

1-2 Exponents

Warm Up

Problem of the Day

Lesson Presentation

1-2 Exponents

Warm Up Simplify.

1. $2 \cdot 2 \cdot 2$

8

2. $3 \cdot 3 \cdot 3 \cdot 3$

81

3. $5 \cdot 5 \cdot 5$

125

4. $4 \cdot 4 \cdot 4$

64

5. $6 \cdot 6 \cdot 6 \cdot 6 \cdot 6$

7,776

1-2 Exponents

Problem of the Day

You intend to place water lilies in the pond in your backyard. A water lily doubles in size every day. From the time you install the first lily until the entire surface of the pond is covered will take 20 days. how long will it take for the pond to be half covered?

19 days

1-2 Exponents

Learn to represent numbers by using exponents.

Vocabulary

power

exponent

base

1-2 Exponents

A DNA molecule makes a copy of itself by splitting in half. Each half becomes a molecule that is identical to the original. The molecules continue to split so that the two become four, the four become eight, and so on.

Each time DNA copies itself, the number of molecules doubles. After four copies, the number of molecules is $2 \cdot 2 \cdot 2 \cdot 2 = 16$.

1-2 Exponents

This multiplication can also be written as a **power**, using a *base* and an *exponent*. The **exponent** tells how many times to use the **base** as a factor.



Reading Math

Read 2^4 as “the fourth power of 2” or “2 to the fourth power.”

1-2 Exponents

Additional Example 1: Evaluating Powers

Find each value.

A. 4^4

$$\begin{aligned}4^4 &= 4 \cdot 4 \cdot 4 \cdot 4 \\ &= 256\end{aligned}$$

Use 4 as a factor 4 times.

B. 7^3

$$\begin{aligned}7^3 &= 7 \cdot 7 \cdot 7 \\ &= 343\end{aligned}$$

Use 7 as a factor 3 times.

C. 19^1

$$19^1 = 19$$

Use 19 as a factor 1 time.

1-2 Exponents

Check It Out: Example 1

Find each value.

A. 3^3

$$\begin{aligned} 3^3 &= 3 \cdot 3 \cdot 3 \\ &= 27 \end{aligned}$$

Use 3 as a factor 3 times.

B. 6^2

$$\begin{aligned} 6^2 &= 6 \cdot 6 \\ &= 36 \end{aligned}$$

Use 6 as a factor 2 times.

B. 14^1

$$14^1 = 14$$

Use 14 as a factor 1 time.

1-2 Exponents

Any number to the zero power, except zero is equal to 1.

$$6^0 = 1$$

$$10^0 = 1$$

$$19^0 = 1$$

Zero to the zero power is *undefined*, meaning that it does not exist.

1-2 Exponents

To express a whole number as a power, write the number as a product of equal factors. Then write the product using the base and an exponent.

For example, $10,000 = 10 \cdot 10 \cdot 10 \cdot 10 = 10^4$.

1-2 Exponents

Additional Example 2: Expressing Whole Numbers as Powers

Write each number using an exponent and the given base.

A. 625, base 5

$$\begin{aligned} 625 &= 5 \cdot 5 \cdot 5 \cdot 5 && \text{5 is used as a factor 4 times.} \\ &= 5^4 \end{aligned}$$

B. 64, base 2

$$\begin{aligned} 64 &= 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 && \text{2 is used as a factor 6} \\ &= 2^6 && \text{times.} \end{aligned}$$

1-2 Exponents

Check It Out: Example 2

Write each number as an exponent and the given base.

A. 2,401, base 7

$$\begin{aligned}2,401 &= 7 \cdot 7 \cdot 7 \cdot 7 \\ &= 7^4\end{aligned}$$

*7 is used as a factor
4 times.*

B. 243, base 3

$$\begin{aligned}243 &= 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \\ &= 3^5\end{aligned}$$

*3 is used as a factor
5 times.*

1-2 Exponents

Additional Example 3: *Application*

On Monday, Erik tells 3 people a secret. The next day each of them tells 3 more people. If this pattern continues, how many people besides Erik will know the secret on Friday?

On Monday, 3 people know the secret.

On Tuesday, 3 times as many people know as those who knew on Monday.

On Wednesday, 3 times as many people know as those who knew on Tuesday.

On Thursday, 3 times as many people know as those who knew on Wednesday.

1-2 Exponents

Additional Example 3 Continued

On Friday, 3 times as many people know as those who knew on Thursday.

Each day the number of people is 3 times greater.

$$3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 = 3^5 = 243$$

On Friday 243 people besides Erik will know the secret.

1-2 Exponents

Check It Out: Example 3

In a game, a contestant had a starting score of one point. She doubled her score every turn for four turns. Write her score after four turns as a power. Then find her score.

After the first turn, she had 2 points.

After the second turn, she would have 4 points.

After the third turn, she would have 8 points.

After each turn, her point total is 2 times greater.

$$2 \cdot 2 \cdot 2 \cdot 2 = 2^4 = 16 \text{ points}$$

1-2 Exponents

Lesson Quiz

Find each value.

1. 7^3 343

2. 6^3 216

3. 3^4 81

4. 8^5 32,768

Write each number using an exponent and given base.

5. 125, base 5 5^3

6. 16, base 2 2^4

7. Find the volume of a cube if each side is 12 inches long. $1,728 \text{ in}^3$