Exponents

Below, a and b represent any numbers.

◆ Definition: For n = 1, 2, 3, . . .

$$a^n = \underbrace{a \cdot a \cdot a \cdot \ldots \cdot a}_{\text{n-factors of a}}$$

◆ Zero exponent (Definition) $a^0 = 1, \quad (a \neq 0).$

◆ Negative exponent $a^{-n} = \frac{1}{a^n}.$

Below, m and n represent integers.

◆ Rational exponent $a^{\frac{m}{n}} = \left(\sqrt[n]{a}\right)^m = \sqrt[n]{a^m}$. Providing that a is not negative when n is an odd number.

■ Exponent Laws

Provided that denominator are nonzero, the laws for the combination of exponents (indices or powers) are: for all real numbers a and b and integers m and n,

◆ Product rule $a^m \cdot a^n = a^{m+n}$

◆ Quotient rule: $\frac{a^m}{a^n} = a^{m-n}$

◆ Power rules $(a^m)^n = a^{m\,n}$

$$(a\,b)^m = a^m\,b^m$$

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

■ **Note:** $-a^n$ does not in general equal $(-a)^n$. But, $-a^n = -(a^n)$.