Name _____ Date _____

6.1 Properties of Exponents

For use with Exploration 6.1

Essential Question How can you write general rules involving properties of exponents?

1 EXPLORATION: Writing Rules for Properties of Exponents

Work with a partner.

a. What happens when you multiply two powers with the same base? Write the product of the two powers as a single power. Then write a *general rule* for finding the product of two powers with the same base.

i. $(2^2)(2^3) =$ _____

ii. $(4^1)(4^5) =$ _____

iii. $(5^3)(5^5) =$ _____

iv. $(x^2)(x^6) =$ _____

b. What happens when you divide two powers with the same base? Write the quotient of the two powers as a single power. Then write a *general rule* for finding the quotient of two powers with the same base.

i. $\frac{4^3}{4^2} =$ _____

ii. $\frac{2^5}{2^2} =$ _____

iii. $\frac{x^6}{x^3} =$ _____

iv. $\frac{3^4}{3^4} =$ _____

c. What happens when you find a power of a power? Write the expression as a single power. Then write a *general rule* for finding a power of a power.

i. $(2^2)^4 =$ _____

ii. $(7^3)^2 =$ _____

iii. $(y^3)^3 =$ _____

iv. $(x^4)^2 =$ _____

6.1 Properties of Exponents (continued)

1 EXPLORATION: Writing Rules for Properties of Exponents (continued)

d. What happens when you find a power of a product? Write the expression as the product of two powers. Then write a *general rule* for finding a power of a product.

i. $(2 \bullet 5)^2 =$ _____ **ii.** $(5 \bullet 4)^3 =$ _____

iii. $(6a)^2 =$ _____ **iv.** $(3x)^2 =$ _____

e. What happens when you find a power of a quotient? Write the expression as the quotient of two powers. Then write a *general rule* for finding a power of a quotient.

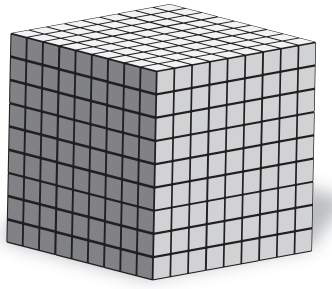
i. $\left(\frac{2}{3}\right)^2 =$ _____ **ii.** $\left(\frac{4}{3}\right)^3 =$ _____

iii. $\left(\frac{x}{2}\right)^3 =$ _____ **iv.** $\left(\frac{a}{b}\right)^4 =$ _____

Communicate Your Answer

2. How can you write general rules involving properties of exponents?

3. There are 3^3 small cubes in the cube below. Write an expression for the number of small cubes in the large cube at the right.



Name _____ Date _____

6.1 Notetaking with Vocabulary

For use after Lesson 6.1

In your own words, write the meaning of each vocabulary term.

power

exponent

base

scientific notation

Core Concepts

Zero Exponent

Words For any nonzero number a, $a^0 = 1$. The power 0^0 is undefined.

Numbers $4^0 = 1$ **Algebra** $a^0 = 1$, where $a \neq 0$

Negative Exponents

Words For any integer n and any nonzero number a, a^{-n} is the reciprocal of a^n.

Numbers $4^{-2} = \frac{1}{4^2}$ **Algebra** $a^{-n} = \frac{1}{a^n}$, where $a \neq 0$

Notes:

Name_____ Date _____

6.1 Notetaking with Vocabulary (continued)

Product of Powers Property

Let a be a real number, and let m and n be integers.

Words To multiply powers with the same base, add their exponents.

Numbers $4^6 \bullet 4^3 = 4^{6+3} = 4^9$ **Algebra** $a^m \bullet a^n = a^{m+n}$

Quotient of Powers Property

Let a be a nonzero real number, and let m and n be integers.

Words To divide powers with the same base, subtract their exponents.

Numbers $\frac{4^6}{4^3} = 4^{6-3} = 4^3$ **Algebra** $\frac{a^m}{a^n} = a^{m-n}$, where $a \neq 0$

Power of a Power Property

Let a be a real number, and let m and n be integers.

Words To find a power of a power, multiply the exponents.

Numbers $\left(4^6\right)^3 = 4^{6\bullet 3} = 4^{18}$ **Algebra** $\left(a^m\right)^n = a^{mn}$

Notes:

Power of a Product Property

Let a and b be real numbers, and let m be an integer.

Words To find a power of a product, find the power of each factor and multiply.

Numbers $(3 \bullet 2)^5 = 3^5 \bullet 2^5$ **Algebra** $(ab)^m = a^m b^m$

Power of a Quotient Property

Let a and b be real numbers with $b \neq 0$, and let m be an integer.

Words To find the power of a quotient, find the power of the numerator and the power of the denominator and divide.

Numbers $\left(\frac{3}{2}\right)^5 = \frac{3^5}{2^5}$ **Algebra** $\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$, where $b \neq 0$

Notes:

Name _____ Date _____

6.1 Notetaking with Vocabulary (continued)

Extra Practice

In Exercises 1–8, evaluate the expression.

1. 3^0 **2.** $(-2)^0$ **3.** 3^{-4} **4.** $(-4)^{-3}$

5. $\frac{2^{-3}}{5^0}$ **6.** $\frac{-3^{-2}}{2^{-3}}$ **7.** $\frac{4^{-1}}{-7^0}$ **8.** $\frac{3^{-1}}{(-5)^0}$

In Exercises 9–23, simplify the expression. Write your answer using only positive exponents.

9. z^0 **10.** a^{-8} **11.** $6a^0b^{-2}$

12. $14m^{-4}n^0$ **13.** $\frac{3^{-2}r^{-3}}{s^0}$ **14.** $\frac{2^3a^{-3}}{8^{-1}b^{-5}c^0}$

15. $\frac{3^5}{3^3}$ **16.** $\frac{(-2)^7}{(-2)^5}$ **17.** $(-5)^3 \bullet (-5)^3$

18. $(q^5)^3$ **19.** $(a^{-4})^2$ **20.** $\frac{c^4 \bullet c^3}{c^6}$

21. $(-4d)^4$ **22.** $(-3f)^{-3}$ **23.** $\left(\frac{4}{x}\right)^{-3}$

24. A rectangular prism has length x, width $\frac{x}{2}$, and height $\frac{x}{3}$. Which of the expressions represent the volume of the prism? Select all that apply.

A. $6^{-1}x^3$ **B.** $6^{-1}x^{-3}$ **C.** $(6x^{-3})^{-1}$ **D.** $2^{-1} \bullet 3^{-1} \bullet x^3$