EDUCATION
MADE SIMPLE

Arithmetic & algebra · Lesson 1/7 · ●○○ Basic

Powers and their properties

What is a power? Base, exponent and why 2^3 is not 2×3. Then the special cases (exponent 1, exponent 0, base 10) and the 4 properties of powers: product and quotient with the same base, power of a power and powers with the same exponent.

In this video we solve 3 exercises step by step, from easy to harder.

The method

$$a^m \cdot a^n = a^{m+n}$$

$$a^m \div a^n = a^{m-n}$$

$$(a^m)^n = a^{m \cdot n}$$

$$a^n \cdot b^n = (a \cdot b)^n$$

Worked examples

Exercise 1

Work out these powers: 2^5, 10^4, 7^1 and 9^0.

Data: $2^5 \cdot 10^4 \cdot 7^1 \cdot 9^0$

1. **The base 2 is multiplied by itself 5 times**

$$2^5 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$$

$$2^5 = 4 \cdot 2 \cdot 2 \cdot 2 = 32$$

> 💡 Careful: it is not 2 × 5!

Result: $2^5 = 32$

2. **Base 10: a 1 followed by as many zeros as the exponent**

$$10^4 = 10 \cdot 10 \cdot 10 \cdot 10$$

$$10^4 = 1\underbrace{0000}_{4} = 10{,}000$$

Result: $10^4 = 10{,}000$

3. **Exponent 1 and exponent 0**

$$7^1 = 7$$

$$9^0 = 1$$

> 💡 Any number except 0, raised to 0, is 1

Result: $7^1 = 7 \quad 9^0 = 1$

✓ Check

$$2^5 = 2^4 \cdot 2 = 16 \cdot 2 = 32 \checkmark$$

Exercise 2

Work it out using the properties of powers: $3^4 \times 3^2 \div 3^3$

Data: $3^4 \cdot 3^2 \div 3^3$

1. **Product with the same base: add the exponents**

$$3^4 \cdot 3^2 = 3^{4+2} = 3^6$$

Result: $3^4 \cdot 3^2 = 3^6$

2. **Quotient with the same base: subtract the exponents**

$$3^6 \div 3^3 = 3^{6-3} = 3^3$$

Result: $3^6 \div 3^3 = 3^3$

3. **Now we work out the power**

$$3^3 = 3 \cdot 3 \cdot 3 = 27$$

💡 Without the properties: 81 × 9 ÷ 27, much longer!

Result: $3^3 = 27$

✓ Check

$$81 \cdot 9 \div 27 = 729 \div 27 = 27 \checkmark$$

Exercise 3

Work it out using the properties of powers: $(2^3)^2 \times 5^6$

Data: $(2^3)^2 \cdot 5^6$

1. **Power of a power: multiply the exponents**

$$(2^3)^2 = 2^{3 \cdot 2} = 2^6$$

💡 Careful: here you multiply, you don't add!

Result: $(2^3)^2 = 2^6$

2. **Same exponent: multiply the bases**

$$2^6 \cdot 5^6 = (2 \cdot 5)^6 = 10^6$$

Result: $2^6 \cdot 5^6 = 10^6$

3. **Base 10: a 1 followed by six zeros**

$$10^6 = 1{,}000{,}000$$

Result: $10^6 = 1{,}000{,}000$

✓ **Check**

$$64 \cdot 15{,}625 = 1{,}000{,}000 \checkmark$$

. . .

© Education Made Simple