2.1 Scientific Notation Day 1

Learning objective:
*write and compare numbers in scientific notation

Common Core Standard 8.EE.3

– Use numbers expressed in the form of a single digit times a whole-number power of 10 to estimate very large or very small quantities

Math Practices- *MP1 Solve problems/persevere MP2 Reason MP 4 Model Mathematics MP 5 Use Tools MP 6 Attend to Precision MP 7 Look for and use structure MP 8 Express regularity in reasoning*

Quick Write

Why is scientific notation helpful to scientists and other people that work with very, very large or small numbers?

*Use website for sources

Quick Write

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and other people that work with very, very large or small numbers?

Quick Write

Why is scientific notation helpful to scientists and other people that work with very, very large or small numbers?

Other Way of Writing It

Sometimes people use the ^ symbol (above the 6 on your keyboard), as it is easy to type.

Example: **$3 \times 10\text{^}4$ is the same as 3×10^4**

- **$3 \times 10\text{^}4 = 3 \times 10 \times 10 \times 10 \times 10 = 30{,}000$**

How to Do it

To figure out the power of 10, think "how many places do I move the decimal point?"

When the number is 10 or greater, the decimal point has to move **to the left**, and the power of 10 will be positive.

When the number is smaller than 1, the decimal point has to move **to the right**, so the power of 10 will be negative:

$$1.23 \times 10^{11}$$

The first number 1.23 is called the coefficient. It must be greater than or equal to 1 and less than 10.

The second number is called the base . It must always be 10 in scientific notation. The base number 10 is always written in exponent form. In the number 1.23×10^{11} the number 11 is referred to as the exponent or power of ten.

2.1 Scientific Notation Day 1

How many stars are there in the universe?

Scientists estimate there to be _____ stars in the universe! (22 zeros!)
Numbers like this are so large that scientists have invented a method called _____ _____ to write these very, very large numbers (and very, very small numbers).

2.1 Scientific Notation Day 1

Day 1 – Writing Very Large and Small Numbers in Scientific Notation

How many stars are there in the universe?

Scientists estimate there to be 60,000,000,000,000,000,000,000 stars in the universe! (22 zeros!)
Numbers like this are so large that scientists have invented a method called _____Scientific_____ _____Notation_____ to write these very, very large numbers (and very, very small numbers).

2.1 Scientific Notation Day 1

Recall

Powers of 10

10^1 = _____

10^2 = _____

10^3 = _____

When we multiply a decimal by a _____ power of ten, we move the decimal to the _____.

Examples:

$1.58 \cdot 10^1 = 1.58 \cdot$ _____ = _____

$1.58 \cdot 10^2 = 1.58 \cdot$ _____ = _____

$1.58 \cdot 10^3 = 1.58 \cdot$ _____ = _____

2.1 Scientific Notation Day 1

Recall

Powers of 10

10^1 = 10

10^2 = 100

10^3 = 1000

When we multiply a decimal by a positive power of ten, we move the decimal to the right.

Examples:

$1.58 \cdot 10^1 = 1.58 \cdot 10 = 15.8$

$1.58 \cdot 10^2 = 1.58 \cdot 100 = 158.0$

$1.58 \cdot 10^3 = 1.58 \cdot 1000 = 1,580.0$

2.1 Scientific Notation Day 1

Recall

10^{-1} = _____

10^{-2} = _____

10^{-3} = _____

When we multiply a decimal by a _____ power of ten, we move the decimal to the_____.

Examples:

$1.5 \cdot 10^{-1} = 1.5 \cdot$ _____ = _____

$1.5 \cdot 10^{-2} = 1.5 \cdot$ _____ = _____

$1.5 \cdot 10^{-3} = 1.5 \cdot$ _____ = _____

2.1 Scientific Notation Day 1

Recall

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

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

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

When we multiply a decimal by a ____negative____ power of ten, we move the decimal to the __left____.

Examples:

$1.5 \cdot 10^{-1} = 1.5 \cdot$ __$\frac{1}{10}$__ = __.15__

$1.5 \cdot 10^{-2} = 1.5 \cdot$ __$\frac{1}{100}$__ = 0.015

$1.5 \cdot 10^{-3} = 1.5 \cdot$ __$\frac{1}{1000}$__ = 0.0015

2.1 Scientific Notation Day 1

Quick Check

- $1.8 \cdot 100 =$ _____
- $0.28 \cdot 10^3 =$ _____
- $1.3 \cdot 10^4 =$ _____

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Quick Check

a) $1.8 \cdot 100 =$ 180

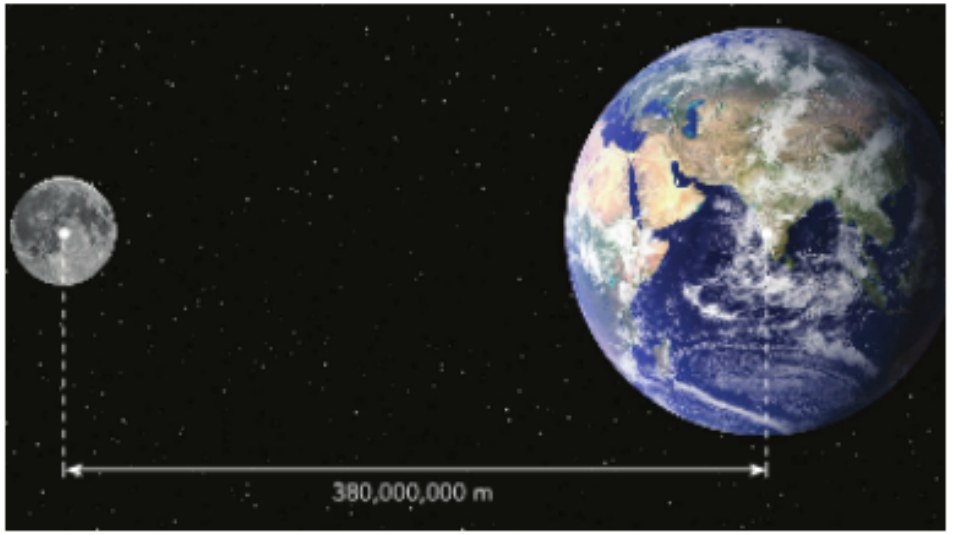
b) $0.28 \cdot 10^3 =$ 280

c) $1.3 \cdot 10^4 =$ 13000

2.1 Scientific Notation Day 1

Scientists, like Astronomers, work with very large and very small numbers.

For example, the average distance from the Earth to the moon is approximately 380,000,000 meters. Sometimes it's hard to keep track of so many zeros in such a large number. This is why scientific notation is very helpful!



What other things can you think of that we might want to represent very large or very small numbers with?

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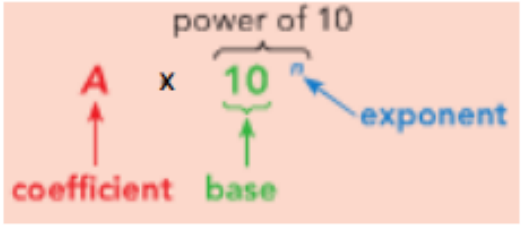
Real Life Examples of Scientific Notation

- 7×10^{9}= Population of the world is around 7 billion written out as 7,000,000,000
- 1.08×10^{9}= Approximate speed of light is 1080 million km per hour or 1,080,000,000 km per hour
- 2.4×10^{5}= Distance from the Earth to the moon is 240 thousand miles or 240,000 miles
- 9.3×10^{7}= Distance from the Earth to the sun is 93 million miles or 93,000,000 miles
- 3.99×10^{13}= Distance from the sun to the nearest star (Proxima Centauri) is 39,900,000,000,000 km
- 9.4605284×10^{15}= Distance light travels in a year is less than 9.5 trillion kilometers, or exactly 9,460,528,400,000,000 km
- 1.4×10^{8}= Amount of water surface area on the Earth is 140 million square miles or 140,000,000 square miles
- 1.0×10^{14}= Approximate number of cells in the human body is 100 trillion or 100,000,000,000,000
- 1.332×10^{-3}= Density of oxygen is 1332 millionths g per cc or .001332 g per cc
- 2.4×10^{-3}= Diameter of a grain of sand is 24 ten-thousandths inch or .0024 inch
- 7.53×10^{-10}= Mass of a dust particle is 0.000000000753 kg

2.1 Scientific Notation Day 1

Scientific Notation can be used to represent a positive, finite decimal *s* as the product d x 10^n, where *d* is a finite decimal greater than or equal to 1, but less than 10 (i.e. $1 \leq d < 10$), and *n* is an integer.

Scientific Notation



For numbers greater than or equal to 10, use a

_____

exponent.

Example 1

The finite decimal 584.392 is equal to every one of the following:

5.84392×10^2 584.392×10^0 58439.2×10^{-2} 5843.92×10^{-1}

0.584392×10^3 5843920×10^{-4} 58.4392×10^1 0.00584392×10^5

However, there is only one that is written in scientific notation. Why is this the only one written in scientific notation?

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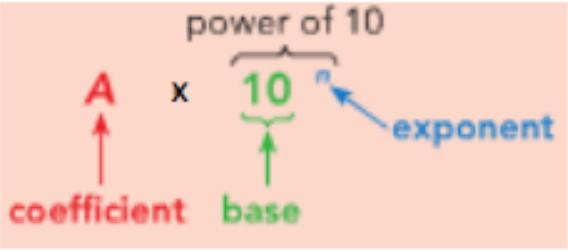

For numbers greater than or equal to 10, use a positive exponent.

For positive numbers less

Example 1

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However, there is only one that is written in scientific notation. Why is this the only one written in scientific notation? The first one has *d* greater than or equal to 1 and less than 10.

2.1 Scientific Notation Day 1

Practice 1

Are the following numbers written in scientific notation? If not, state the reason.

a) The Statue of Liberty is 3.05×10^{2} feet tall.

b) People spend approximately 4050.0×10^{-1} minutes on Facebook each month.

c) A golf ball has a diameter of about 1.680×10^{0} inches.

d) It would take a person approximately $0.116 + 10^{3}$ hours to walk to Washington, DC from Rochester, NY.

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Practice 1

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a) The Statue of Liberty is 3.05×10^{2} feet tall.
Yes

b) People spend approximately 4050.0×10^{-1} minutes on Facebook each month.
No, d > 10.

c) A golf ball has a diameter of about 1.680×10^{0} inches.
Yes

d) It would take a person approximately $0.116 + 10^{3}$ hours to walk to Washington, DC from Rochester, NY.
No, d < 1 and we must have a product, not a sum.