Name: _____ Date: Aug 19 Hour: ____Alg 1____

Unit 1A Day 1and 2: Forms of Numbers

Focus Question: How do I read and write numbers in exponential form or scientific notation?

A. Forms of Numbers

1. Brainstorm: What are at least 10 ways to write the number 16?

$\frac{64}{4}$ $10+6$ 4^2 $\frac{48}{3}$ $\frac{1}{2}\cdot 32$

When you were first introduced to numbers, you were taught the numbers 1, 2, 3, 4, etc. You kept learning about bigger and bigger numbers like 1,725 and 10,600,327. Then you learned about decimals (numbers in between whole numbers) like 4.6 or 0.125. These numbers are written in what is called **standard form**. **Standard form of a number** uses place value to make sense of how big (or small) the number is.

When you started to learn to multiply you learned other ways to write numbers. For instance 10 could be written as $5\cdot 2$ or 16 could be written as $2\cdot 2\cdot 2\cdot 2$. When we write numbers in a longer way that makes use of its factors, this is called **factored or expanded form.** (If it is prime factors only, it is called **prime factorization.)**

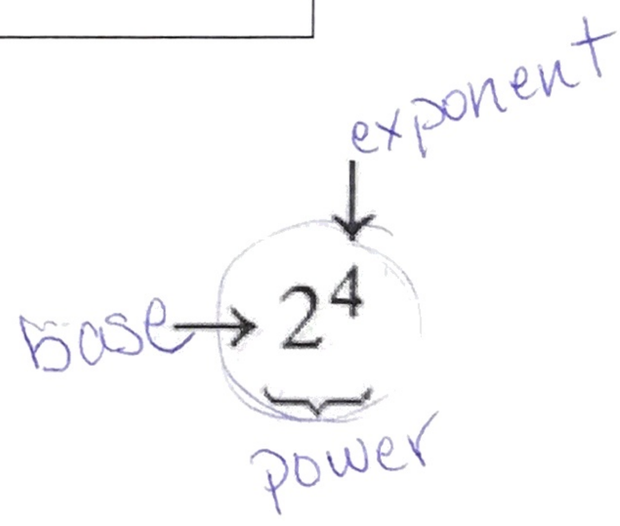
When a number had several of the same factors, you wrote it in a shortened way called **exponential form.** The table below gives several numbers in their standard, expanded, prime factorization, and exponential form.

Standard Form	Expanded	Prime Factorization	Exponential Form
16	$4\cdot 4$ or $2\cdot 8$	$2\cdot 2\cdot 2\cdot 2$	2^4
90	$9\cdot 10$ or $5\cdot 3\cdot 6$	$5\cdot 2\cdot 3\cdot 3$	$5\cdot 2\cdot 3^2$ or $10\cdot 3^2$
250	$25\cdot 10$ or $2\cdot 5\cdot 25$	$2\cdot 5\cdot 5\cdot 5$	$2\cdot 5^3$

a. Why is "Exponential Form" called Exponential form?

It uses exponents

b. What is the number in front of the exponent called? base



c. What does the exponent tell you?

how many times to use the base as a factor

*The other name for exponent is **index**. Another name for a base with an exponent is a **power.***

d. When a number has no exponent, what exponent is implied? one

e. Write the following in exponential form and standard form.

i. $5\cdot 2\cdot 2\cdot 2$ ii. $7\cdot 2\cdot 6\cdot 6\cdot 6\cdot 6$ iii. $2\cdot 3\cdot 3\cdot 7\cdot 7\cdot 7\cdot 7\cdot 7\cdot 7$

Exp Form: $5\cdot 2^3$ Exp Form: $7\cdot 2\cdot 6^4$ or $14\cdot 6^4$ Exp. Form: $2\cdot 3^2\cdot 7^6$

Standard Form: 40 Standard Form: 18144 Standard Form: 2117682

*The button on the calculator that lets you do exponents other than 2 is ^ a.k.a. carrot *

f. Give the base and then write the following in expanded and standard form.

i. $5 \cdot 7^2$

Base: 7

Expanded: 5·7·7

Standard: 245

ii. $\frac{1}{2} \cdot 11^4$

Base: 11

Expanded: $\frac{1}{2} \cdot 11 \cdot 11 \cdot 11 \cdot 11$

Standard: 7320.5

iii. $7^5 \cdot 10^9$

Base(s): 7 & 10

Expanded: 7·7·7·7·7·10·10·10·10·10·10·10·10·10

Standard: 1.6807E13 ← New Form!

At this point, your calculators should be giving you some crazy looking number that used an E in it. This number is called **scientific notation**. Scientific notation is a way of writing really large and really small numbers that always uses 10 as the base.

It is written $c \cdot 10^x$ and $1 \leq c < 10$ (which basically means between 1 & 10)

The E found in calculators is taking the place of base 10. $1.6807 \cdot 10^{13}$

B. Scientific Notation: Why use 10 as the base?

1. Write the following in expanded form and standard form (**without a calculator**!).

a. 10^2

Expanded: 10·10

Standard: 100

b. 10^5

Expanded: 10·10·10·10·10

Standard: 100000

c. 10^8

Expanded: 10·10·10·10·10·10·10·10

Standard: 100,000,000

d. Why did you not need a calculator to do those problems?

Our place value number system is base 10.

2. Fill in the table to understand what happens when you multiply by a power of 10. (**Yes, use a calculator!**)

2.75	$2.75 \cdot 10^1$	$2.75 \cdot 10^2$	$2.75 \cdot 10^3$	$2.75 \cdot 10^{-1}$	$2.75 \cdot 10^{-2}$
	27.5	275	2750	0.275	0.0275

3. What happens when you multiply a number times a positive power of 10?

We make #'s larger & the decimal moves right

4. What happens when you multiply a number times a negative power of 10?

We make the # smaller & the decimal moves left

5. What power of 10 would you use if you didn't want to move the decimal?

10^0

(Yes, exponents can be negative and zero, more on that a tiny bit later in the unit.)

C. Changing Numbers from scientific notation to standard form

If the exponent is negative you move the decimal that many places to the left.

If the exponent is positive you move the decimal that many places to the right.

Change each number to properly written standard form.

21) 2.66×10^{4} — right 4

2.66000 (1, 2, 3, 4) → 26,600

22) 1.5×10^{-2} — left 2

0,1,5 (1) → 0.015

23) 7.75×10^{-1} — left 1

0.775

24) 8.3×10^{7} — right 7

83,000,000

30) 4×10^{0}

4

26) 1.71×10^{7}

17,100,000

D. Changing Numbers from standard form to scientific notation

For scientific notation, the coefficient must be between 1 & 10 (1 is okay, 10 is not).

Once you figure out the coefficient, you simply need to count how many places the decimal moves.

Finally decide if the exponent is positive or negative. It is positive if the original # is >1

The exponent is negative if the original # is btwn 0 & 1

Change each number into proper scientific notation.

1) 0.000006 → $6 \cdot 10^{-6}$

2) 5400000. → $5.4 \cdot 10^{6}$

9) 48900. → $4.89 \cdot 10^{4}$

6) 0.0000002 → $2 \cdot 10^{-7}$

3) 60 → $6 \cdot 10^{1}$

4) 0.009 → $9 \cdot 10^{-3}$

5) 6.7 → $6.7 \cdot 10^{0}$

13) 0.000216 → $2.16 \cdot 10^{-4}$

Watch the video at http://viewpure.com/EMLPJqeW78Q to understand the size and power base 10 numbers.