Name _____ Date_____

Exponents

1. What is the difference between $6z$ and z^6?

2. Write 10^3 as a multiplication expression having repeated factors.

3. Write $8 \times 8 \times 8 \times 8$ using exponents.

1. Complete the table by filling in the blank cells. Use a calculator when needed.

Exponential Form	Expanded Form	Standard Form
3^5		
	$4 \times 4 \times 4$	
$(1.9)^2$		
$\left(\frac{1}{2}\right)^5$		

2. Why do whole numbers raised to an exponent get greater, while fractions raised to an exponent get smaller?

3. The powers of 2 that are in the range 2 through $1{,}000$ are $2, 4, 8, 16, 32, 64, 128, 256$, and 512. Find all the powers of 3 that are in the range 3 through $1{,}000$.

4. Find all the powers of 4 in the range 4 through $1{,}000$.

5. Write an equivalent expression for $n \times a$ using only addition.

6. Write an equivalent expression for w^b using only multiplication.
   a. Explain what w is in this new expression.
   b. Explain what b is in this new expression.

7. What is the advantage of using exponential notation?

8. What is the difference between $4x$ and x^4? Evaluate both of these expressions when $x = 2$.

1. What is the difference between $6z$ and z^6?

   $6z = z + z + z + z + z + z$ *or 6 times z ;* $z^6 = z \times z \times z \times z \times z \times z$

2. Write 10^3 as a series of products.

   $10 \times 10 \times 10$

3. Write $8 \times 8 \times 8 \times 8$ using an exponent.

   8^4

1. Complete the table by filling in the blank cells. Use a calculator when needed.

Exponential Form	Expanded Form	Standard Form
3^5	$3 \times 3 \times 3 \times 3 \times 3$	243
4^3	$4 \times 4 \times 4$	64
$(1.9)^2$	1.9×1.9	3.61
$\left(\frac{1}{2}\right)^5$	$\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2}$	$\frac{1}{32}$

2. Why do whole numbers raised to an exponent get greater, while fractions raised to an exponent get smaller?

   As whole numbers are multiplied by themselves, products are larger because there are more groups. As fractions of fractions are taken, the product is smaller. A part of a part is less than how much we started with.

3. The powers of 2 that are in the range 2 through $1,000$ are $2, 4, 8, 16, 32, 64, 128, 256$, and 512. Find all the powers of 3 that are in the range 3 through $1,000$.

   $3, 9, 27, 81, 243, 729$

4. Find all the powers of 4 in the range 4 through $1,000$.

   $4, 16, 64, 256$

5. Write an equivalent expression for $n \times a$ using only addition.

   $\underbrace{(a + a + \cdots a)}_{\text{n times}}$

6. Write an equivalent expression for w^b using only multiplication.

   $w^b = \underbrace{(w \cdot w \cdots w)}_{\text{b times}}$

a. Explain what w is in this new expression.

w is the factor that will be repeatedly multiplied by itself.

b. Explain what b is in this new expression.

b is the number of times w will be multiplied.

7. What is the advantage of using exponential notation?

It is a shorthand way of writing a multiplication expression if the factors are all the same.

8. What is the difference between $4x$ and x^4? Evaluate both of these expressions when $x = 2$.

$4x$ means four times x, this is the same as $x + x + x + x$. On the other hand, x^4 means x to the fourth power, or $x \times x \times x \times x$.

When $x = 2$, $4x = 4 \times 2 = 8$.

When $x = 2$, $x^4 = 2 \times 2 \times 2 \times 2 = 16$.