

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

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. $10^6 =$

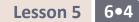






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5. $g^3 =$

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. $0.75\times0.75\times0.75=$

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





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4. One student thought two to the third power was equal to six. What mistake do you think he made, and how would you help him fix his mistake?









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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

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

Exponential Form	Expanded Form	Standard Form
35		
	$4 \times 4 \times 4$	
$(1.9)^2$		
$\left(\frac{1}{2}\right)^5$		

- 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.





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