Lesson 7-1 Expand Your Thinking

Exponents are a convenient way to show that a number is multiplied over and over again. For example, $2^4 = 2 \cdot 2 \cdot 2 \cdot 2 = 16$. The number 2 is called the **base**. This is the number that will be multiplied. The number 4 is called the **exponent**, or power. It tells how many times to multiply the base.

1. Expand each expression. Then find the value of the product.

   a. $2^3 =$

   b. $2^4 =$

   c. $2^5 \cdot 3^3 =$

   d. $3^4 =$

   e. $3^6 =$

   f. $3^5 \cdot 2^4 =$

2. Follow the pattern to complete the following problems. (Don't use your calculator - think about what happens as you move up one row in each column or down one row in each column.)

   a. $2^5 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = 32$

   b. $2^4 = 2 \cdot 2 \cdot 2 \cdot 2 =$

   c. $2^3 = 2 \cdot 2 \cdot 2 =$

   d. $2^2 =$

   e. $2^1 =$

   f. $2^0 =$

   g. $2^{-1} =$

   h. $2^{-2} = \frac{1}{2 \cdot 2} =$

   i. $2^{-3} =$ =

   j. $2^{-4} =$ =

   k. $2^{-5} =$ =

   l. $3^5 = 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 = 243$

   m. $3^4 = 3 \cdot 3 \cdot 3 \cdot 3 =$

   n. $3^3 = 3 \cdot 3 \cdot 3 =$

   o. $3^2 =$ =

   p. $3^1 =$

   q. $3^0 =$

   r. $3^{-1} =$

   s. $3^{-2} =$ =

   t. $3^{-3} =$ =

   u. $3^{-4} =$ =

   v. $3^{-5} =$ =

3. Your work in #2 should show that $2^0 = 1$ and $3^0 = 1$. Explain why it makes sense for both of these answers to be the same.

The Exponent Zero Rule - (Part of Skill 12)

Any base number raised to the exponent zero equals 1.

$$b^0 = 1$$

4. Use the *Exponent Zero Rule* to find the answers to each of the following:

   a. 2^0 =
   b. 3^0 =
   c. 4^0 =
   d. 5^0 =
   e. 10^0 =
   f. 20^0 =

5. Your work in #2 should show that $2^1 = 2$ and $3^1 = 3$. Explain why it makes sense for the answer to be the same number as the base.

The Exponent One Rule - (Part of Skill 12)

Any base number raised to the exponent one equals the base number.

$$b^1 = b$$

6. Use the *Exponent One Rule* to find the answers to each of the following:

   a. 2^1 =
   b. 3^1 =
   c. 4^1 =
   d. 5^1 =
   e. 10^1 =
   f. 20^1 =

7. Your work in #2 should show that $2^3 = 8$ and $2^{-3} = \frac{1}{8}$, $3^2 = 9$ and $3^{-2} = \frac{1}{9}$. This can be expressed by the following rule:

The Negative Exponent Rule - (Part of Skill 12)

Any base number raised to a negative exponent equals one over the base number raised to the opposite exponent.

$$b^{-n} = \frac{1}{b^n}, \text{ or } \frac{1}{b^{-n}} = b^n$$

8. Use the *Negative Exponent Rule* to find the answers to each of the following:

   a. $4^{-2} = \frac{1}{4^2} =$
   b. $3^{-1} = \frac{1}{3^1} =$
   c. 2^{-4} =
   d. 5^{-2} =
   e. 10^{-3} =
   f. 3^{-4} =

Problem 4 Using an Exponential Expression STEM

Population Growth **A population of marine bacteria doubles every hour under controlled laboratory conditions. The number of bacteria is modeled by the expression $1000 \cdot 2^h$, where h is the number of hours after a scientist measures the population size. Evaluate the expression for $h = 0$ and $h = -3$. What does each value of the expression represent in the situation?**

* There were 1000 bacteria at the time the scientist measured the population.
* There were 125 bacteria 3 hrs before the scientist measured the population.

Got It? **4.** A population of insects triples every week. The number of insects is modeled by the expression $5400 \cdot 3^w$, where w is the number of weeks after the population was measured. Evaluate the expression for $w = -2$, $w = 0$, and $w = 1$. What does each value of the expression represent in the situation?

* 600 represents the number of insects 2 weeks before the pop. was measured.
* 5400 represents the pop. when it was measured.
* 16,200 represents the number of insects 1 week after the pop. was measured.

Mastery Algebra 1 Practice 7-1 Name:_____

Per: ____ ☐

7-1 Zero and Negative Exponents

Simplify each expression completely. Leave your answer in fraction form, if necessary. (1 pt each)

1. h^{-42}	2. $\frac{3^2 \cdot t^0}{9}$	3. $4^{-2} \cdot r^{-3}$
4. $\frac{14}{2y^{-6}}$	5. $\frac{3^{-3}}{b^{-2}}$	6. $2^{-3}m^7n^{-11}$

7. Suppose a person is admitted to the hospital for an infection, and that the function $y = 2500 \cdot 0.80^x$ models the number of bacteria present in their bloodstream x hours after being admitted to the hospital.

a. How many bacteria are present when they are admitted (0 hours)?

(2)

b. How many bacteria were there 8 hours before they were admitted?

(2)