Exponents & Radicals

Zero exponent:

\[ a^0 = 1; \quad a \neq 0 \]

Negative exponents:

\[ a^{-n} = \frac{1}{a^n}; \quad a \neq 0 \]

Multiplication with common bases:

\[ a^x a^y = a^{x+y} \]

Division with common bases:

\[ \frac{a^x}{a^y} = a^{x-y}; \quad a \neq 0 \]

Raising an exponent to another exponent:

\[ (a^x)^y = a^{xy} \]

Raising a product to an exponent:

\[ (ab)^x = a^x b^x \]

Raising a quotient to an exponent:

\[ \left( \frac{a}{b} \right)^x = \frac{a^x}{b^x}; \quad b \neq 0 \]
Fractional exponents:

\[ \frac{n}{a^n} = \sqrt[n]{a^n} \]

nth root of a product:

\[ \sqrt[n]{ab} = \sqrt[n]{a} \cdot \sqrt[n]{b} \]

nth root of a quotient:

\[ \sqrt[n]{\frac{a}{b}} = \frac{\sqrt[n]{a}}{\sqrt[n]{b}} \]

Taking the root of a root:

\[ \sqrt[n]{\sqrt[n]{a}} = \sqrt[n]{a} \]

Properties of nth roots:

\[ \sqrt[n]{a^n} = a; \text{ if } n \text{ is odd} \]
\[ \sqrt[n]{a^n} = |a|; \text{ if } n \text{ is even} \]