
Operations with Scientific Notation

Tuesday, September (1.2×10^1), 2016

AIMS:

- ✓ SWBAT add, subtract, multiply, and divide with numbers in scientific and standard notation.

AGENDA:

- I. Do Now (2 min)
- II. Open/Do Now Review (3 min)
- III. Class Notes: Operations with Scientific Notation
- IV. Examples
- V. Independent Practice
- VI. Practicing our AIMS:
 - ✓ Exit Ticket (5 min)
 - ✓ Homework: ExPWN it! 11
- VII. Close (2 min)

Will your choices help us STRIVE?

“There is
NO SUBSTITUTE
for HARD WORK.”

— THOMAS EDISON

AIMS:

- ✓ SWBAT add, subtract, multiply, and divide with numbers in scientific and standard notation.

AIM CHECK:

- ✓ What is the main difference between adding/subtracting and multiplying/dividing in scientific notation?

- ✓ Rewrite 4.33×10^{23} so it is to the power of 20.

**8th Grade
Math**

Operations
with
Scientific
Notation

Name: Key #:

Date: _____

Homeroom: _____



ExpWN It! 11

AIM(S):

- ✓ SWBAT add, subtract, multiply, and divide with numbers in scientific and standard notation.

DO NOW

Directions: Complete the following questions.

Write the following numbers in **scientific notation**.

1) 396,000,000

$$3.96 \times 10^8$$

2) 11,020

$$1.102 \times 10^4$$

3) 0.000316

$$3.16 \times 10^{-4}$$

4) 6,310,000

$$6.31 \times 10^6$$

5) 0.114

$$1.14 \times 10^{-1}$$

6) 0.00876

$$8.76 \times 10^{-3}$$

7) 210 million

↓
6 zeros

$$2.1 \times 10^8$$

8) 3 one-thousandths

$$3 \times 10^{-3}$$

9) 2 trillion

≈ 12 zeros

$$2 \times 10^{12}$$

Class Notes: Operations with Scientific Notation

Directions: Board Equals Paper!

| VOCAB | Addition or Subtraction Key Words/Ideas | | Multiplication or Division Key Words/Ideas | | |
|-------|--|--|--|--------------------------|--|
| | sum total add combined average (+ the ÷) | "er" words like greater, taller together difference subtract | product times | for every each per | quotient divided equally evenly |

How do we Multiply or Divide in Scientific Notation?

Steps to multiplying/dividing in scientific notation:

- 1) Write all numbers you need to use in scientific notation.
- 2) Write your problem. Then, use the commutative and assoc. properties to reorganize your numbers, putting the leading digits together and the powers of 10 together.
- 3) Multiply/Divide the leading digits
- 4) Multiply/Divide the powers of ten using the rules $\frac{x^m}{x^n} = x^{m-n}$ & $x^m x^n = x^{m+n}$
- 5) Recombine. If necessary, correct your answer so it is still in scientific notation

Example 1: The world population is about 7 billion. There are 4.6×10^6 ants for every human on the planet. About how many ants are there in the world?

① world pop: 7×10^9
 ants: 4.6×10^6

$$\begin{array}{r} 4.6 \\ \times 7 \\ \hline 32.2 \end{array}$$

② $(7 \times 10^9) \times (4.6 \times 10^6)$
 $= (7 \times 4.6) \times (10^9 \times 10^6)$

③ 32.2×10^{15}

④ $= (3.22 \times 10^1) \times 10^{15} = 3.22 \times 10^{16}$

There are 3.22×10^{16} ants in the world!

Example 2: Facebook processes about 990 billion likes per year. If the company has approximately 8.9×10^8 users of the social media, about how many likes is each user responsible for per year? Write your answer in scientific and standard notation.

① likes per year: 9.9×10^{11}
 # of users: 8.9×10^8

③ $\approx 1.1 \times 10^3$

$$\begin{array}{r} 1.1 \dots \\ 8.9 \overline{) 9.9} \\ \underline{-8.9} \\ 100 \\ \underline{-89} \\ 11 \end{array}$$

② $9.9 \times 10^{11} \div 8.9 \times 10^8$

~~(9.9/8.9)~~
 $\frac{9.9 \times 10^{11}}{8.9 \times 10^8} = \frac{9.9}{8.9} \times \frac{10^{11}}{10^8}$

Each user is responsible for about 1.1×10^3 , or 1,100 likes each year!

Adding and Subtracting in Scientific Notation

- 1) Write all numbers you need to use in scientific notation.
- 2) Write your problem.
- 3) Check if all powers of 10 are the same. Just like having a common denom., you need to have the same power of 10 to add/subtract! If not, correct them by splitting a larger power of 10 in to two multiplied amounts (see pg. 8 in yesterday's packet)
- 4) Once all powers of 10 are the same, use the distributive prop. to put all leading digits together in parentheses. Your power of 10 is multiplied on the outside
- 5) Add/subtract all leading digits.
- 6) If necessary, correct your answer so it is still in scientific notation

Example 3: The mass of Earth is 5.9×10^{24} kg. The mass of Pluto is 13,000,000,000,000,000,000,000. Compared to Pluto, how much greater is Earth's mass than Pluto's mass?

① Mass of Earth: 5.9×10^{24}
 Mass of Pluto: 1.3×10^{22}

② $5.9 \times 10^{24} - 1.3 \times 10^{22}$
 \downarrow
 $5.9 \times 10^2 \times 10^{22} - 1.3 \times 10^{22}$

③ $(590 - 1.3) \times 10^{22}$
 \checkmark
 588.7×10^{22}
 $= 5.887 \times 10^{24}$

The mass of the Earth is 5.887×10^{24} kg greater than Pluto's mass!

Example 4: Here are the masses of the so-called inner planets of the solar system.

Mercury: 3.3×10^{23} kg

Earth: 5.9×10^{24} kg

Venus: 4.9×10^{24} kg

Mars: 6.4×10^{23} kg

What is the average mass of all four inner planets? Write your answer in scientific notation.

Average: add & ÷ by 4.

$$\frac{3.3 \times 10^{23} + 5.9 \times 10 \times 10^{23} + 4.9 \times 10 \times 10^{23} + 6.4 \times 10^{23}}{4}$$

$$= \frac{(3.3 + 59 + 49 + 6.4) \times 10^{23}}{4} = \frac{117.7 \times 10^{23}}{4} = 29.425 \times 10^{23} = 2.9425 \times 10^{24}$$

The average mass of inner planets is about 2.9425×10^{24} .

Independent Practice

Directions: Complete every question below! Do your best! When done, you may work on the **ADVANCED WORK ONLY** (not homework ☺)

- 1) The speed of light is 300,000,000 meters per second. The sun is approximately 1.5×10^{11} meters from Earth. How many seconds does it take for sunlight to reach Earth?

speed of light: 3×10^8
sun distance: 1.5×10^{11}

$$\frac{1.5 \times 10^{11} \text{ m/s}}{3 \times 10^8 \text{ m}} = \frac{1.5}{3} \times \frac{10^{11}}{10^8} = 0.5 \times 10^3 = 5 \times 10^2$$

It takes 500 seconds for sunlight to reach Earth.

- 2) The mass of the moon is about 7.3×10^{22} kg. It would take approximately 26,000,000 moons to equal the mass of the sun. Determine the mass of the sun.

Mass of moon: 7.3×10^{22}
of moons: 2.6×10^7

$$(7.3 \times 10^{22}) \times (2.6 \times 10^7) = (7.3 \times 2.6) \times (10^{22} \times 10^7) = 18.98 \times 10^{29} = 1.898 \times 10^{30}$$

The sun is about 1.898×10^{30} kg.

Keep going! There are more challenges ahead!

- 3) The mass of the moon is about 7.3×10^{22} kg, the mass of Earth is 5.9×10^{24} kg. The mass of Pluto is 13,000,000,000,000,000,000,000. Determine the combined mass of the moon, Earth, and Pluto.

$$\begin{aligned}7.3 \times 10^{22} + 1.3 \times 10^{22} + 5.9 \times 10^{24} &= (7.3 + 1.3 + 590) \times 10^{22} \\ &= 598.6 \times 10^{22} \\ &= 5.986 \times 10^{24}\end{aligned}$$

The combined mass of the Earth, Moon, & Pluto is 5.986×10^{24}

- 4) How many combined moon, Earth, and Pluto masses (i.e., the answer to Exercise 3) are needed to equal the mass of the sun (i.e., the answer to Exercise 2)?

$$\frac{1.898 \times 10^{30}}{5.986 \times 10^{24}} = \frac{1.898}{5.986} \times \frac{10^{30}}{10^{24}} \approx 0.32 \times 10^6 = 3.2 \times 10^5$$

It would take 3.2×10^5 combined moon/Earth/Pluto masses to get the mass of the sun.

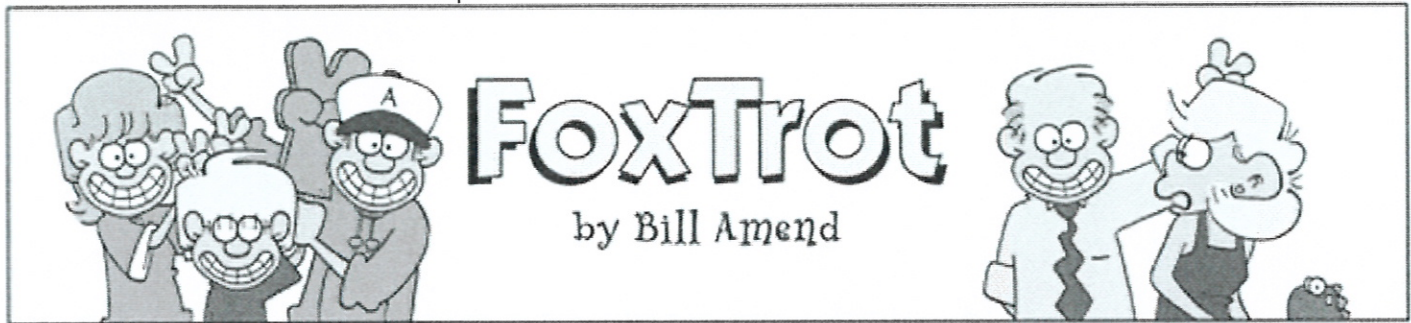
- 5) Suppose the geographic areas of California and the U.S. are 1.637×10^5 and 3.794×10^6 sq. mi., respectively. California's population (as of 2012) is approximately 3.804×10^7 people. If population were proportional to area, what would be the U.S. population?

8th Grade Math Advanced Work (Due 9/14/16)

Directions: Complete this for dollars! Turn in advanced work with your homework.

Name: _____ #: _____ HR: _____

Decode the below comic strip:



16-11-13-5-10-2-15-18-13-23-8-11-17-11-12-22-11-12-19

key:

$$A = \sqrt{121}$$

$$B = 2^3$$

$$C = \sin \frac{\pi}{2}$$

$$D = 51 \div 3$$

$$E = \sqrt[3]{1000}$$

$$F = \frac{1}{2} \left(\frac{1}{2} \left(\frac{1}{2} (16) \right) \right)$$

$$G = \frac{5}{3} + \frac{5}{3} + \frac{5}{3}$$

$$H = 4205 - 4186$$

$$I = \sqrt{13} \times \sqrt{13}$$

$$J = \frac{14}{5} \times \frac{10}{4}$$

$$K = |-26|$$

$$L = (9x + 9x) \div 3x$$

$$M = (9 \times 11) - (7 \times 11)$$

$$N = \sqrt{400}$$

$$O = 1 + 2 + 3 + 4 + 5$$

$$P = 4^{\sqrt{4}}$$

$$Q = \int_0^2 9x^2 dx$$

$$R = \frac{4\pi + 5\pi}{\pi}$$

$$S = (5 \times 2 \times 2) + 3$$

$$T = \sqrt{144}$$

$$U = -3 \cos \pi$$

$$V = 5^4 \div 5^2$$


$$W = 2^{(5-3)}$$

$$X = 9216 \div 512$$

$$Y = \sqrt{49} \times \sqrt{9}$$

$$Z = \frac{14 \cdot 14 \cdot 14}{14 \cdot 14}$$



| | | | |
|---------------------------|--|-----------------------|---|
| Name and Number: _____ | <h2>Exit Ticket</h2> <h3>8th Grade Math</h3> <p>ExPWN it! 11</p> <p>Operations with Scientific Notation</p> | Ms. Huber |  |
| Date: _____ | | ____/ 5 = ____% DNG | |
| Class: _____ | | A B C D F | |

Directions: Complete all of the below problems. Do not use notes. This is an independent task, so you may not get help from your teacher either. Try your best! Work on Advanced work when done.

- The speed of light is 3×10^8 meters per second. The sun is approximately 230,000,000,000 meters from Mars. How many seconds does it take for sunlight to reach Mars?

- If the sun is approximately 1.5×10^{11} meters from Earth, what is the approximate distance from Earth to Mars?

| | | | |
|--|------------------------------------|---------------|---------------------------------|
| Reflect on your understanding of TODAY'S LESSON , and circle the most true statement | | | |
| I don't get it at all | I just need <u>some help</u> | I understand | I could teach it! |
| Reflect on your effort in TODAY'S CLASS , and circle the most true statement | | | |
| I wasn't working hard today | I was trying but off-task a little | I was on task | I was laser-focused on learning |

