

3-2

Exponents

You need your notebook and clicker today.

What You'll Learn

To use exponents and to simplify expressions with exponents

🔊 **New Vocabulary** exponent, base, power

Why Learn This?

Exponents are used to represent numbers. You need exponents to write large numbers like the number of stars in a galaxy.

CONTENT STANDARDS

6.EE.1, 6.EE.2, 6.EE.2.c



You can write 625 as a product of factors.

$$625 = \underbrace{5 \times 5 \times 5 \times 5}_{\text{factors}}$$

The number 5 is used as a factor four times. An **exponent** tells you how many times a number, or **base**, is used as a factor.

$$5 \times 5 \times 5 \times 5 = 5^4 \quad \leftarrow \text{exponent}$$

↑
base

5^4 is a power. A **power** is a number that can be expressed using an exponent.

EXAMPLE Using an Exponent

- 1 Write $3 \times 3 \times 3 \times 3$ using an exponent. Name the base and the exponent.

$$3 \times 3 \times 3 \times 3 = 3^4 \quad \leftarrow 3^4 \text{ means that 3 is used as a factor 4 times.}$$

The base is 3, and the exponent is 4.

1 EXAMPLE Write $5 \times 5 \times 5 \times 5$ using an exponent. Name the base and the exponent.

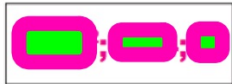
$$5 \times 5 \times 5 \times 5 = 5^4 \quad \longleftarrow \quad 5^4 \text{ means that } 5 \text{ is used as a factor } 4 \text{ times.}$$

The base is 5 and the exponent is 4.

Quick Check

1. Write each expression using an exponent. Name the base and the exponent.

a. 3.94×3.94



b. $7 \times 7 \times 7 \times 7$



c. $x \cdot x \cdot x$



EXAMPLE**Simplifying a Power**

2 Anatomy You have 2^5 bones in your hand and arm. What is the value of 2^5 ?

$$2^5 = 2 \times 2 \times 2 \times 2 \times 2 = 32 \quad \leftarrow \text{The base 2 is used as a factor 5 times.}$$

The value of 2^5 is 32.

2 **EXAMPLE** Simplify each expression.

a. $6^3 = 6 \times 6 \times 6 = 216$

← The base 6 is used as factor 3 times.

b. $3^5 = 3 \times 3 \times 3 \times 3 \times 3 = 243$

← Use a calculator without an exponent key.

c. $2.7^4 = 2.7 \wedge 4 = 53.1441$

← Use a calculator with an exponent key.

The order of operations can be extended to include exponents.

KEY CONCEPTS **Order of Operations**

1. Do all operations within parentheses first.
2. Do all work with exponents.
3. Multiply and divide in order from left to right.
4. Add and subtract in order from left to right.

EXAMPLE**Simplifying an Expression**

3 Simplify $3 \times (7^2 + 18 \div 2)$.

$$3 \times (49 + 18 \div 2) \leftarrow \text{Simplify within parentheses. Simplify } 7^2.$$

$$3 \times (49 + 9) \leftarrow \text{In parentheses, simplify } 18 \div 2.$$

$$3 \times (58) \leftarrow \text{In parentheses, add } 49 + 9.$$

$$174 \leftarrow \text{Multiply 3 and 58.}$$



3 EXAMPLE Simplify the expression: $24 - (8 - 1.2 \times 5)^2$.

$24 - (8 - 6)^2$ ← Simplify 1.2×5 in parentheses first.

$24 - (2)^2$ ← In parentheses, simplify $8 - 6$.

$24 - 4$ ← Simplify 2^2 .

20 ← Subtract 4 from 24.

Table talk and see if you can complete all of these blanks.

Vocabulary and Key Concepts

Order of Operations

1. Do all operations within first.
2. Do all work with exponents.
3. and in order from left to right.
4. and in order from left to right.

An tells you how many times
a number, or , is used as a factor.

$$8 \times 8 \times 8 = 8^3 \quad \leftarrow \text{ }$$

↑

A power is _____ _____



Solve: $2^3 - 6 \div 3$

A $2/3$

D 4

B 6

E 2

C 0

F 3



Solve: $5 + (2 + 1)^2$

A 11

B 64

C 14

D 16

Power down your clickers and put them away.

You have an assignment worksheet, and time to begin working on it now.

Reteaching 3-2

Exponents

An *exponent* tells how many times a number is used as a factor.

$3 \times 3 \times 3 \times 3$ shows the number 3 is used as a factor 4 times.

$3 \times 3 \times 3 \times 3$ can be written 3^4 .

In 3^4 , 3 is the *base* and 4 is the exponent.

Read 3^4 as "three to the fourth power."

- To *simplify* a power, first write it as a product.

$$2^5 = 2 \times 2 \times 2 \times 2 \times 2 = 32$$

- When you simplify expressions with exponents, do all operations inside parentheses first. Then simplify the powers.

$$\begin{aligned}\text{Example: } 30 - (2 + 3)^2 &= 30 - 5^2 \\ &= 30 - 25 \\ &= 5\end{aligned}$$

Name the base and the exponent.

1. 3^6

base _____

exponent _____

2. 6^2

base _____

exponent _____

3. 8^4

base _____

exponent _____

Write each expression using an exponent. Name the base and the exponent.

4. $9 \times 9 \times 9$

5. $6 \times 6 \times 6 \times 6$

6. $1 \times 1 \times 1 \times 1 \times 1$

Simplify each expression.

7. 6^2

8. 3^5

9. 10^4

10. $4^2 + 5^2$

11. $2 \times 6 - 2^3$

12. $6^2 + 4^2$

13. $5 + 5^2 - 2$

14. $24 \div 4 + 2^4$

15. $9 + (40 \div 2^3)$

16. $(4^2 + 4) \div 5$

17. $10 \times (30 - 5^2)$

18. $12 + 18 \div 3^2$
