Name_____

Algebra 2
Lesson 1-2 Part 2
Properties of Exponents

Exponentials is at the heart of most Algebra 2 ideas and concepts. Let's review the basic exponent properties you learned in Algebra 1.

$$\boldsymbol{a^n = a \cdot a \cdot a \cdot a \cdot \ldots}\textbf{..(n times)}$$

$$\boldsymbol{a^m \cdot a^n = a^{m+n}}$$

$$\boldsymbol{\frac{a^m}{a^n} = a^{m-n}}$$

$$\boldsymbol{(a^n)^m = a^{n+m}}$$

$$\boldsymbol{(ab)^n = a^n \cdot b^n}$$

$$\boldsymbol{a^0 = 1}$$

$$\boldsymbol{a^{-n} = \frac{1}{a^n}}$$

Examples: Simplify:

$a^3 \cdot a^5 = a^{3+5} = a^8$

$\frac{k^8}{k^3} = k^{8-3} = k^5$

$(x^3)^5 = x^{3 \cdot 5} = x^{15}$

$(4x^5y^8c^3)^0 = 1$

$(2y^3)^5 = (2^1y^3)^5 = 2^{1x5}xy^{3x5} = 2^5 \cdot y^{15} = 32y^{15}$

(make a positive exponent): $k^{-4} = \frac{1}{k^4}$

The main points to remember are:

- Multiplication causes the exponents to add
- Division causes the exponents to subtract,
- Parentheses cause the exponents to multiply
- with the outside value.

Very large or very small numbers are best represented as a power of ten (scientific notation). Planetary distances are very, very large. In contrast, blood cell and wasp weights are very, very small. Scientific notation greatly simplifies computing very large or very small numbers by converting such numbers into powers of 10. Thus:

Distance from sun to Venus	108,230,000	1.0823×10^8km
Distance from sun to Saturn	1,428,300,000	1.4283×10^9km
Size of a red blood cell	0.000007	7.0×10^{-6} m
Weight of a parasitic wasp	0.00000492	4.92×10^{-6}g

Algebra 2
Lesson 1-2 Part 2
Properties of Exponents

The following general rules can be used to simplify scientific notation problems.

- To convert a large number move the decimal point to the **left** and use a **positive** exponent on the base 10.
- To convert a small number move the decimal point to the **right** and use **negative** exponent on the base 10.
- Leave **one** digit on the left of the decimal point.

Example:

Simplify using scientific notation.

$(6.4 \cdot 10^6) \div 8 = (6.4 \div 8) \cdot 10^6$ (power of 10 goes last)
$= (0.8 \cdot 10^6$
$= (8.0 \cdot 10^{-1}) \cdot 10^6$
$=8.0 \cdot 10^{-1+6}$
$8.0 \cdot 10^5$ (make 1 digit on left)

Example:

Compute and round off answer to the nearest hundredth (2 places).

$(8.015 \cdot 10^6) \times (1.754 \cdot 10^{11})$
$(8.015 \cdot 1.754) \times (10^6 \cdot 10^{11})$ (regroup powers of 10)
$14.06 \times 10^{6+11}$ (round off to 2 places)
$1.406 \times 10^{1+6+11}$ (leave one number on left)
1.406×10^{18} (can use either symbol $\cdot \, or \, \times$

Name_____

Algebra 2
Problem set 1-2

1. Simplify the following.

a) $n^4 \cdot n^3$

b) $4y^2 \cdot 5y^5 \cdot 3k^3$

c) $-4c^3 \cdot 2c^8k^2 \cdot -6k^5$

d) $3n^3 \cdot 4c^2n^7 \cdot -5c^4n^4y$

2. Simplify the following.

a) $\frac{k^5}{k^2}$

b) $\frac{4k^6}{-2k^3}$

c) $\frac{20c^5k^3}{4c^3k^2}$

3. Simplify the following.

a) $(n^3)^4$

b) $(2n^4)^3 \cdot (4n^2)$

c) $(-3n^2k^3)^4 \cdot \left(2nk^2\right)^4$

d) $\frac{(2c^5k^3)^4}{(4c^2k)^4}$

4. Simplify the following.

a) $(4c^2k^3)^0$

b) $(-3c^0k^2)^0x4n^2$

c) $(3c^2k^5)^2x(-5c^3k^7)^0$

d) $(\frac{4c^2k^3}{6c^3k^2})^0$

5. Simplify (make positive exponents).

a) c^{-4}

b) $c^{-3} \cdot (3c^2k^{-5})$

c) $(c^{-3})^{-2} \cdot (4c^2k^{-3}) \cdot (4c^5k)^0$

6. Convert to scientific notation

a) $3,450,000

b) 0.0000341

c) distance from the earth to the sun is 93 million miles.

d) 1.5 billion calculations per second.