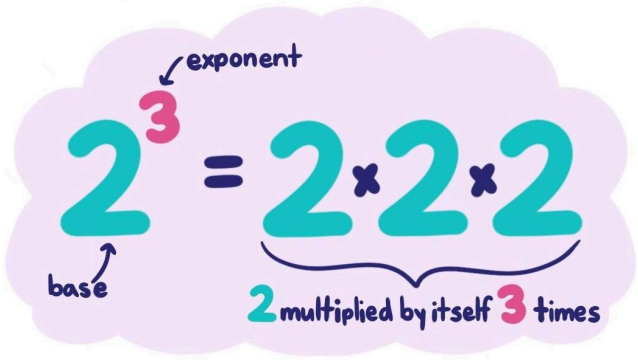


Laws of Exponents with Whole Number Exponents

Notes	Video Links & Practice Space
<p>Vocabulary</p> <ol style="list-style-type: none">1. Base: the number used as a _____ in exponential form.2. Exponent: the number of times the _____ occurs as a factor.3. Expression: one or more terms, may include variables, _____, operators, and grouping symbols.4. Factor: one of the numbers of _____ that are multiplied together to produce a product.  <p>Important Note: Notice how 2^3 is not $2 \cdot 3$</p>	<p>Vocabulary (1:03)</p>

Product of Powers Law

To multiply factors that have the same base, keep the base the same and _____ the exponents.

Multiplying Powers with Same Base

$$a^m \cdot a^n = \underline{\hspace{2cm}}$$

$$2^3 \cdot 2^4 =$$

Important Note: When multiplying powers, do not multiply or add the *bases*.

$$2^3 \cdot 2^4 = 2^{3+4} = 2^7$$

How does this work?

$$\begin{aligned} 2^3 \cdot 2^4 &= (2 \cdot 2 \cdot 2)(2 \cdot 2 \cdot 2 \cdot 2) \\ &= 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \\ &= 2^7 \end{aligned}$$

Important Note: The product property can only be used for powers that have the _____ base.

We _____ use the product property to simplify $5^3 \times 8^2$ Why?

Because the powers have DIFFERENT bases.

The bases must be the _____ in order to _____ the exponents.

Product of Powers Law (2:31)

Practice Problems #1

Simplify

$5^4 \cdot 5^7 =$	$2^2 \cdot 2^9 =$
$3^4 \cdot 3^6 =$	$6^5 \cdot 6 =$

Important Note: If a number has an exponent of 1, it is usually not shown because any number with an _____ of 1 equals itself. For example, $6^1 = 6$

[Product of Powers Law Practice \(1:29\)](#)

Quotient of Powers Law

To divide expressions that have the same base, keep the base the same and _____ the exponents.

Dividing Powers with Same Base

$$\frac{a^m}{a^n} = \underline{\hspace{2cm}}$$

$$\frac{2^5}{2^3} =$$

Important Note: When dividing powers, do not divide or subtract the *bases*.

[Quotient of Powers Law \(1:55\)](#)

How does this work?

$$\frac{2^5}{2^3} = \frac{\cancel{2} \cdot \cancel{2} \cdot \cancel{2} \cdot 2 \cdot 2}{\cancel{2} \cdot \cancel{2} \cdot \cancel{2}}$$

$$\frac{2 \cdot 2}{1} = 2^2$$

We _____ use the quotient property to simplify

$4^2 \div 7^3$ Why?

Because the powers have DIFFERENT bases.

The bases must be the _____ in order to _____ the exponents.

Practice Problems #2

Simplify

$\frac{6^3}{6} =$	$8^9 \div 8^5 =$
$\frac{10^6}{10^4} =$	How many times larger is 3^8 than 3^3 ?

[Quotient of Powers Law Practice \(1:54\)](#)

Zero Exponent Law

When the base has an exponent of zero, it is _____ to 1.

$$a^0 = 1 \text{ when } a \neq 0$$

$$5^0 = 1$$

How does this work?

$$\frac{3^3}{3^3} = \frac{\cancel{3} \cdot \cancel{3} \cdot \cancel{3}}{\cancel{3} \cdot \cancel{3} \cdot \cancel{3}} = \frac{1}{1} = 1$$

$$\frac{3^3}{3^3} = 3^{3-3} = 3^0 = 1$$

[Zero Exponent Law \(1:14\)](#)

Practice Problems #3

Simplify

$3.2^0 =$	$1200^0 =$
$(2)^0 =$	$16^{-3} \cdot 16^3 =$

[Zero Exponent Law Practice \(0:53\)](#)

Power of a Power Law

To raise an expression with an exponent to another exponent, keep the base the same and _____ the exponents.

$$(a^m)^n =$$

$$(8^2)^5 =$$

See why this works:

Product Property

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

Expanded Form

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

Important Note: We do not add or multiply the base by the exponent. We only multiply the exponents.

Power of a Power Law (2:05)

Practice Problems #4

Simplify

$(6^2)^4 =$	$(9^0)^5 =$
$(5^3)^x =$	$-(4^5)^3 =$

[Power of a Power Law Practice \(1:18\)](#)

Power of Product Law

To raise a product to an exponent, raise each _____ to the exponent.

$$(ab)^m = a^m \cdot b^m$$

$$(7^2 \cdot 9^4)^3$$

Power of a Quotient Law

$$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m} \quad b \neq 0$$

$$\left(\frac{11^4}{15^6}\right)^3 = \frac{11^{4 \cdot 3}}{15^{6 \cdot 3}} = \frac{11^{12}}{15^{18}}$$

[Power of Product Law \(1:56\)](#)

Practice Problems #5

Simplify

$$(2^5 \cdot 3^6)^4 =$$

$$\left(\frac{5^2}{4^3}\right)^6 =$$

Evaluate vs Simplify

$$\left[\frac{\left(\frac{1}{4}\right)^7}{\left(\frac{1}{4}\right)^6} \right]^2$$

Equivalent Expressions

$$(6^3 \times 4^5)^4$$

[Power of a Product Law Practice \(4:57\)](#)