

7-2

Reteaching

Multiplying Powers With the Same Base

When multiplying powers with the same base, you add the exponents. This is true for numerical and algebraic expressions.

Problem

What is each expression written as a single power?

a. $3^4 \cdot 3^2 \cdot 3^3$

All three powers have the same base, so this expression can be written as a single power by adding the exponents.

$$\begin{aligned} 3^4 \cdot 3^2 \cdot 3^3 &= 3^{4+2+3} \\ &= 3^9 \end{aligned}$$

All powers have the same base. Add the exponents.
Simplify the exponent.

3^4 represents 4 factors of 3, 3^2 represents 2 factors of 3, and 3^3 represents 3 factors of 3. This is a total of 9 factors of 3, so the answer is reasonable.

Even when an expression contains negative or rational exponents, the exponents can be added when the bases are the same in a product of powers.

b. $11^{-3} \cdot 11^4 \cdot 11^{-5}$

$$\begin{aligned} 11^{-3} \cdot 11^4 \cdot 11^{-5} &= 11^{-3+4+(-5)} \\ &= 11^{-4} \end{aligned}$$

All powers have the same base. Add the exponents.
Simplify the exponent.

c. $2^{\frac{1}{5}} \cdot 2^{\frac{3}{5}}$

$$\begin{aligned} 2^{\frac{1}{5}} \cdot 2^{\frac{3}{5}} &= 2^{\frac{1}{5} + \frac{3}{5}} \\ &= 2^{\frac{4}{5}} \end{aligned}$$

All powers have the same bases. Add the exponents.
Simplify the exponent.

Problem

What is the simplified form of $(1.8 \times 10^{11})(2.7 \times 10^8)$? Write the answer in scientific notation.

Use the Associative and Commutative Properties of Multiplication to regroup and reorder the factors so that the powers of 10 are grouped together and numbers that are not powers of 10 are grouped separately from the powers of 10.

$$(1.8 \times 10^{11})(2.7 \times 10^8) = (1.8 \cdot 2.7)(10^{11} \cdot 10^8) \quad \text{Associative and Commutative Prop. of Mult.}$$

$$= (4.86)(10^{11+8})$$

Multiply the numbers in the first set of parentheses. Add the exponents for the powers of 10.

$$= 4.86 \times 10^{19}$$

Simplify the exponent.

Exercises

Simplify each expression.

1. a^2a^3

2. $3n^3n^5$

3. $8k^3 \cdot 3k^6$

4. $(8p^5)(6p^4)$

5. $21d^{\frac{1}{2}} \cdot 9d^{\frac{1}{4}}$

6. $(-6.1m^4)(3m^2)$

7. $h^5 \cdot h^2 \cdot h^{10}$

8. $(-9q^{-8})(6q^{11})$

9. $(16r^{-7})(-2r)$

10. $(y^3z^{13})(y^2z^{-6})$

11. $\left(-3x^{\frac{1}{2}}\right)\left(5w^8\right)\left(4x^{\frac{1}{3}}\right)$

12. $(15fg^2)(f^3g^{-3})(-8f^{-1}g^6)$

13. $m^{-6} \cdot m^3 \cdot n^{-2}$

14. $-6j^{-3}k \cdot 7jk^5$

15. $-2uvw^{-1} \cdot 3u^2v^{-2}w$

Simplify each expression. Write each answer in scientific notation.

16. $(4 \times 10^3)(2 \times 10^5)$

17. $(1 \times 10^4)(6 \times 10^3)$

18. $(7 \times 10^2) \cdot 10^5$

19. $(8 \times 10^9)(3 \times 10^{-5})$

20. $(2 \times 10^5)(5 \times 10^6)$

21. $(7 \times 10^{-8})(3 \times 10^{-6})$

Write each answer in scientific notation.

22. The distance light travels in one year (one light-year) is about 5.87×10^{12} mi. A star called Proxima Centauri is 4.2 light-years away from Earth. About how many miles from Earth is Proxima Centauri?

23. After the Revolutionary War, the U.S. national debt was approximately 7.5×10^7 dollars. In 2008, the debt was approximately 1.33×10^5 times the original amount. What was the national debt in 2008?

Complete each equation.

24. $4^{\square} \cdot 4^3 = 4^{13}$

25. $8^6 \cdot 8^5 \cdot 5 = 8^{\square}$

26. $3^4 \cdot 3^{\square} = 3^{10}$

27. $k^{11} \cdot k^{\square} = k^2$

28. $w^{\square} \cdot w^{\frac{2}{5}} = w^{\frac{4}{5}}$

29. $x^2 \cdot x^{\square} \cdot x = x^9$

30. $p^{-5} \cdot p^{\square} = p^3 \cdot p^2$

31. $n^5 \cdot n^{-17} \cdot n^{\square} = n^{13}$

32. $t^5 u^2 \cdot t^{\square} u = t^{-4} u^3$