

# Powers and Exponents (Pages 336–340)

**Perfect squares** are the product of a number and itself. For example, 9 is a perfect square because  $3 \times 3 = 9$ . The expression  $3 \times 3$  can be written using an **exponent**. An exponent tells how many times a number, called the **base**, is used as a factor. Numbers that are expressed using exponents are called **powers**.

Symbols	Words	Meaning
$3^1$	3 to the first power	3
$w^2$	w to the second power or w squared	$w \cdot w$
$3^5$	3 to the fifth power	$3 \cdot 3 \cdot 3 \cdot 3 \cdot 3$
$4s^3$	4 times s to the third power or 4 times s cubed	$4 \cdot s \cdot s \cdot s$
$(3)^2(-4)^3$	3 squared times minus 4 cubed	$(3)(3)(-4)(-4)(-4)$
$7 \cdot 2^4$	7 times 2 to the fourth power	$7 \cdot 2 \cdot 2 \cdot 2 \cdot 2$
$(a + b)^3$	The quantity $a + b$ to the third power	$(a + b)(a + b)(a + b)$

## EXAMPLE

Evaluate  $3m^2 + n^3$  if  $m = 6$  and  $n = -2$ .

$$\begin{aligned}
 3m^2 + n^3 &= 3(6)^2 + (-2)^3 && \text{Replace } m \text{ with } 6 \text{ and } n \text{ with } -2. \\
 &= 3(36) + (-8) && 6^2 = 36, (-2)^3 = -8 \\
 &= 108 - 8 \text{ or } 100
 \end{aligned}$$

## PRACTICE

Write each expression using exponents.

- $8 \cdot 8 \cdot 8 \cdot 8$
- $a \cdot a \cdot a \cdot a \cdot a$
- 9
- $5 \cdot x \cdot x \cdot x \cdot x \cdot y \cdot y$
- $(-7)(-7)(-7)(-2)(-2)$
- 4 cubed

Write each power as a multiplication expression.

- $6^5$
- $g^4$
- $4n^2$
- $2pq^3$
- $(-5y)^2$
- $9 \cdot 4^3$

Evaluate each expression if  $x = 4$ ,  $y = -3$ , and  $z = 2$ .

- $x^2$
- $3y^2$
- $yz^5$
- $x + z^4$
- $2(x + y)^5$
- $2x^3 + 4z$



19. **Standardized Test Practice** Evaluate  $x^4 + y^3$  if  $x = 2$  and  $y = 5$ .

- A 14                      B 23                      C 141                      D 7<sup>7</sup>

Answers: 1.  $8^4$  2.  $4n^2$  3. 9 4.  $5x^3y^2$  5.  $(-7)^3(-2)^2$  6.  $4^3$  7.  $6 \cdot 6 \cdot 6 \cdot 6 \cdot 6 \cdot 6 \cdot 6$  8.  $g \cdot g \cdot g \cdot g \cdot g$  9.  $4 \cdot n \cdot n \cdot n$  10.  $2 \cdot p \cdot p \cdot p \cdot p$  11.  $(-5y)(-5y)$  12.  $9 \cdot 4 \cdot 4 \cdot 4$  13.  $16$  14.  $27$  15.  $-96$  16.  $20$  17.  $2$  18.  $136$  19. C