Algebra 1 **Name** _____
Chapter 8 Notes

Section 8.1 "Multiplication Properties of Exponents"

Multiplication Properties of Exponents:

Product of Powers Property: To multiply powers having the same base, add the exponents

$a^m \cdot a^n = a^{m+n}$ Ex 1: $3^2 \cdot 3^4 =$

Power of a Power Property: To find the power of a power, multiply the exponents

$(a^m)^n = a^{mn}$ Ex 2: $(2^2)^3 =$

Power of a Product Property: To find the power of a product, find the power of each factor and multiply

$(a \cdot b)^m = a^m \cdot b^m$ Ex 3: $(2 \cdot 4)^3 =$

NOTE: $(a + b)^m \neq a^m + b^m$

*You have to find the sum first, then raise it to a power! $(2 + 3)^4 =$

Examples

1) $x^3 \cdot x^5 =$

2) $4^2 \cdot 4^3 =$

3) $(x^2)^4 =$

4) $(2^3)^4 =$

5) $(x \cdot x)^3 =$

6) $(2 \cdot 3)^2 =$

7) $(3 + 4)^2 =$

8) $(x + 2x)^6 =$

9) $x^3 \cdot x^5 \cdot x^2 =$

Evaluating with Exponents:

First, simplify the expression. Second, evaluate the expression when a = 1 and b = 2.

10) $a^2 \cdot a^3 =$

11) $(a^3)^2 =$

12) $(ab^2)^2 =$

13) $-(ab^3)^2 =$

14) $(ab^2)(a^2)^3 =$

15) $(-b)^3 a^2 =$

Directions: Fill in the square with > or < or =

16) $(5 \cdot 6)^2 \square 5 \cdot 6^2$

17) $(2^3 \cdot 2^4) \square 2^{12}$

18) $(9^3)^2 \square 9^5$

19) $(2^5)(2^2) \square 2^{10}$

Section 8.2 "Zero and Negative Exponents"

Zero Exponents: Any non-zero number raised to the zero power is ALWAYS one!

$a^0 = 1,\ a \neq 0$ Example 1: $3^0 =$

Negative Exponents- Any non-zero number raised to a negative exponent is the same as 1 over the base raised to the positive power

a^{-n} is the reciprocal of a^n . . . $a^{-n} = \frac{1}{a^n}$ Example 2: $3^{-2} =$

$\frac{1}{a^{-n}} = \frac{a^n}{1} = a^n$ Example 3: $\frac{1}{4^{-2}} =$

Examples:

Rewrite with Positive Exponents:

4) $5^{-3} =$ 5) $2^{-x} =$ 6) $\left(\frac{1}{4}\right)^{-1} =$ 7) $\frac{2}{x^{-5}} =$

Simplify the Zero Exponent Expressions:

8) $3^0a^25^2 =$ 9) $(-3)^0x^2 =$

Simplify the expressions:

10) $3x^{-2}y^{-3} =$ 11) $(2x)^{-3} =$

12) $(2^{-1})^{-4} =$ 13) $x^{-3}y^5 =$

14) $(-2^{-3})^{-1} =$ 15) $-3(-2)^{-4} =$

16) $\frac{3xy^{-3}}{4x^{-2}}$ 17) $\left(\frac{-2x^{-3}}{4x^4}\right)^{-2}$

Section 8.3 "Division Properties of Exponents"

Quotient of Powers Property: To divide powers having the same base, subtract exponents

$$\frac{a^m}{a^n} = a^{m-n} \qquad a \neq 0$$

Example 1: $\frac{4^5}{4^3} =$

Example 2: $\frac{x^6y^2}{yx^4} =$

Power of a Quotient Property: To find a power of a quotient, find the power of the numerator and the power of the denominator, and divide

$$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m} \qquad b \neq 0$$

Example 3: $\left(\frac{3}{2}\right)^4 =$

Example 4: $\left(\frac{a}{2}\right)^3 =$

Example 5: $\left(\frac{a^2}{2^3}\right)^{-2} =$

Simplify the Expressions:

6) $\frac{3^4}{3^3} =$

7) $\frac{x^6}{x^3} =$

8) $\frac{5^2 \cdot 5^4}{5^3} =$

9) $\left(\frac{-3}{y}\right)^3 =$

10) $\frac{2x^2y}{3x} \cdot \frac{9xy^2}{y^4} =$

11) $\frac{5x^{-3}y^2}{x^5y^{-1}} \cdot \frac{(2xy^3)^{-2}}{xy} =$

Section 8.4 "Scientific Notation"

Scientific Notation: Numbers of the form $C \times 10^n$, where $1 \leq C \leq 9$, and n is an integer representing the number of places the decimal point has been "moved"

Writing Large Numbers in Scientific Notation

- Move the decimal point between the first and second non-zero numbers
- Count the number of places you moved the decimal point to the LEFT…this is your "power" on the 10
- Rewrite the number with the relocated decimal, drop any zeroes that were on the end, and add "x 10^{power}" after the number

Ex 1: 1,500,000 = Ex 2: 3,000,000,000 = Ex 3: 169,652,000,000,000 =

Writing Small Numbers in Scientific Notation

- Move the decimal point between the first and second non-zero numbers
- Count the number of places you moved the decimal point to the RIGHT…this is your "negative power" on the 10
- Rewrite the number with the relocated decimal, drop any zeroes that were at the beginning, and add "x 10^{-power}" after the number

Ex 4: .00098 = Ex 5: .0000006942 = Ex 6: .007085 =

Changing Numbers from Scientific Notation to Decimal Form

- For numbers with a POSITIVE exponent…move the decimal point that many places RIGHT
  Ex 7: $3.98 \times 10^{10} =$

- For numbers with a NEGATIVE exponent…move the decimal point that many places LEFT
  Ex 8: $6.69 \times 10^{-5} =$

Computations With Numbers in Scientific Notation

- Multiplication: Multiply the base numbers together and multiply the power numbers together
  Ex 9: $(3.6 \times 10^3)(7.8 \times 10^4) =$

- Division: Divide the base numbers and divide the power numbers
  Ex 10: $(2.403 \times 10^6) \div (1.35 \times 10^3) =$

- Scientific Notation numbers raised to a power: Raise the base number to the power and the power number to the power
  Ex 11: $(3.6 \times 10^3)^2 =$

Section 8.5 "Exponential Growth Functions"

Exponential Growth: A quantity that increases by the same percent in each unit of time

Exponential Growth Model:
$y = C(1 + r)^t$ C = initial amount

C = initial amount
$(1 + r)$ = the growth factor
r = the growth rate
t = the time period

Ex 1: You invest $1000 in an account that pays 6% annual interest compounded yearly. What is the account balance after 10 years?

Ex 2: How much would you invest at 3.5% to withdraw $2900 after 4 years?

Ex 3: 50 chipmunks are released into Hixon Forest. Chipmunks triple in population each year.

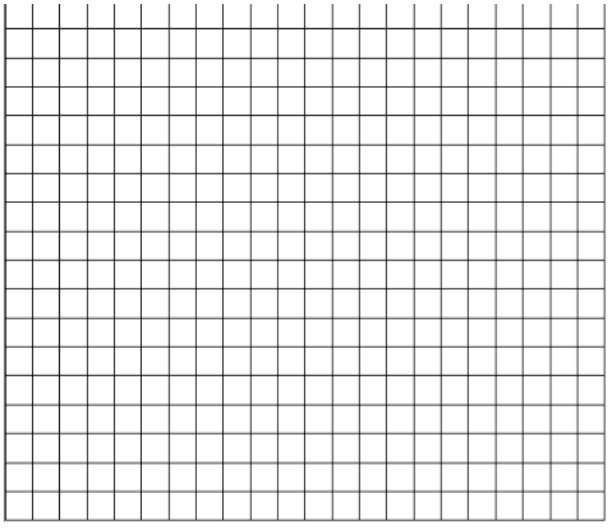
What is the percent increase each year?
*Remember growth factor = 1 + r

What will be the population after 4 years?

Ex 3: Plotting Exponential Growth
You invest $100 on your birthday in an account at an annual compounded rate of 4%. What will the balance be over the next 20 years?

t	0	2	4	6	8	10	12	14	16	18	20
y	100										

Graph the table of the exponential growth.



***Exponential Growth is NOT a straight line, it is NOT a linear relationship!**

Section 8.6 "Exponential Decay Functions"

Exponential Decay: A quantity that decreases by the same percent in each unit of time

Exponential Decay Model:
$y = C(1 - r)^t$ $(1 - r)$ = decay factor
r = decay rate

NOTE: **Growth factor** **$(1 + r) > 1$**
Decay factor **$(1 - r) < 1$**

Ex 1: Your iPad was originally $200. Like all electronics, it loses value every year. It depreciates at a rate of 12% per year. What will the value be in 4 years?

Ex 2: Penny Experiment
You start with 100 pennies in a cup and shake them out on a table. After each shake, you remove all tails, put the heads back in, and repeat until there are no more pennies left.

C =
t =
r = rate of decrease = ____
y = number of pennies left

$y = C(1 - r)^t$

$y = 100(1 - ?)^t$

Make a Table:

x	0	1	2	3	4	5	6	7	8	9	10
y	100										