Product of Powers

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

When multiplying exponents with similar bases, you add the exponents.

$4^3 \cdot 4^5 =$

$11^{-3} \cdot 11^5 =$

$7^9 \cdot 7^1 =$

$b^{-2} \cdot b^{-4} =$

$x^{12} \cdot x^3 =$

$5^5 \cdot 5^5 =$

Quotient of Powers

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

When dividing exponents with similar bases, you subtract the exponents.

$\frac{8^{20}}{8^4} =$

$\frac{y^{15}}{y^3} =$

$\frac{c^3}{c^{-4}} =$

$x^8 \div x^5 =$

$7^{11} \div 7^6 =$

$\frac{100^{300}}{100^{200}} =$

Power of a Power

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

When you have an exponent raised to another power, you multiply the powers.

$(14^2)^2 =$

$(m^4)^3 =$

$(8^3)^{10} =$

$(13^{-2})^{-3} =$

$(t^{-2})^6 =$

$(5^{100})^2 =$

Power of a Product

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

When raising multiple bases to a power, all bases get the power.

$(2a)^4 =$

$(10g)^5 =$

$(x^2y^3)^5 =$

$(4h)^3 =$

$(7r)^2 =$

$(3a^5b^7)^3 =$

Power of a Quotient

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

When raising a fraction to a power, both the numerator and the denominator are raised to the power.

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

$\left(\frac{12}{7}\right)^{11} =$

$\left(\frac{5}{6}\right)^{10} =$

$\left(\frac{w}{v}\right)^t =$

$\left(\frac{x}{y}\right)^4 =$

$\left(\frac{3}{8}\right)^2 =$

Negative Exponent

$a^{-m} = \frac{1}{a^m}, a \neq 0$

A base raised to a negative exponent is equal to the reciprocal of the same base raised to the positive version of the exponent.

$6^{-2} =$

$s^{-19} =$

$t^{-23} =$

$3^{-4} =$

$2^{-6} =$

$12^{-2} =$

Negative Base $(-3)^2 = 9, and\ -3^2 = -9$

When raising a negative base inside parenthesis, you raise the negative number to a power. A negative sign not inside parenthesis is not raised.

$-3^3 =$ $-10^4 =$

$-5^3 =$ $-1^{22} =$

$-2^5 =$ $-134^1 =$

Zero Exponent $a^0 = 1, a \neq 0$

Any number -- except zero -- when raised to the power of zero equals one. A negative number would equal negative one.

$-13.6^0 =$ $-77^0 =$

$353{,}018^0 =$ $1^0 =$

$\pi^0 =$ $.\overline{54}^0 =$