

Introduction to Exponents & Some Basic Exponent Laws

Here is an example of a **power**: 3^4

Notice the pattern if we multiply powers of the same base:

$$5^4 \times 5^2$$

$$2^5 \times 2$$

$$x^2(x^3)$$

The multiplication law: $a^m \times a^n =$

To multiply powers of LIKE BASES we add the exponents.

Examples: $2^8(2^3)$

$$y^4(y^{10})$$

Notice the pattern if we divide powers of the same base:

$$5^4 \div 5^2$$

$$\frac{x^5}{x^4}$$

The division law: $a^m \div a^n =$ OR $\frac{a^m}{a^n} =$

To divide powers of LIKE BASES we *subtract* the exponents

Examples:

$$\frac{5^{11}}{5^8}$$

=

$$\frac{y^2(y^6)}{y^4}$$

=

The examples below illustrate the idea of “power of a power” or “power on a power”

$$(10^4)^2$$

$$(5^2)^3$$

The power on a power law: $(a^m)^n =$

To simplify a power on a power we multiply the exponents.

Examples:

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

$$(x^2)^9$$
$$=$$

The following examples illustrate “power of a product”

$$(2 \times 3)^3$$

$$(2x)^4$$

The power of a product rule can be summarized as follows: $(ab)^n =$

Examples

$$(2x)^7$$

$$(-3x^2)^4$$

The examples below look at powers with rational bases.

$$\left(\frac{3}{4}\right)^3$$

$$\left(\frac{1}{5}\right)^4$$

This rule can be summarized as follows: $\left(\frac{a}{b}\right)^n =$

Examples:

$$\left(\frac{2}{9}\right)^2$$

$$\left(\frac{-1}{4}\right)^3$$

$$\left(\frac{-1}{2}\right)^4$$

Summary of Basic Exponent Laws

Multiplication of Powers	$a^m \times a^n = a^{m+n}$
Division of Powers	$\frac{a^m}{a^n} = a^{m-n}$
Power of a Power	$(a^m)^n = a^{mn}$
Power of a Product	$(ab)^n = a^n b^n$
Power of a Quotient/Powers with Rational Bases	$\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$

Examples

Simplify each of the following:

$$\frac{x^2(x^3)^5 x}{x^{10}}$$

$$\left(\frac{2}{3}\right)^2 \times \left(\frac{2}{3}\right)^2 \times \left(\frac{2}{3}\right)$$

$$\frac{(2x^2)^3}{4x^3}$$