Use the following rules to find the powers of monomials. The same rules can be used with negative exponents.

**Power of a Power**
For any number \( a \) and positive integers \( m \) and \( n \), \((a^m)^n = a^{mn} \).

**Power of a Product**
For all numbers \( a \) and \( b \) and positive integer \( m \), \((ab)^m = a^m b^m \).

**Power of a Monomial**
For all numbers \( a \) and \( b \) and positive integers \( m \), \(n\), and \( p \), \((a^m b^n)^p = a^{mp} b^{np} \).

**EXAMPLES**

A Simplify \((s^4)^3\).

\[(s^4)^3 = s^{4 \cdot 3} = s^{12}\]

B Simplify \((y^5 z^3)^3\).

\[(y^5 z^3)^3 = (y^5)^3 (z^3)^3 = y^{15} z^9\]

**Try These Together**
**Simplify.**

1. \((6^3)^2\)
2. \((2^4)^6\)
3. \((ab^2)^2\)

HINT: When finding a power of a power, remember to multiply exponents. Also remember that \( a \) is the same as \( a^1 \).

**PRACTICE**

Simplify.

4. \((-5^2)^6\)
5. \((2x^2 y^3)^2\)
6. \((m^2)^3\)
7. \(5(-r^6)^5\)
8. \((n^2 m)^2\)
9. \((-11gh)^2\)
10. \((p^6 q^3)^2\)
11. \(-7(b^5)^8\)
12. \(-3y(x^4)^2\)
13. \((h^2)^{-6}\)
14. \((-w^3)^{-7}\)
15. \((8yz)^{-2}\)

Evaluate each expression if \( x = 3 \), \( y = -1 \), and \( z = 2 \).

16. \(6z^2\)
17. \((xy^2)^3\)
18. \(-5(y^3 z)^3\)
19. \((x^5 y^4)^2\)

20. Biology Suppose it takes 1 hour for a culture with 1 bacterium to grow to four bacteria. To grow to 64, or \(4^3\), bacteria, it must quadruple three times. If the culture quadruples another three times, there will be \((4^3)^2\) bacteria.

a. Write \((4^3)^2\) as a power of 4.

b. \(4^3 = 64\). Use this information to find \((4^3)^2\).

21. **Standardized Test Practice** Simplify the expression \(-7(m^3 n^4)^2\).

A \(-7m^5 n^6\)  B \(-7m^6 n^8\)  C \(7m^6 n^8\)  D \(-7mn^2\)

**ANSWERS:**

A 13  B 21  C 14  D 2  E 8  F 19  G 30  H 9  I 18  J 16  K 12  L 2  M 10  N 1  O 1  P 1  Q 1  R 1  S 1  T 1  U 1  V 1  W 1  X 1  Y 1  Z 1