



# 4-2 Powers and Exponents (Pages 175–179)

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**. Any number, except 0, raised to the zero power, is defined to be 1. So  $5^0 = 1$  and  $14^0 = 1$ . The number 12,345 is in **standard form**. You can use exponents to express a number in expanded form. In **expanded form**, 12,345 is  $(1 \times 10^4) + (2 \times 10^3) + (3 \times 10^2) + (4 \times 10^1) + (5 \times 10^0)$ .

Powers need to be included in the rules for order of operations.

<b>Order of Operations</b>	<ol style="list-style-type: none"> <li>1. Do all operations within grouping symbols; start with the innermost grouping symbols.</li> <li>2. Evaluate all powers in order from left to right.</li> <li>3. Do all multiplications and divisions in order from left to right.</li> <li>4. Do all additions and subtractions in order from left to right.</li> </ol>
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## EXAMPLES

**A** Write  $(5 \times 10^3) + (2 \times 10^2) + (7 \times 10^1) + (3 \times 10^0)$  in standard form.  
*This is 5000 + 200 + 70 + 3 or 5273.*

**B** Write 139,567 in expanded form.  
 $(1 \times 10^5) + (3 \times 10^4) + (9 \times 10^3) + (5 \times 10^2) + (6 \times 10^1) + (7 \times 10^0)$

## Try These Together

1. Write  $(3)(3)$  using exponents.  
*HINT: The number 3 is used as a factor 2 times.*

2. Write  $7 \cdot 7 \cdot 7 \cdot 7 \cdot 7 \cdot 7 \cdot 7 \cdot 7$  using exponents. *HINT: This is  $7^?$ .*

## PRACTICE

**Write each multiplication expression using exponents.**

3.  $a \cdot a \cdot a \cdot a \cdot a$       4.  $(8 \cdot 8)(8 \cdot 8)$       5.  $(x \cdot x)(x \cdot x)(x \cdot x)$       6.  $(-12)(-12)(-12)$

**Write each power as a multiplication expression.**

7.  $14^3$       8.  $m^9$       9.  $(-2)^4$       10.  $y^{10}$       11.  $(-x)^8$       12.  $p^5$

**Write each number in expanded form.**

13. 25      14. 721      15. 1591      16. 40      17. 508      18. 360

19. **Carpeting** Use the formula  $A = s^2$  to find how many square feet of carpet are needed to cover a rectangular floor measuring 12 feet by 12 feet.



**20. Standardized Test Practice** Evaluate  $m^3 - n^2$  for  $m = 3$  and  $n = -5$ .

- A** -16      **B** 2      **C** 19      **D** 52

<b>Answers:</b> 1. $3^2$ 2. $7^8$ 3. $a^5$ 4. $(8 \cdot 8)(2 \cdot 2)$ or $8^4$ 5. $(x \cdot x)(x \cdot x)$ or $x^4$ 6. $(-12)^3$ 7. $14 \cdot 14 \cdot 14$ 8. $m \cdot m \cdot m \cdot m \cdot m$ 9. $(-2)(-2)(-2)(-2)$ 10. $y \cdot y \cdot y \cdot y \cdot y \cdot y \cdot y \cdot y \cdot y \cdot y$ 11. $(-x)(-x)(-x)(-x)(-x)(-x)(-x)(-x)$ 12. $d \cdot d \cdot d \cdot d \cdot d$ 13. $(2 \times 10^1) + (5 \times 10^0)$ 14. $(7 \times 10^2) + (2 \times 10^1) + (1 \times 10^0)$ 15. $(1 \times 10^3) + (5 \times 10^2) + (9 \times 10^1) + (1 \times 10^0)$ 16. $(4 \times 10^1) + (0 \times 10^0)$ 17. $(5 \times 10^2) + (0 \times 10^1) + (0 \times 10^0)$ 18. $(3 \times 10^3) + (8 \times 10^2) + (8 \times 10^1) + (8 \times 10^0)$ 19. $144$ ft <sup>2</sup> 20. <b>B</b>
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