Name _____ Date _____

LESSON 2.1

Practice B

For use with the lesson "Use Properties of Exponents"

Evaluate the expression. Tell which properties of exponents you used.

1. $2^5 \cdot 2^3$

2. $(-7)^2(-7)$

3. $4^{-6} \cdot 4^{-1}$

4. $(5^{-2})^2$

5. $\dfrac{4^{-7}}{4^{-3}}$

6. $\dfrac{8^{-4}}{8^2}$

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

8. $\left(\dfrac{4}{5}\right)^{-3}$

Write the answer in scientific notation.

9. $(6.1 \times 10^5)(2.2 \times 10^6)$

10. $(2.6 \times 10^{-7})(1.3 \times 10^2)$

11. $(3.4 \times 10^{-1})(3.1 \times 10^{-2})$

12. $(5.8 \times 10^{-7})(8.1 \times 10^{12})$

13. $(4.5 \times 10^4)^2$

14. $(3.7 \times 10^{-5})^2$

15. $(7.2 \times 10^{-3})^3$

16. $\dfrac{9.9 \times 10^9}{1.5 \times 10^8}$

17. $\dfrac{8.4 \times 10^{-6}}{2.4 \times 10^9}$

Simplify the expression. Tell which properties of exponents you used.

18. $\dfrac{x^8}{x^4}$

19. $\dfrac{y^4}{y^{-7}}$

20. $(3^2s^3)^6$

21. $(4^0w^2)^{-5}$

22. $(y^4z^2)(y^{-3}z^{-5})$

23. $(2m^3n^{-1})(8m^4n^{-2})$

24. $(7c^7d^2)^{-2}$

25. $(5g^4h^{-3})^{-3}$

26. $\dfrac{x^5y^{-8}}{x^5y^{-6}}$

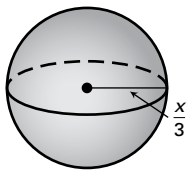
27. $\dfrac{16q^0r^{-6}}{4q^{-3}r^{-7}}$

28. $\dfrac{12a^{-3}b^9}{21a^2b^{-5}}$

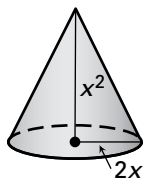
29. $\dfrac{8e^{-4}f^{-2}}{18ef^{-5}}$

Write an expression for the surface area or volume in terms of *x*.

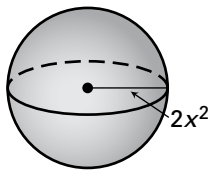
30. $S = 4\pi r^2$



31. $V = \frac{1}{3}\pi r^2 h$



32. $V = \frac{4}{3}\pi r^3$



33. **Birds** Some scientists estimate that there are about 8600 species of birds in the world. The mean number of birds per species is approximately 12,000,000. About how many birds are there in the world? Write your answer in scientific notation.

34. **Biology** A red blood cell has a diameter of approximately 0.00075 centimeter. If one of the arteries in your body has a diameter of 0.0456 centimeter, how many red blood cells could fit across the artery? Write your answer in scientific notation.

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Lesson 2.1 Use Properties of Exponents

Teaching Guide

1. -2: 3 **2.** 81; 9; 729; 729 **3.** 25; 125; 3125; 3125 **4.** It is equivalent to the base raised to the sum of the two exponents. **5.** A way to write numbers using powers of 10 having the form $c \times 10^n$ where $1 \le c < 10$ and n is an integer; 6.4×10^7; 3.4×10^{-4}

Investigating Algebra Activity

1. a. $(6 \cdot 6 \cdot 6 \cdot 6)(6 \cdot 6 \cdot 6 \cdot 6 \cdot 6 \cdot 6 \cdot 6)$; 6^{11}
b. $(3 \cdot 3 \cdot 3 \cdot 3)(3 \cdot 3 \cdot 3 \cdot 3)(3 \cdot 3 \cdot 3 \cdot 3)$; 3^{12}
c. $\frac{5 \cdot 5 \cdot 5 \cdot 5 \cdot 5 \cdot 5 \cdot 5 \cdot 5}{5 \cdot 5 \cdot 5 \cdot 5} = 5 \cdot 5 \cdot 5 \cdot 5$; 5^4
d. $\frac{4}{7} \cdot \frac{4}{7} \cdot \frac{4}{7} \cdot \frac{4}{7} \cdot \frac{4}{7} = \frac{4 \cdot 4 \cdot 4 \cdot 4 \cdot 4}{7 \cdot 7 \cdot 7 \cdot 7 \cdot 7}$; $\frac{4^5}{7^5}$

2. See answers to Exercise 1. **3.** For the product of powers property, the exponents in the *Simplified form* column are the sum of the exponents in the *Exponential expression* column. For the power of a power property, the exponents in the *Simplified form* column are the product of the exponents in the *Exponential expression* column. For the quotient of powers property, the exponents in the *Simplified form* column are the difference of the exponents in the *Exponential expression* column. For the power of a quotient property, the exponent in the *Exponential expression* column is applied to the numerator and denominator to give the expression in the *Simplified form* column. **4.** *Sample answer:* The product of powers property means that if you are multiplying like bases, the exponents will be added. The power of a power property means that if you are raising a power to a power, the exponents will be multiplied. The quotient of a power property means that if you are dividing like bases, the exponents will be subtracted. The power of a quotient property means that if you are raising a quotient to a power, you will raise both the numerator and denominator to that power.

Practice Level A

1. 9 **2.** 125 **3.** 32 **4.** 256 **5.** 1 **6.** $\frac{1}{2}$
7. $\frac{1}{49}$ **8.** $\frac{1}{1{,}000{,}000}$ **9–20.** Check properties.
9. 1024 **10.** -243 **11.** 15,625 **12.** 1
13. $\frac{1}{32}$ **14.** 27 **15.** 1,000,000,000 **16.** $\frac{25}{36}$
17. -3125 **18.** $\frac{1}{8}$ **19.** 6561 **20.** 32
21. 5.27×10^5 **22.** 5.26×10^{-5} **23.** 2.3×10^{-3}
24. 5.983×10^{12} **25.** 1.76×10^{16}
26. 7.0×10^{-7} **27.** 4.8×10^9 **28.** 3.534×10^3
29. 7.84×10^6 **30.** 1.849×10^5 **31.** 6.0×10^2
32. 7.5×10^1 **33–40.** Check properties.
33. b^6 **34.** x^2 **35.** s^{14} **36.** $25y^2$ **37.** z^4
38. $\frac{1}{m^4}$ **39.** $\frac{x^3}{27}$ **40.** $\frac{16}{n^2}$ **41.** 3.26×10^8
42. about 2.65×10^4 dollars

Practice Level B

1–8. Check properties. **1.** 256 **2.** -343
3. $\frac{1}{16{,}384}$ **4.** $\frac{1}{625}$ **5.** $\frac{1}{256}$ **6.** $\frac{1}{262{,}144}$ **7.** $\frac{8}{27}$
8. $\frac{125}{64}$ **9.** 1.342×10^{12} **10.** 3.38×10^{-5}
11. 1.054×10^{-2} **12.** 4.698×10^6
13. 2.025×10^9 **14.** 1.369×10^{-9}
15. 3.73248×10^{-7} **16.** 6.6×10^1
17. 3.5×10^{-15} **18–29.** Check properties.
18. x^4 **19.** y^{11} **20.** $531{,}441s^{18}$
21. $\frac{1}{w^{10}}$ **22.** $\frac{y}{z^3}$ **23.** $\frac{16m^7}{n^3}$ **24.** $\frac{1}{49c^{14}d^4}$
25. $\frac{h^9}{125g^{12}}$ **26.** $\frac{1}{y^2}$ **27.** $4q^3r$ **28.** $\frac{4b^{14}}{7a^5}$
29. $\frac{4f^3}{9e^5}$ **30.** $S = \frac{4}{9}\pi x^2$ **31.** $V = \frac{4}{3}\pi x^4$
32. $V = \frac{32}{3}\pi x^6$ **33.** about 1.03×10^{11}
34. about 6.1×10^1

Practice Level C

1–8. Check properties. **1.** 25 **2.** 2187
3. 1024 **4.** 256 **5.** $\frac{64}{27}$ **6.** 729 **7.** $\frac{512}{19{,}683}$
8. $\frac{1}{125}$ **9.** 2.139×10^5 **10.** 9.72×10^{-6}
11. 1.6×10^5 **12.** 2.0×10^{-3} **13.** 1.0×10^{-6}
14. 2.5×10^1 **15–22.** Check properties. **15.** x^6
16. $-\frac{2m^7}{n^6}$ **17.** $\frac{45c^{13}}{d^5}$ **18.** 1 **19.** $\frac{9}{x^{14}y^2}$ **20.** $\frac{27r^6}{q^3s^3}$
21. $\frac{1}{z^{12}}$ **22.** b^{18} **23.** *Sample answer:* $a^4b^4c^5$
24. *Sample answer:* $6x^3y^4z$ **25.** *Sample answer:* $16m^6n^{17}$ **26.** about 1.665×10^{25} **27. a.** $\frac{2}{3}$ **b.** $\frac{\pi}{6}$

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