



Activity

# 6-1

## Rational Exponents and Properties of Exponents



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### CRITIQUE & EXPLAIN

Students are asked to write an equivalent expression for  $3^{-3}$ . Casey and Jacinta each write an expression on the board.

Casey

$$3^{-3} = -27$$

Jacinta

$$3^{-3} = \frac{1}{27}$$

A. Who is correct, Casey or Jacinta? Explain.

B. **Reason** What is the most likely error that was made? © MP.2

#### HABITS OF MIND

**Look for Relationships** How do you know when exponential expressions are equivalent? Explain. © MP.7

**EXAMPLE 1** **Try It!** Write Radicals Using Rational Exponents

1. How can you write  $\sqrt[3]{2}$  using rational exponents?

**EXAMPLE 2** **Try It!** Use the Product of Powers Property to Solve Equations With Rational Exponents

2. What is the solution of  $(2^{\frac{x}{4}})(2^{\frac{x}{6}}) = 2^3$ ?

**EXAMPLE 3** **Try It!** Use the Power of Power Property to Solve Equations With Rational Exponents

3. What is the solution of each equation?
  - a.  $256^{x+2} = 4^{3x+9}$

b.  $(\frac{1}{8})^{\frac{x}{2}-1} = (\frac{1}{4})^{\frac{x}{3}}$

**HABITS OF MIND**

**Communicate Precisely** When is the value of an expression undefined? Explain. © MP.6





**EXAMPLE 4**  **Try It!** Use the Power of a Product Property to Solve Equations With Rational Exponents

4. When the side length of Blanket A is multiplied by  $2^{\frac{1}{2}}$  the result is 6 yards. Find the area of Blanket A.

**EXAMPLE 5**  **Try It!** Use the Quotient of Powers Property to Solve Equations With Rational Exponents

5. What is the value of  $x$  if the side length of Terrarium A is 3 times greater than the side length of Terrarium B?

**HABITS OF MIND**

**Look for Relationships** Can you use the same properties of exponents for expressions with rational exponents as you do when computing with integers? Explain. © MP.7



## Do You UNDERSTAND?

- ESSENTIAL QUESTION** What are the properties of rational exponents and how are they used to solve problems?
- Communicate Precisely** A square has an area of  $15 \text{ ft}^2$ . What are two ways of expressing its side lengths? © MP.6
- Look for Relationships** If  $3^x = 3^y$ , what is the relationship between  $x$  and  $y$ ? © MP.7
- Error Analysis** Corey wrote  $\sqrt[3]{4^2}$  as  $4^{\frac{3}{2}}$ . What error did Corey make? © MP.3
- Reason** When is it useful to have rational exponents instead of radicals? © MP.2
- Vocabulary** How are *rational exponents* different than whole number exponents? How are they the same?

## Do You KNOW HOW?

Write each radical using rational exponents.

7.  $\sqrt{7}$

8.  $\sqrt{15}$

9.  $\sqrt[3]{6^4}$

10.  $\sqrt[3]{2^3}$

11.  $\sqrt[4]{2^4}$

12.  $\sqrt{8^3}$

Solve each equation.

13.  $(2^{\frac{x}{3}})(2^{\frac{x}{4}}) = 2^5$

14.  $(4^{\frac{x}{2}})(4^{\frac{x}{5}}) = 4^8$

15.  $64^{x+1} = 4^{x+7}$

16.  $16^{(x-3)} = 2^{(x-6)}$

17.  $(\frac{1}{243})^{-\frac{x}{3}} = (\frac{1}{9})^{-\frac{x}{2}} + 1$

18.  $(\frac{1}{36})^{(x-4)} = (\frac{1}{216})^{x+1}$

