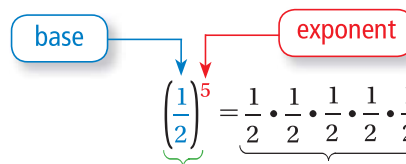


8.1 Lesson

Key Vocabulary

power, p. 320
base, p. 320
exponent, p. 320

A **power** is a product of repeated factors. The **base** of a power is the repeated factor. The **exponent** of a power indicates the number of times the base is used as a factor.


$$\left(\frac{1}{2}\right)^5 = \underbrace{\frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2}}_{\frac{1}{2} \text{ is used as a factor } 5 \text{ times.}}$$

EXAMPLE 1 Writing Expressions Using Exponents

Write each product using exponents.

a. $(-7) \cdot (-7) \cdot (-7)$

Because -7 is used as a factor 3 times, its exponent is 3.

▶ So, $(-7) \cdot (-7) \cdot (-7) = (-7)^3$.

b. $\pi \cdot \pi \cdot r \cdot r \cdot r$

Because π is used as a factor 2 times, its exponent is 2. Because r is used as a factor 3 times, its exponent is 3.

▶ So, $\pi \cdot \pi \cdot r \cdot r \cdot r = \pi^2 r^3$.

Try It Write the product using exponents.

1. $\frac{1}{4} \cdot \frac{1}{4} \cdot \frac{1}{4} \cdot \frac{1}{4} \cdot \frac{1}{4}$

2. $0.3 \cdot 0.3 \cdot 0.3 \cdot 0.3 \cdot x \cdot x$

Math Practice

Communicate Precisely

Explain why you need to use parentheses to write powers when the base is negative.

EXAMPLE 2 Evaluating Expressions

Evaluate each expression.

a. $(-2)^4$

$(-2)^4 = (-2) \cdot (-2) \cdot (-2) \cdot (-2)$
 $= 16$

The base is -2 .

Write as repeated multiplication.
Simplify.

b. -2^4

$-2^4 = -(2 \cdot 2 \cdot 2 \cdot 2)$
 $= -16$

The base is 2.

Write as repeated multiplication.
Simplify.

Try It Evaluate the expression.

3. 12^2

4. $(-2)^6$

5. -5^4

6. $\left(-\frac{1}{6}\right)^3$

EXAMPLE 3 Using Order of Operations

Evaluate each expression.

$$\begin{aligned}\text{a. } 3 + 2 \cdot 3^4 &= 3 + 2 \cdot 81 \\ &= 3 + 162 \\ &= 165\end{aligned}$$

Evaluate the power.

Multiply.

Add.

$$\begin{aligned}\text{b. } 3^3 - 8^2 \div 2 &= 27 - 64 \div 2 \\ &= 27 - 32 \\ &= -5\end{aligned}$$

Evaluate the powers.

Divide.

Subtract.

$$\begin{aligned}\text{c. } -3 \cdot (-10^2 + 70) &= -3 \cdot (-100 + 70) \\ &= -3 \cdot (-30) \\ &= 90\end{aligned}$$

Evaluate the power.

Perform operation in parentheses.

Multiply.

Math Practice

Look for Structure

Can you use the Distributive Property to evaluate the expression in part (c)? Explain.

Try It Evaluate the expression.

7. $9 - 2^5 \cdot 0.5$

8. $|-3^3 \div 27|$

9. $(7 \cdot 4 - 4^3) \div 6$



Self-Assessment for Concepts & Skills

Solve each exercise. Then rate your understanding of the success criteria in your journal.

WRITING EXPRESSIONS USING EXPONENTS Write the product using exponents.

10. $(-0.9) \cdot (-0.9) \cdot (-0.9)$

11. $\frac{1}{8} \cdot \frac{1}{8} \cdot y \cdot y \cdot y$

EVALUATING EXPRESSIONS Evaluate the expression.

12. 11^2

13. -6^3

14. $(-0.3)^4$

USING ORDER OF OPERATIONS Evaluate the expression.

15. $|-24 \div 2^2|$

16. $(3^3 - 6 \cdot 8) \div 7$

17. **WHICH ONE DOESN'T BELONG?** Which expression does *not* belong with the other three? Explain your reasoning.

$(-2)^6$

-8^2

8^2

2^6