

Products of Powers

Study the example problems showing how to find the power of a power and the products of powers with the same exponent. Then solve problems 1–10.

Example

Same Base and Same Exponent

Simplify: $(8^2)^3$

One Way:

$$\begin{aligned}(8^2)^3 &= 8^2 \cdot 8^2 \cdot 8^2 \\ &= 8 \cdot 8 \cdot 8 \cdot 8 \cdot 8 \cdot 8 \\ &= 8^6\end{aligned}$$

Another Way:

$$\begin{aligned}(8^2)^3 &= 8^2 \cdot 8^2 \cdot 8^2 \\ &= 8^{2 \cdot 3} \quad \text{Multiply the exponents.} \\ &= 8^6\end{aligned}$$

Different Base and Same Exponent

Simplify: $(2^4)(5^4)$

One Way:

$$\begin{aligned}(2^4)(5^4) &= (2 \cdot 2 \cdot 2 \cdot 2)(5 \cdot 5 \cdot 5 \cdot 5) \\ &= (2 \cdot 5)(2 \cdot 5)(2 \cdot 5)(2 \cdot 5) \\ &= 10 \cdot 10 \cdot 10 \cdot 10 \\ &= 10^4\end{aligned}$$

Another Way:

$$\begin{aligned}(2^4)(5^4) &= (2 \cdot 5)^4 \quad \text{Multiply the bases.} \\ &= 10^4\end{aligned}$$

- 1** The expression $(8^2)^3$ in the example problem is a product of powers. What are the powers being multiplied? What are the powers being multiplied in the expression $(2^4)(5^4)$?

- 2** Simplify: $(7^5)^6$. Write your answer using an exponent.

- 3** Simplify: $(6^3)(9^3)$. Write your answer using an exponent.

- 4** Is the statement $(3^5)^4 = (3^4)^5$ true? Explain your reasoning.



Solve.

5 Simplify: $(7^5)(4^5)$. Write your answer using an exponent.

6 Explain in words how to simplify: $(153^2)^7$.

7 Is the statement $(10^5)(4^5) = 14^5$ true? Explain your reasoning.

8 What is the value of x in the equation $(5^x)^5 = 5^{35}$? Explain.

9 Without evaluating the expressions, tell which is greater, $(4^4)(5^4)$ or $(2^5)(10^5)$. Explain your reasoning.

10 Nicholas says that $(2^6)(2^6)$ equals 2^{12} and also equals 4^6 . Do you agree? Explain your reasoning.

