

Lesson 4-2

Example 1 Write Expressions Using Exponents

Write each expression using exponents.

a. $5 \cdot 5 \cdot 5 \cdot 5$

The base is 5. It is a factor 4 times, so the exponent is 4.

$$5 \cdot 5 \cdot 5 \cdot 5 = 5^4$$

b. $d \cdot d \cdot d \cdot d \cdot d \cdot d$

The base is d . It is a factor 6 times, so the exponent is 6.

$$d \cdot d \cdot d \cdot d \cdot d \cdot d = d^6$$

c. $(-2)(-2)(-2)$

The base is -2 . It is a factor 3 times, so the exponent is 3.

$$(-2)(-2)(-2) = (-2)^3$$

d. $(m - 7)(m - 7)(m - 7)(m - 7)(m - 7)$

The base is $m - 7$. It is a factor 5 times, so the exponent is 5.

$$(m - 7)(m - 7)(m - 7)(m - 7)(m - 7) = (m - 7)^5$$

e. $9 \cdot x \cdot x \cdot x \cdot x \cdot y \cdot y \cdot y \cdot y$

$$9 \cdot x \cdot x \cdot x \cdot x \cdot y \cdot y \cdot y \cdot y = 9 \cdot (x \cdot x \cdot x \cdot x) \cdot (y \cdot y \cdot y \cdot y) \\ = 9x^3y^4$$

Group the factors with like bases.

$$x \cdot x \cdot x \cdot x = x^3 ; y \cdot y \cdot y \cdot y = y^4$$

Then write using exponents.

Example 2 Use Exponents in Expanded Form

Express 27,486 in expanded form.

Step 1 Use place value to write the value of each digit in the number.

$$27,486 = 20,000 + 7,000 + 400 + 80 + 6 \\ = (2 \times 10,000) + (7 \times 1000) + (4 \times 100) + (8 \times 10) + (6 \times 1)$$

Step 2 Write each place value as a power of 10 using exponents.

$$27,486 = (2 \times 10^4) + (7 \times 10^3) + (4 \times 10^2) + (8 \times 10^1) + (6 \times 10^0) \\ \text{Recall that } 10^0 = 1.$$

Example 3 Evaluate Expressions

Evaluate each expression.

a. 3^4

$$3^4 = 3 \cdot 3 \cdot 3 \cdot 3 \\ = 81$$

3 is a factor 4 times.

Multiply.

b. $30 - a^3$ if $a = 2$

$$30 - a^3 = 30 - 2^3 \\ = 30 - (2)(2)(2) \\ = 30 - 8 \\ = 22$$

Replace a with 2.

2 is a factor 3 times.

Multiply.

Subtract.

c. $-2(x + 2y)^2$ if $x = -4$ and $y = 3$

$$\begin{aligned} -2(x + 2y)^2 &= -2(-4 + 2 \cdot 3)^2 && \text{Replace } x \text{ with } -4 \text{ and } y \text{ with } 3. \\ &= -2(2)^2 && \text{Simplify the expressions inside the parentheses.} \\ &= -2(4) && \text{Evaluate } (2)^2. \\ &= -8 && \text{Simplify.} \end{aligned}$$