In Exercises 1–8, evaluate the expression. ▶ *Example 1*

1. $(-7)^0$

2. 4^0

3. 5^{-4}

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

5. $\dfrac{2^{-6}}{4^0}$

6. $\dfrac{5^{-1}}{-9^0}$

7. $\dfrac{-3^{-3}}{6^{-2}}$

8. $\dfrac{(-8)^{-2}}{3^{-4}}$

In Exercises 9–18, simplify the expression. Write your answer using only positive exponents. ▶ *Example 2*

9. x^{-7}

10. y^0

11. $9x^0y^{-3}$

12. $15c^{-8}d^0$

13. $\dfrac{2^{-2}m^{-3}}{n^0}$

14. $\dfrac{10^0r^{-11}s}{3^2}$

15. $\dfrac{4^{-3}a^0}{b^{-7}}$

16. $\dfrac{p^{-8}}{7^{-2}q^{-9}}$

17. $\dfrac{2^2y^{-6}}{8^{-1}z^0x^{-7}}$

18. $\dfrac{13x^{-5}y^0}{5^{-3}z^{-10}}$

In Exercises 19–28, simplify the expression. Write your answer using only positive exponents. ▶ *Example 3*

19. $\dfrac{5^6}{5^2}$

20. $\dfrac{(-6)^8}{(-6)^5}$

21. $(-9)^2 \cdot (-9)^2$

22. $4^{-5} \cdot 4^5$

23. $(p^6)^4$

24. $(s^{-5})^3$

25. $6^{-10} \cdot 6^5$

26. $-7 \cdot (-7)^{-4}$

27. $\dfrac{x^5}{x^4} \cdot x$

28. $\dfrac{z^8 \cdot z^2}{z^5}$

29. **MODELING REAL LIFE**
A microscope magnifies an object 10^5 times. The length of an object is 10^{-7} meter. What is its magnified length?
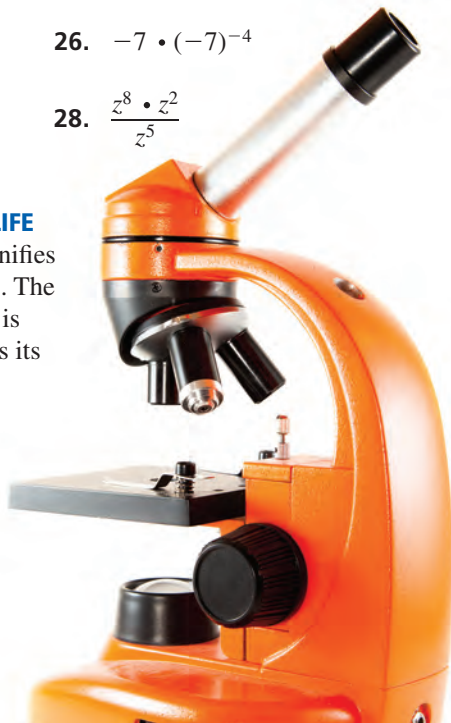
30. **MODELING REAL LIFE** A seed from an orchid has a mass of 10^{-6} gram. The mass of a seed from a double coconut palm is 10^{10} times the mass of the seed from the orchid. What is the mass of the seed from the double coconut palm in kilograms? (1 kg $= 10^3$ g)

ERROR ANALYSIS **In Exercises 31 and 32, describe and correct the error in simplifying the expression.**

31.

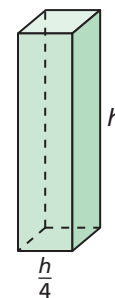✗ $2^4 \cdot 2^5 = (2 \cdot 2)^{4+5}$
$= 4^9$

32.

✗ $\dfrac{x^5 \cdot x^3}{x^4} = \dfrac{x^8}{x^4}$
$= x^{8/4}$
$= x^2$

In Exercises 33–40, simplify the expression. Write your answer using only positive exponents. ▶ *Example 4*

33. $(-5z)^3$

34. $(4x)^{-4}$

35. $\left(\dfrac{6}{n}\right)^{-2}$

36. $\left(\dfrac{-t}{3}\right)^2$

37. $(3s^8)^{-5}$

38. $(-8p^3)^3$

39. $\left(-\dfrac{w^3}{9}\right)^{-2}$

40. $\left(\dfrac{1}{2r^6}\right)^{-6}$

41. **COLLEGE PREP** Which of the expressions represent the volume of the square prism, where s is the side length of the base and h is the height of the prism? Select all that apply. ▶ *Example 5*
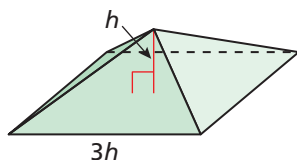
Ⓐ $\dfrac{h^3}{16}$

Ⓑ $\dfrac{h^3}{4}$

Ⓒ $\dfrac{4^{-2}}{h^{-3}}$

Ⓓ $(2^{-2})^2h^3$

Ⓔ $16s^3$

Ⓕ $4s^3$

42. COLLEGE PREP Which of the expressions represent the volume of the square pyramid, where s is the side length of the base and h is the height of the pyramid? Select all that apply.
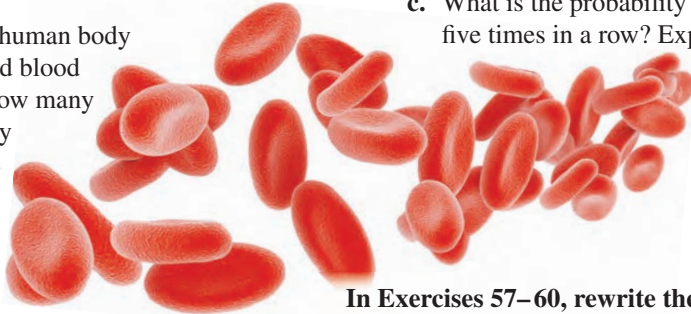

A h^3

B $3h^3$

C $\dfrac{1}{3^{-1}h^{-3}}$

D $\dfrac{1}{3h^{-3}}$

E $\left(\dfrac{3}{s}\right)^{-3}$

F $\dfrac{s^3}{9}$

In Exercises 43–46, simplify the expression. Write your answer using only positive exponents.

43. $\left(\dfrac{2x^{-2}y^3}{3xy^{-4}}\right)^4$

44. $\left(\dfrac{4s^5t^{-7}}{-2s^{-2}t^4}\right)^3$

45. $\left(\dfrac{3m^{-5}n^2}{4m^{-2}n^0}\right)^2 \cdot \left(\dfrac{mn^4}{9n}\right)^2$

46. $\left(\dfrac{3x^3y^0}{x^{-2}}\right)^4 \cdot \left(\dfrac{y^2x^{-4}}{5xy^{-8}}\right)^3$

In Exercises 47–50, evaluate the expression. Write your answer in scientific notation and in standard form.

47. $(3 \times 10^2)(1.5 \times 10^{-5})$

48. $(6.1 \times 10^{-3})(8 \times 10^9)$

49. $\dfrac{(6.4 \times 10^7)}{(1.6 \times 10^5)}$

50. $\dfrac{(3.9 \times 10^{-5})}{(7.8 \times 10^{-8})}$

51. MODELING REAL LIFE The human body produces about 4.8×10^6 red blood cells in 4×10^{-2} minute. How many red blood cells does the body produce each minute? Write your answer in scientific notation and in standard form. ▶ *Example 6*

52. MODELING REAL LIFE The speed of light is approximately 3×10^5 kilometers per second. How long does it take sunlight to reach Jupiter? Write your answer in scientific notation and in standard form.

Sun   Jupiter

Average Distance: 7.8×10^8 kilometers

53. MP NUMBER SENSE Without evaluating, order $(7 \cdot 7)^5$, $(7 \cdot 7)^{-8}$, and $(7 \cdot 7)^0$ from least to greatest. Explain your reasoning.

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54. MP STRUCTURE Without evaluating, rewrite $\dfrac{3^{10} \cdot 27^9}{9^{12}}$ as a single power with base 3.

55. MP PROBLEM SOLVING A byte is a unit used to measure a computer's memory. The table shows the numbers of bytes in several units of measure.

Unit	kilobyte	megabyte	gigabyte	terabyte
Number of bytes	2^{10}	2^{20}	2^{30}	2^{40}

a. How many kilobytes are in 1 terabyte? Write your answer as a power.

b. How many megabytes are in 16 gigabytes? Write your answer as a power.

c. Another unit used to measure a computer's memory is a bit. There are 8 bits in a byte. How can you convert the number of bytes in each unit of measure given in the table to bits? Can you still use a base of 2? Explain.

56. MP STRUCTURE The probability of rolling a 6 on a number cube is $\frac{1}{6}$. The probability of rolling a 6 twice in a row is $\left(\frac{1}{6}\right)^2 = \frac{1}{36}$.

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 four times in a row?

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

In Exercises 57–60, rewrite the expression as a power of a product.

57. $8a^3b^3$

58. $16r^2s^2$

59. $64w^{18}z^{12}$

60. $81x^4y^8$

61. MP STRUCTURE Find the value of each missing exponent.

$$\left(\dfrac{p^5q^7r^2}{p^{-2}qr^6}\right)^{\blacksquare} = \dfrac{r^{12}}{p^{21}q^{\blacksquare}}$$