Lesson 13: Expressions with Exponents

Let's use the meaning of exponents to decide if equations are true.

13.1: Which One Doesn't Belong: Twos

Which one doesn't belong?

$2 \cdot 2 \cdot 2 \cdot 2$

2^4

16

$4 \cdot 2$

13.2: Is the Equation True?

Decide whether each equation is true or false, and explain how you know.

1. $2^4 = 2 \cdot 4$

2. $3 + 3 + 3 + 3 + 3 = 3^5$

3. $5^3 = 5 \cdot 5 \cdot 5$

4. $2^3 = 3^2$

5. $16^1 = 8^2$

6. $\frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} = 4 \cdot \frac{1}{2}$

7. $\left(\frac{1}{2}\right)^4 = \frac{1}{8}$

8. $8^2 = 4^3$

13.3: What's Your Reason?

In each list, find expressions that are equivalent to each other and explain to your partner why they are equivalent. Your partner listens to your explanation. If you disagree, explain your reasoning until you agree. Switch roles for each list. (There may be more than two equivalent expressions in each list.)

1. a. $5 \cdot 5$

   b. 2^5

   c. 5^2

   d. $2 \cdot 5$

2. a. 4^3

   b. 3^4

   c. $4 \cdot 4 \cdot 4$

   d. $4 + 4 + 4$

3. a. $6 + 6 + 6$

   b. 6^3

   c. 3^6

   d. $3 \cdot 6$

4. a. 11^5

   b. $11 \cdot 11 \cdot 11 \cdot 11 \cdot 11$

   c. $11 \cdot 5$

   d. 5^{11}

5. a. $\frac{1}{5} \cdot \frac{1}{5} \cdot \frac{1}{5}$

   b. $\left(\frac{1}{5}\right)^3$

   c. $\frac{1}{15}$

   d. $\frac{1}{125}$

6. a. $\left(\frac{5}{3}\right)^2$

   b. $\left(\frac{3}{5}\right)^2$

   c. $\frac{10}{6}$

   d. $\frac{25}{9}$

Are you ready for more?

What is the last digit of $3^{1,000}$? Show or explain your reasoning.

Lesson 13 Summary

When working with exponents, the bases don't have to always be whole numbers. They can also be other kinds of numbers, like fractions, decimals, and even variables. For example, we can use exponents in each of the following ways:

$$\left(\frac{2}{3}\right)^4 = \frac{2}{3} \cdot \frac{2}{3} \cdot \frac{2}{3} \cdot \frac{2}{3}$$

$$(1.7)^3 = (1.7) \cdot (1.7) \cdot (1.7)$$

$$x^5 = x \cdot x \cdot x \cdot x \cdot x$$