

Natural Exponents (1-5)

1. $a^n \cdot a^m = a^{n+m}$
2. $\frac{a^n}{a^m} = a^{n-m} \quad a \neq 0$
3. $(a^n)^m = a^{nm}$
4. $(ab)^n = a^n b^n$
5. $\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n} \quad b \neq 0$

Integer Exponents (1-7)

6. $a^0 = 1$ if $a \neq 0$ and 0^0 is undefined
7. $a^{-n} = \frac{1}{a^n} \quad a \neq 0$

Rational Exponents (1-9)

8. $a^{\frac{1}{n}} = \sqrt[n]{a}$ if n is odd, $a^{\frac{1}{n}}$ always exists
but if n is even, $a^{\frac{1}{n}}$ is only defined if $a \geq 0$
9. Suppose that $m \neq 1$.
$$a^{\frac{m}{n}} = \begin{cases} \sqrt[n]{a^m} = (\sqrt[n]{a})^m & \text{if } a \geq 0 \\ \text{undefined} & \text{if } a < 0 \end{cases}$$