Power of A Power

Additional Examples — Lesson 8-4

1 EXAMPLE **Simplify $(a^3)^4$.**

$(a^3)^4 = a^{3 \cdot 4}$ Multiply exponents when raising a power to a power.

$= a^{12}$ Simplify.

2 EXAMPLE **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.

3 EXAMPLE **Simplify $(4x^3)^2$.**

$(4x^3)^2 = 4^2(x^3)^2$ Raise each factor to the second power.

$= 4^2x^6$ Multiply exponents of a power raised to a power.

$= 16x^6$ Simplify.

4 EXAMPLE **Simplify $(4xy^3)^2(x^3)^{-3}$.**

$(4xy^3)^2(x^3)^{-3} = 4^2x^2(y^3)^2 \cdot (x^3)^{-3}$ Raise the three factors to the second power.

$= 4^2 \cdot x^2 \cdot y^6 \cdot x^{-9}$ Multiply exponents of a power raised to a power.

$= 4^2 \cdot x^2 \cdot x^{-9} \cdot y^6$ Use the Commutative Property of Multiplication.

$= 4^2 \cdot x^{-7} \cdot y^6$ Add exponents of powers with the same base.

$= \frac{16y^6}{x^7}$ Simplify.

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5 EXAMPLE **An object has a mass of 10^2 kg. The expression $10^2 \cdot (3 \times 10^8)^2$ describes the amount of resting energy in joules the object contains. Simplify the expression.**

$10^2 \cdot (3 \times 10^8)^2 = 10^2 \cdot 3^2 \cdot (10^8)^2$ Raise each factor within parentheses to the second power.

$= 10^2 \cdot 3^2 \cdot 10^{16}$ Simplify $(10^8)^2$.

$= 3^2 \cdot 10^2 \cdot 10^{16}$ Use the Commutative Property of Multiplication.

$= 3^2 \cdot 10^{2+16}$ Add exponents of powers with the same base.

$= 9 \times 10^{18}$ Simplify. Write in scientific notation.