

Laws of Exponents

Product of Powers (same base)

$$a^x \cdot a^y = a^{x+y}$$

Add exponents.

Quotient of Powers (same base)

$$\frac{a^x}{a^y} = a^{x-y}$$

Top exponent minus bottom exponent.

Power of a Power

$$(a^x)^y = a^{x \cdot y}$$

Multiply exponents.

Power of a Product

$$(a^x \cdot b^y)^z = a^{x \cdot z} \cdot b^{y \cdot z}$$

Multiply exponents.

Power of a Quotient

$$\left(\frac{a^y}{b^z}\right)^x = \frac{a^{x \cdot y}}{b^{x \cdot z}}$$

Multiply exponents.

Negative Exponents

$$\frac{1}{a^{-y}} = a^y \quad a^{-y} = \frac{1}{a^y}$$

Switch sides, move from bottom to top or top to bottom and make the exponent positive.

Zero Exponents

$a^0 = 1$ always unless $a = 0$
then a^0 is undefined.

Anything to the zero power is one except zero to the zero power, it is undefined.