

Lesson 5: Exponents

Classwork

Opening Exercise

As you evaluate these expressions, pay attention to how you arrived at your answers.

$$4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4$$

$$9 + 9 + 9 + 9 + 9$$

$$10 + 10 + 10 + 10 + 10$$

Examples 1–10

Write each expression in exponential form.

1. $5 \times 5 \times 5 \times 5 \times 5 =$

2. $2 \times 2 \times 2 \times 2 =$

Write each expression in expanded form.

3. $8^3 =$

4. $10^6 =$

5. $g^3 =$

Go back to Examples 1–4, and use a calculator to evaluate the expressions.

What is the difference between $3g$ and g^3 ?

6. Write the expression in expanded form, and then evaluate.

$$(3.8)^4 =$$

7. Write the expression in exponential form, and then evaluate.

$$2.1 \times 2.1 =$$

8. Write the expression in exponential form, and then evaluate.

$$0.75 \times 0.75 \times 0.75 =$$

The base number can also be a fraction. Convert the decimals to fractions in Examples 7 and 8 and evaluate. Leave your answer as a fraction. Remember how to multiply fractions!

9. Write the expression in exponential form, and then evaluate.

$$\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} =$$

10. Write the expression in expanded form, and then evaluate.

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

Exercises

1. Fill in the missing expressions for each row. For whole number and decimal bases, use a calculator to find the standard form of the number. For fraction bases, leave your answer as a fraction.

Exponential Form	Expanded Form	Standard Form
3^2	3×3	9
	$2 \times 2 \times 2 \times 2 \times 2 \times 2$	
4^5		
	$\frac{3}{4} \times \frac{3}{4}$	
	1.5×1.5	

2. Write five cubed in all three forms: exponential form, expanded form, and standard form.

Lesson Summary

EXPONENTIAL NOTATION FOR WHOLE NUMBER EXPONENTS: Let m be a nonzero whole number. For any number a , the expression a^m is the product of m factors of a , i.e.,

$$a^m = \underbrace{a \cdot a \cdot \cdots \cdot a}_{m \text{ times}}$$

The number a is called the *base*, and m is called the *exponent* or *power* of a .

When m is 1, “the product of one factor of a ” just means a (i.e., $a^1 = a$). Raising any nonzero number a to the power of 0 is defined to be 1 (i.e., $a^0 = 1$ for all $a \neq 0$).

Problem Set

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

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

- Why do whole numbers raised to an exponent get greater, while fractions raised to an exponent get smaller?
- 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.
- Find all the powers of 4 in the range 4 through 1,000.
- Write an equivalent expression for $n \times a$ using only addition.
- Write an equivalent expression for w^b using only multiplication.
 - Explain what w is in this new expression.
 - Explain what b is in this new expression.
- What is the advantage of using exponential notation?
- What is the difference between $4x$ and x^4 ? Evaluate both of these expressions when $x = 2$.