PRACTICE & PROBLEM SOLVING

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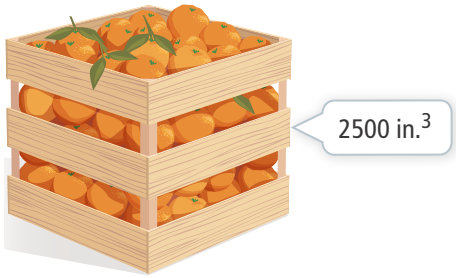
Practice Tutorial

Additional Exercises Available Online

UNDERSTAND

19. Make Sense and Persevere Describe two ways to express the edge length of a cube with a volume shown.



20. Construct Arguments Explain why $5^{\frac{4}{3}}$ must be equal to $\sqrt[3]{5^4}$ if the Power of a Power Property holds for rational exponents.

21. Error Analysis Describe and correct the error a student made when starting to solve the equation $8^{x+3} = 2^{2x-5}$.

$$8^{x+3} = 2^{2x-5}$$
$$(2^3)^{x+3} = 2^{2x-5}$$
$$2^{3x+3} = 2^{2x-5}$$
$$\vdots$$

✗

22. Construct Arguments The Power of a Quotient rule is $\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$, $b \neq 0$. Will this rule work with rational exponents if $\frac{a}{b}$ is a positive number? Give an example to support your argument.

23. Higher Order Thinking The Zero Exponent Property is $a^0 = 1$, $a \neq 0$.

a. How could you use properties of exponents to explain why $a^0 = 1$?

b. How could the Zero Exponent Property be applied when solving equations with rational exponents?

24. Use Structure Consider the expression $\sqrt{\sqrt{625}}$.

a. Write the radical using rational exponents.

b. Describe two different ways to evaluate the expression.

c. Simplify the expression from part (b).

PRACTICE

Write each radical using rational exponents.

SEE EXAMPLE 1

25. $\sqrt{3}$

26. $\sqrt[3]{7}$

27. $\sqrt[5]{3^2}$

28. $\sqrt[4]{2^{-5}}$

29. $\sqrt[3]{a^2}$

30. $\sqrt{b^a}$

Solve each equation. SEE EXAMPLES 2–5

31. $\left(5^{\frac{x}{3}}\right)\left(5^{\frac{x}{4}}\right) = 5^5$

32. $\left(2^{\frac{x}{2}}\right)\left(4^{\frac{x}{2}}\right) = 2^6$

33. $\left(3^{\frac{x}{2}+1}\right) = \left(3^{-\frac{5x}{2}}\right)$

34. $625^{2x-3} = 25^{3x-2}$

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

36. $8^{\frac{-x}{3}} = 4$

37. $49^{\frac{x}{4}-1} = 343^{\frac{x}{3}}$

38. $3 = \left(5^{\frac{1}{2}}\right)\left(x^{\frac{1}{2}}\right)$

39. $2 = \left(4^{\frac{1}{3}}\right)\left(2^{\frac{x}{3}}\right)$

40. $\frac{27^{\frac{1}{4}}}{3^{\frac{x}{4}}} = 1$

41. $5^{-\frac{2}{3}} = \frac{125^{\frac{x}{3}}}{25^{\frac{4}{3}}}$

42. $\frac{6^{\frac{1}{4}}}{36^{-\frac{x}{2}}} = 1$

For each partial solution, identify the property of exponents that is used. SEE EXAMPLES 2–4

43.

$$36^{\frac{x}{3}+3} = 216^{\frac{x}{5}}$$
$$(6^2)^{\frac{x}{3}+3} = (6^3)^{\frac{x}{5}}$$
$$6^{\frac{2x}{3}+6} = 6^{\frac{3x}{5}}$$
$$\vdots$$

44.

$$\vdots$$
$$\frac{3^{\frac{3x}{4}}}{3^{\frac{1}{4}}} = 3^{-\frac{3}{4}}$$
$$3^{\frac{3x}{4}-\frac{1}{4}} = 3^{-\frac{3}{4}}$$
$$\vdots$$

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APPLY

45. Use Appropriate Tools The formula for the volume V of a sphere is $\frac{4}{3}\pi r^3$. What is the radius of the basketball shown?

46. Use Structure A singing contest eliminates contestants after each round. To find the number of contestants in the next round, raise the number of contestants in the current round to the power of $\frac{6-n}{7-n}$, where n is the number of the current round.

47. Make Sense and Persevere Photos A, B, and C are all square photos. The area of Photo C is the same as a rectangular photo whose length is the side length of Photo A and whose width is the side length of Photo B. Use the properties of rational exponents to write and solve an equation to find the side length of Photo A to two decimal places.

Photo A
Area = x cm^2

Photo B
Area = 72 cm^2

Photo C
Area = 110 cm^2

ASSESSMENT PRACTICE

48. Match each expression with its equivalent expression.

I. $\sqrt[4]{2^5}$	**A.** $2^{\frac{1}{5}}$
II. $\sqrt{5}$	**B.** $2^{\frac{5}{4}}$
III. $\sqrt[5]{2^4}$	**C.** $2^{\frac{4}{5}}$
IV. $\sqrt[5]{2}$	**D.** $5^{\frac{1}{2}}$

49. SAT/ACT What is the value of x in $27^{\frac{x}{2}} = 3^{x-1}$?

Ⓐ -3
Ⓑ -2
Ⓒ $\frac{1}{3}$
Ⓓ 2
Ⓔ 3

50. Performance Task It is possible to write any positive integer as the sum of powers of 2 with whole number exponents. For example, you can write 75 in the following manner.

$$2^0 + 2^1 + 2^3 + 2^6 = 75$$

Part A Use the equation above to write 75 as the sum of powers of 8, using rational exponents. What are possible values for a, b, c and d?

$$8^a + 8^b + 8^c + 8^d = 75$$

Part B How can you modify the equation you wrote in part A to express 75 as sum of powers of 16?

$$16^a + 16^b + 16^c + 16^d = 75$$

Part C Given that a, b, c, and d are rational numbers, for what types of integer values of x is the following equation true? Explain your answer.

$$x^a + x^b + x^c + x^d = 75$$