

Warm-Ups: WKbk p. 391
 ☆☆☆☆☆☆☆☆☆☆☆☆☆ (1-4, 17-20)

Write each number in standard notation.

1. 7×10^4
~~70,000~~ ✓

2. 3×10^{-2}
~~.03~~ ✓

3. 2.6×10^5
~~260,000~~ ✓
 260,000.

4. 7.1×10^{-4}
~~.00071~~ ✓

Write each number in scientific notation.

17. 51,000,000
 $5.1 \cdot 10^7$
 $5.1E7$

18. 975,000,000,000
 ~~9.75×10^{11}~~
 9.75×10^{11}

19. 0.00000012
 $1.2 \cdot 10^{-7}$
 1.2×10^{-7}
 $1.2E-7$

20. 0.000005008
 5.008×10^{-6}

34, 6

(6) $(3p^{-15})(6p^{11}) = 18p^{-4}$

(39) $(4 \times 10^9)(4.1 \times 10^8) = \frac{18}{p^4}$

16.4×10^{17}
 1.64×10^{18}

WKbk Lesson 8-4 p. 143 Day 66
 More Multiplication Properties of Exponents

Lesson Objectives ▼ Raise a power to a power ▼ Raise a product to a power	NAEP 2005 Strand: Number Properties and Operations Topic: Properties of Number and Operations Local Standards:
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Key Concepts multiply the exponents

Raising a Power to a Power
 For every nonzero number a and integers m and n , $(a^m)^n = a^{mn}$
 Examples $(5^4)^2 = 5^4 \cdot 2 = 5^8$ $(a^2)^3 = a^2 \cdot 3 = a^6$

Raising a Product to a Power
 For every nonzero number a and b and integer n , $(ab)^n = a^n b^n$
 Example $(3x)^4 = 3^4 x^4 = 81x^4$

If more than 1 term is in the (), raised to an exponent, distribute the exponent to each term's exponent.

Examples

1. **Simplifying a Power Raised to a Power** Simplify $(a^3)^4$.
 $(a^3)^4 = a^3 \cdot a^3 \cdot a^3 \cdot a^3$ **multiply** exponents when raising a power to a power.
 $= a^{12}$ Simplify.

2. **Simplifying an Expression With Powers** Simplify $b^2(b^3)^{-2}$.
 $b^2(b^3)^{-2} = b^2 \cdot b^{3 \cdot (-2)}$ **multiply** exponents in $(b^3)^{-2}$.
 $= b^2 \cdot b^{-6}$ Simplify.
 $= b^{2+(-6)}$ **Add** exponents when multiplying powers of the same base.
 $= b^{-4}$ Simplify.
 $= \frac{1}{b^4}$ Write using only positive exponents.

Quick Check

1. Simplify.
 a. $(a^4)^7$ b. $(a^{-4})^7$

a^{28}

$a^{-28} = \frac{1}{a^{28}}$

2. Simplify.
 a. $t^2(t^7)^{-2}$ b. $(a^4)^2 \cdot (a^2)^5$

$t^2 \cdot t^{-14}$
 $t^{-12} = \frac{1}{t^{12}}$

$a^8 \cdot a^{10}$
 a^{18}

Examples

3. **Simplifying a Product Raised to a Power** Simplify $(4xy^3)^2(x^3)^{-3}$.

$(4xy^3)^2 (x^3)^{-3}$
 $4^2 x^2 y^6 \cdot x^{-9}$
 $16x^{-7}y^6 = \frac{16y^6}{x^7}$

Quick Check

3. Simplify each expression.

a. $(2z)^4$ b. $(4g^5)^{-2}$

$2^4 z^4$
 $16z^4$

$4^{-2} g^{-10}$
 $4^{-2} g^{-10} = \frac{1}{16g^{10}}$
 $\frac{1}{4^2 g^{10}}$

c. $(2a^5)^3(3ab^3)^3$ d. $(6mn^3)(5m^{-3})^2$

$2^5 a^{15} \cdot 3^3 a^3 b^9$
 $32a^{18} \cdot 27a^3 b^9$
 $864a^{21} b^9$

p. 395

3, 11, 17, 23

$$\textcircled{3} (m^{-3} h^4)^{-4} = m^{12} n^{-16}$$

$$\textcircled{11} (3f^4 g^{-3})^3 (fg^{-2})^{-1}$$

$$3^3 f^{12} g^{-9} f^{-2} g^2$$

$$27 f^{10} g^{-7} = \frac{27 f^{10}}{g^7}$$

$$\textcircled{17} (m^{-5})^{-3} = m^{15}$$

$$\textcircled{23} b^{-9} \cdot (b^2)^4$$

$$b^{-9} \cdot b^8 = b^{-1} = \frac{1}{b}$$

(2-30 even)