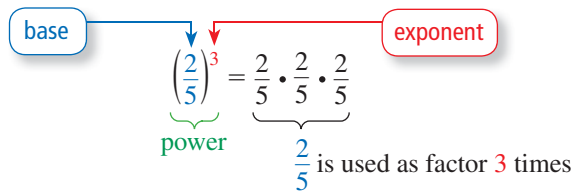


# Powers and Exponents

A **power** is a product of repeated factors. The **base** of a power is the common factor. The **exponent** of a power indicates the number of times the base is used as a factor.



**Example 1** Write each product using exponents.

a.  $(-9) \cdot (-9) \cdot (-9) \cdot (-9) \cdot (-9)$

Because  $-9$  is used as a factor 5 times, its exponent is 5.

▶ So,  $(-9) \cdot (-9) \cdot (-9) \cdot (-9) \cdot (-9) = (-9)^5$ .

b.  $\pi \cdot \pi \cdot h \cdot h \cdot h$

Because  $\pi$  is used as a factor 2 times, its exponent is 2. Because  $h$  is used as a factor 3 times, its exponent is 3.

▶ So,  $\pi \cdot \pi \cdot h \cdot h \cdot h = \pi^2 h^3$ .

**Example 2** Evaluate each expression.

a.  $(-5)^4$

$$\begin{aligned} (-5)^4 &= (-5) \cdot (-5) \cdot (-5) \cdot (-5) \\ &= 625 \end{aligned}$$

Write as repeated multiplication.

Simplify.

b.  $-5^4$

$$\begin{aligned} -5^4 &= -(5 \cdot 5 \cdot 5 \cdot 5) \\ &= -625 \end{aligned}$$

Write as repeated multiplication.

Simplify.

## Practice

Check your answers at [BigIdeasMath.com](http://BigIdeasMath.com).

Write the product using exponents.

1.  $7 \cdot 7 \cdot 7 \cdot 7 \cdot 7 \cdot 7 \cdot 7$   $7^6$

2.  $\left(-\frac{1}{3}\right) \cdot \left(-\frac{1}{3}\right) \cdot \left(-\frac{1}{3}\right) \cdot \left(-\frac{1}{3}\right)$   $\left(-\frac{1}{3}\right)^3$

3.  $x \cdot x \cdot y \cdot y \cdot y \cdot y \cdot y$   $x^2 y^5$

4.  $2.5 \cdot 2.5 \cdot b \cdot b \cdot b \cdot b$   $2.5^2 b^4$

5.  $(-n) \cdot (-n) \cdot (-n) \cdot (-n) \cdot (-n)$   $(-n)^4$

6.  $(-12) \cdot (-12) \cdot v \cdot v \cdot v$   $(-12)^2 v^3$

Evaluate the expression.

7.  $10^4$   $10,000$

8.  $-15^2$   $-225$

9.  $\left(\frac{3}{4}\right)^3$   $\frac{27}{64}$

10.  $\left(-\frac{1}{2}\right)^5$   $-\frac{1}{32}$

11. **VOLUME** Write an expression involving a power that represents the volume (in cubic centimeters) of the die shown. Then find the volume.

$\left(1\frac{3}{5}\right)^3$ ;  $4.096 \text{ cm}^3$

