

Exponents

◆ Definition: a^n

For any real number a and any positive integer n ,

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

■ Exponent Laws

Provided that denominators are taken to be nonzero, the laws for the combination of exponents (indices or powers) are: for all real numbers a, b, m, n

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

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

◆ Power rules $(a^m)^n = a^{mn}$

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

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

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

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

◆ Fractional exponent $a^{\frac{m}{n}} = (\sqrt[n]{a})^m = \sqrt[n]{a^m}$, provided the root is a real number

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