NOTES & HOMEWORK

Name_____
Date _____ Period _____

Scientific Notation

Review:

Multiplication Property of Exponents:

$a^m \cdot a^n = a^{m+n}$ $\qquad$ $a^m \cdot b^n = (a \cdot b)^{m+n}$

Example: $3^5 \cdot 3^4 = 3^{5+4} = 3^9$ $\qquad$ **Example:** $2^3 \cdot 3^4 = (2 \cdot 3)^{3+4} = 6^7$

1.) $3r \cdot r^4$ $\qquad$ 2.) $3x^2 \cdot x^2$

3.) $10^{-13} \cdot 10^5$ $\qquad$ 4.) $(-2m^3)(3.5m^{-3})$

Power Property of Exponents:

$(b^m)^n = b^{mn}$ $\qquad$ $(ab)^n = a^n b^n$

Example: $(x^3)^5 = x^{15}$ $\qquad$ **Example:** $(-2x^2)^4 = (-2)^4 \cdot x^{2 \cdot 4} = 16x^8$

1.) $(x^3y)^4$ $\qquad$ 2.) $(3m^3)^4$ $\qquad$ 3.) $(4a^2b)^3(ab)^3$

Division Property of Exponents:

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

Example: $\frac{3^7}{3^2} = 3^{7-2} = 3^5$

1.) $\frac{b^4}{b^9}$ $\qquad$ 2.) $\frac{z^{10}}{z^5}$

3.) $\frac{m^{-1}n^2}{m^5n}$ $\qquad$ 4.) $\frac{x^2yz^4}{xy^4z^{-3}}$

Negative Exponents:

$b^{-n} = \frac{1}{b^n}$ $\qquad$ AND $\qquad$ $\frac{1}{b^{-n}} = b^n$

Example: $3^{-2} = \frac{1}{3^2} = \frac{1}{9}$ $\qquad$ **Example:** $\frac{1}{x^3} = x^{-3}$

1.) $\frac{2^5}{2^7}$ $\qquad$ 2.) $\frac{x^{13}y^2}{x^{13}y}$

3.) $\frac{m^{-2}}{m^{-5}}$ $\qquad$ 4.) $\frac{(2a^7)(3a^2)}{6a^3}$

Exponents of Zero:

$b^0 = 1$

Example: $25^0 = 1$ **or** $16^{0=1}$

1.) $(2x^3)^0$ 2.) $(15x^2y^5)^0$ 3.) 3^0

New Stuff!!!

Use the calculator to find the answer.**Scientific Notation:**

Jupiter has an average radius of 69,075 km. What is Jupiter's volume?

$$V = \frac{4}{3}\pi r^3$$

Use the calculator to find the answer.

$$V = \frac{4}{3}\pi(69{,}075)^3 = \_\_\_\_\_$$

The calculator displays the answer in this form, called *scientific notation*, because the answer contains more digits than the calculator can display. Scientific notation is a kind of shorthand for very large and very small numbers.

Scientific Notation:

A number is in scientific notation if it is written in the form:

$a \times 10^n$

Example: 3.4×10^6 **or** 5.43×10^{13} **or** 9×10^{-10}

You can change a number from scientific notation into standard notation:

Calculator Version:

1.3806547297E15

$\approx 1.38 \times 10^{15}$ ← **scientific notation**

$= 1.38 \times 1{,}000{,}000{,}000{,}000{,}000$ ← **10^{15} has 15 zeros**

$= 1{,}380{,}000{,}000{,}000{,}000$ ←**standard notation**

Jupiter has a volume slightly greater than 1 quintillion km^3.

Complete the table:

Power of 10	**10**	**10^3**	**10**	**10**	**10**
Standard Notation					
Unit Name	Millions		Ones		Millionths

Number the following values from least to greatest:

_____ Jupiter 1.9×10^{27}

_____ Saturn 5.7×10^{26}

_____ Uranus 8.7×10^{25}

_____ Neptune 1.0×10^{26}

Simplify:

1.) $7 \times (4 \times 10^5) =$

2.) $2.5 \times (6 \times 10^3) =$

3.) $1.5 \times (3 \times 10^4) =$

Example:
In 1993, 436 billion telephone calls were placed by 130 million United States telephone subscribers. What was the average number of calls placed per subscriber?

$$\frac{\text{436 billion calls}}{\text{130 million subscribers}} = \frac{4.35 \times 10^{11}}{1.3 \times 10^8}$$

Type into your calculator:

= 4.36 EE 11 ÷ 1.3 EE 8 ENTER

=_____

Each subscriber made an average of _____ calls in 1993.

Homework: Odd problems only.

Write each number in scientific notation.

1) 0.000006

2) 5400000

3) 60

4) 0.009

5) 6.7

6) 0.0000002

7) 2000000

8) 71×10^{3}

9) 48900

10) 0.0000009

11) 0.63×10^{1}

12) 33×10^{-3}

13) 0.000216

14) 0.0042

15) 0.15×10^{-2}

16) 4.8

Write each number in standard notation.

17) 0.9×10^{-1}

18) 2×10^{-1}

19) 2×10^{5}

20) 804×10^{2}

21) 2.66×10^{4}

22) 1.5×10^{-2}

23) 7.75×10^{-1}

24) 8.3×10^{7}

25) 9.5×10^{7}

26) 1.71×10^{7}

27) 0.9×10^{-3}

28) 38×10^{2}

29) 7.5×10^{-5}

30) 4×10^{0}

31) 8.4×10^{5}

32) 4×10^{-5}

Simplify. Write each answer in scientific notation.

1) $\left(1.08 \times 10^{-3}\right)\left(9.3 \times 10^{-3}\right)$

2) $\left(2 \times 10^{-4}\right)\left(8.1 \times 10^{-1}\right)$

3) $\left(2.32 \times 10^{-6}\right)\left(4 \times 10^{-5}\right)$

4) $\left(3.48 \times 10^{3}\right)\left(9.8 \times 10^{4}\right)$

5) $\left(7.1 \times 10^{-5}\right)\left(6.7 \times 10^{-6}\right)$

6) $\left(6 \times 10^{3}\right)\left(9.91 \times 10^{0}\right)$

7) $\dfrac{7.1 \times 10^{6}}{8.2 \times 10^{1}}$

8) $\dfrac{5.4 \times 10^{-1}}{3.4 \times 10^{1}}$

9) $\dfrac{4 \times 10^{4}}{3.63 \times 10^{-4}}$

10) $\dfrac{9 \times 10^{-5}}{9.24 \times 10^{-6}}$

11) $\dfrac{8.42 \times 10^{3}}{5 \times 10^{2}}$

12) $\dfrac{8.9 \times 10^{6}}{8.4 \times 10^{6}}$

13) $\left(8.9 \times 10^{5}\right)^{4}$

14) $\left(4 \times 10^{-5}\right)^{-6}$

Simplify. Your answer should contain only positive exponents.

1) $\left(x^{-2}x^{-3}\right)^4$

2) $\left(x^4\right)^{-3} \cdot 2x^4$

3) $\left(n^3\right)^3 \cdot 2n^{-1}$

4) $(2v)^2 \cdot 2v^2$

5) $\dfrac{2x^2y^4 \cdot 4x^2y^4 \cdot 3x}{3x^{-3}y^2}$

6) $\dfrac{2y^3 \cdot 3xy^3}{3x^2y^4}$

7) $\dfrac{x^3y^3 \cdot x^3}{4x^2}$

8) $\dfrac{3x^2y^2}{2x^{-1} \cdot 4yx^2}$

9) $\dfrac{x}{\left(2x^0\right)^2}$

10) $\dfrac{2m^{-4}}{\left(2m^{-4}\right)^3}$

11) $\dfrac{\left(2m^2\right)^{-1}}{m^2}$

12) $\dfrac{2x^3}{\left(x^{-1}\right)^3}$

13) $\left(a^{-3}b^{-3}\right)^0$

14) $x^4y^3 \cdot \left(2y^2\right)^0$

15) $ba^4 \cdot \left(2ba^4\right)^{-3}$

16) $\left(2x^0y^2\right)^{-3} \cdot 2yx^3$

17) $\dfrac{2k^3 \cdot k^2}{k^{-3}}$

18) $\dfrac{\left(x^{-3}\right)^4 x^4}{2x^{-3}}$

19) $\dfrac{(2x)^{-4}}{x^{-1} \cdot x}$

20) $\dfrac{\left(2x^3z^2\right)^3}{x^3y^4z^2 \cdot x^{-4}z^3}$

21) $\dfrac{\left(2pm^{-1}q^0\right)^{-4} \cdot 2m^{-1}p^3}{2pq^2}$

22) $\dfrac{\left(2hj^2k^{-2} \cdot h^4j^{-1}k^4\right)^0}{2h^{-3}j^{-4}k^{-2}}$