Simplify each expression. Assume all variables are positive.

1. $\sqrt[4]{32}$

2. $\sqrt[5]{64}$

3. $\sqrt[3]{24}$

4. $\sqrt[3]{32}$

5. $\sqrt{16x^4}$

6. $\sqrt[3]{27y^3}$

7. $\sqrt[3]{-8x^4}$

8. $\sqrt[3]{y^6}$

9. $\sqrt[3]{\dfrac{x^9}{27}}$

10. $\sqrt[3]{\dfrac{16}{x^3}}$

11. $\sqrt{\dfrac{50}{z}}$

12. $\sqrt[3]{\dfrac{x^{15}}{7}}$

Write each expression in radical form, and simplify.

13. $49^{\frac{1}{2}}$

14. $8^{\frac{2}{3}}$

15. $16^{\frac{3}{4}}$

16. $27^{\frac{4}{3}}$

17. $7^{\frac{1}{3}}$

18. $5^{\frac{2}{3}}$

19. $(-27)^{\frac{2}{3}}$

20. $(-32)^{\frac{3}{5}}$

21. $(-1000)^{\frac{2}{3}}$

22. $-36^{\frac{3}{2}}$

23. $(-1)^{\frac{1}{3}}$

24. $4^{\frac{5}{2}}$

Write each expression by using rational exponents. Assume all variables are positive.

25. $\sqrt[5]{11^2}$

26. $\sqrt[4]{x^3}$

27. $\sqrt[8]{y^2}$

28. $\sqrt[5]{7}$

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

30. $\left(\sqrt[4]{2}\right)^2$

31. $\sqrt{4^3}$

32. $\left(\sqrt{y}\right)^5$

33. $\sqrt[4]{7^8}$

34. $\left(\sqrt[8]{z}\right)^2$

35. $\sqrt[6]{m^4}$

36. $-\sqrt{19^7}$

Simplify each expression. Assume all variables are positive.

37. $8^{\frac{1}{2}} \cdot 8^{\frac{3}{2}}$

38. $n^{\frac{1}{3}} \cdot n^{\frac{5}{3}}$

39. $16^{\frac{1}{4}} \cdot 16^{\frac{1}{4}} \cdot 16^{\frac{3}{4}}$

40. $x^{\frac{1}{2}} \cdot x^3$

41. $\left(5^{\frac{1}{2}}\right)^6$

42. $\left(7^{\frac{3}{2}}\right)^{\frac{2}{3}}$

43. $\dfrac{49^{\frac{1}{4}}}{49^{\frac{3}{4}}}$

44. $\dfrac{25^{\frac{5}{4}}}{25^{\frac{1}{4}}}$

45. $8^{-\frac{1}{3}}$

46. $\left(\dfrac{1}{25}\right)^{-\frac{1}{2}}$

47. $\left(x^3 z^9\right)^{\frac{2}{3}}$

48. $\left(x^{\frac{1}{2}} y^2\right)^4 \sqrt[3]{y^3}$

49. $\left(m^4 n^2\right)^{\frac{1}{2}} \sqrt{m^2 n^2}$

50. $\dfrac{7^{\frac{1}{2}}}{\sqrt{7}}$

51. $\left(y^{\frac{2}{3}}\right) \sqrt[3]{y^9}$

52. $\dfrac{z^{\frac{1}{3}}}{\sqrt[3]{z^2}}$

53. The formula $r = \left(\dfrac{3V}{4\pi}\right)^{\frac{1}{3}}$ gives the radius r, in inches, of a sphere that has a volume of V cubic inches. Use the formula to find the radius of a sphere that has a volume of 36π in³.

54. For which values of n is $2^{\frac{n}{2}}$ an integer? What are the integer values of $2^{\frac{n}{2}}$?

55. **Write About It** Describe two different ways to simplify the expression $\sqrt[3]{7^6}$. Which method is easier? Why?

56. **Critical Thinking** Explain how to solve the equation $16^{\frac{x}{2}} = 64$.