Vocabulary and Concept Check

MATCHING Match the property with its example.

1. Quotient of Powers Property

2. Power of a Power Property

3. Power of a Quotient Property

4. Power of a Product Property

A. $(4^5)^2 = 4^{5 \cdot 2}$ B. $\left(\dfrac{5}{2}\right)^4 = \dfrac{5^4}{2^4}$ C. $(5 \cdot 2)^4 = 5^4 \cdot 2^4$ D. $\dfrac{4^5}{4^2} = 4^{5-2}$

5. **DIFFERENT WORDS, SAME QUESTION** Which is different? Find "both" answers.

Simplify $3^3 \cdot 3^6$.   Simplify 3^{3+6}.   Simplify 3^{6-3}.   Simplify $3^6 \cdot 3^3$.

Practice and Problem Solving

Simplify the expression.

6. $(n^4)(n^3)$

7. $\dfrac{x^5}{x^3}$

8. $(c^5)^3$

9. $(4b)^3$

10. $\left(\dfrac{k}{3}\right)^5$

11. $\dfrac{(2a)^6}{a^2}$

Simplify. Write your answer using only positive exponents.

12. $8^{-2} \cdot 8^7$

13. $b^4 \cdot b^7$

14. $\dfrac{12^7}{12^2}$

15. $\dfrac{d^5}{d^8}$

16. $(5^5)^4$

17. $(x^3)^{-2}$

ERROR ANALYSIS Describe and correct the error in simplifying the expression.

18.
$$x^5 \cdot x^{-2} = x^{5 \cdot (-2)}$$
$$= x^{-10}$$
$$= \frac{1}{x^{10}}$$

19.
$$(m^3)^4 = m^{3+4}$$
$$= m^7$$

20. **MICROSCOPE** A microscope magnifies an object 10^5 times. The length of an object is 10^2 nanometers. What is its magnified length?

Simplify. Write your answer using only positive exponents.

21. $(6.2y)^2$

22. $\left(\dfrac{w}{4}\right)^4$

23. $\left(-\dfrac{6}{d}\right)^{-2}$

24. $(7p)^{-3}$

25. $(-5x)^5$

26. $\left(\dfrac{3n^3}{4}\right)^2$

27. **ERROR ANALYSIS** Describe and correct the error in simplifying the expression.

$$\left(\frac{x^3}{3}\right)^2 = \frac{(x^3)^2}{3} = \frac{x^6}{3}$$

28. **OPEN-ENDED** Use the properties of exponents to write three expressions equivalent to x^8.

29. **REASONING** Are the expressions $(a^4)^2$ and a^{4^2} equivalent? Explain your reasoning.

30. **GEOMETRY** Consider Cube A and Cube B.

    a. Which property of exponents should you use to find the volume of each cube?

    b. How can you use the Power of a Quotient Property to find how many times greater the volume of Cube B is than the volume of Cube A?

2x

8x

2m
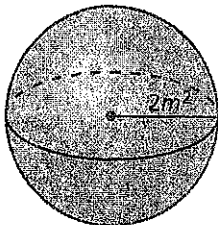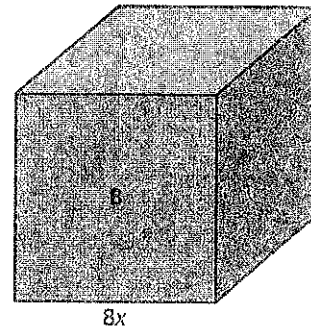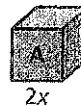
31. **SPHERE** The volume V of a sphere is $V = \dfrac{4}{3}\pi r^3$, where r is the radius. What is the volume of the sphere in terms of m and π?

32. **PROBABILITY** The probability of rolling a 6 on a number cube is $\dfrac{1}{6}$. The probability of rolling a 6 twice in a row is $\left(\dfrac{1}{6}\right)^2 = \dfrac{1}{36}$.

    a. Write an expression that represents the probability of rolling a 6 n times in a row.

    b. What is the probability of rolling a 6 five times in a row?

    c. What is the probability of flipping heads on a coin five times in a row?