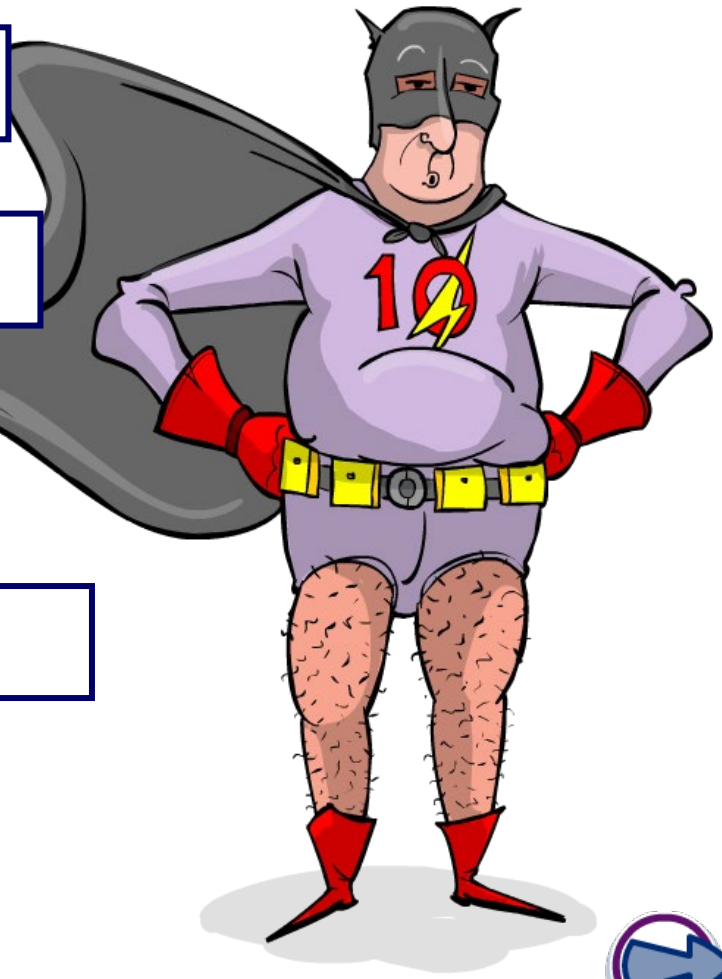
80,000,000 = 8×10^7

230,000,000 = 2.3×10^8

724,000 = 7.24×10^5

6,003,000,000 = 6.003×10^9

371.45 = 3.7145×10^2



Large number practice (2)

Match the scientific notation to the ordinary numbers

2.168

2.168

2.168

2.168 × 10

These numbers are written in scientific notation. How can they be written as ordinary numbers?

Press **start** to begin.

start

21,680,000

Negative powers of ten

We use **negative** powers of ten to give us decimals.

$0.1 = \frac{1}{10} = \frac{1}{10^1} = 10^{-1}$

$0.01 = \frac{1}{100} = \frac{1}{10^2} = 10^{-2}$

$0.001 = \frac{1}{1000} = \frac{1}{10^3} = 10^{-3}$

$0.0001 = \frac{1}{10000} = \frac{1}{10^4} = 10^{-4}$

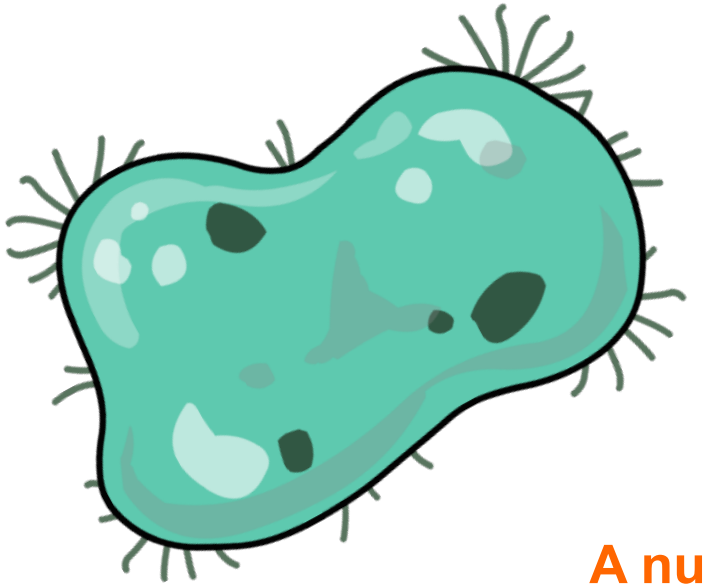
$0.00001 = \frac{1}{100000} = \frac{1}{10^5} = 10^{-5}$

$0.000001 = \frac{1}{1000000} = \frac{1}{10^6} = 10^{-6}$

Small numbers

We can write very small numbers using negative powers of ten.

To write a small number in scientific notation, we use a number between 1 and 10, multiplied by a negative power of 10.



Many bacteria are approximately 0.000001 m in length.

We can write this number as 1×10^{-6} m.

A number between 1 and 10

A negative power of 10

Writing small numbers

Question 1 of 2:

Write the number **0.000006** in scientific notation.

Click the "=" button to show
the calculations step by step.

Small number practice (1)

How can we write these numbers in scientific notation?

0.0006 = 6×10^{-4}

0.00000072 = 7.2×10^{-7}

0.0000502 = 5.02×10^{-5}

0.0000000329 = 3.29×10^{-8}

0.001008 = 1.008×10^{-3}

Small number practice (2)

Match the scientific notation to the ordinary numbers

9.108

9.108

9.108

9.108 × 10

0.09108

These numbers are written in scientific notation. How can they be written as ordinary numbers?

Press **start** to begin.

start

Calculations with Scientific Notation

Question 1 of 4: addition

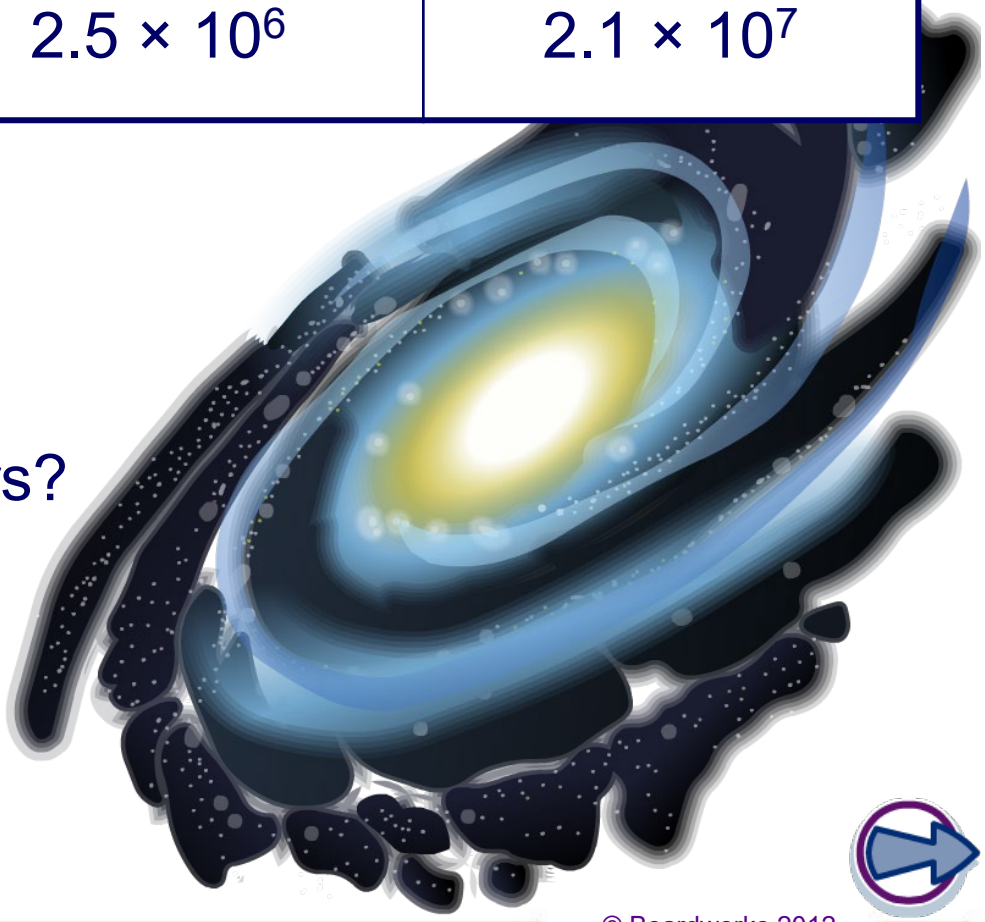
The population of Florida is 1.9×10^7. The population of Wyoming is 5.7×10^5. What is the combined population of these two states?

Click the "=" button to show the calculations step by step.

Nearby galaxies

The table below contains information about two galaxies.

	Andromeda	Pinwheel
Distance from Milky Way (light years)	2.5×10^6	2.1×10^7



Which galaxy is farthest from the Milky Way?

How would you write these distances as ordinary numbers?

How much farther away is the Pinwheel galaxy than the Andromeda galaxy?

Grains on Sandy Beach

Sandy Beach contains 10 metric tons of sand. One metric ton is equivalent to 1,000,000 grams.

How many grams of sand are there on Sandy Beach? Express your answer in scientific notation.

There are 1.0×10^{11} grains of sand on the beach. How much does a single grain weigh? Choose an appropriate unit for your answer.

The grains on Pebble Beach weigh 1.0×10^{-2} g. How many times heavier are they than the grains on Sandy Beach?

Calculations with scientific notation

Use a scientific calculator to figure out the following:

1. $(2.5 \times 10^5)(3.5 \times 10^2) = 87500000 = \mathbf{8.75 \times 10^7}$

2. $\dfrac{2 \times 10^{12}}{5.2 \times 10^9} = 384.6153846 = \mathbf{384.62}$ (nearest hundredth)

3. $(7.1 \times 10^{-10})(3.45 \times 10^2) = 2.4495_{\text{E}}-07$

$= \mathbf{2.4495 \times 10^{-7}}$

Notice that the calculator display may read **E –07**. This is the same as $\times 10^{-7}$.